

Southern Sandoval County Arroyo Flood Control Authority

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EXECUTIVE ENGINEER Charles Thomas, P.E.

December 1, 2018

U.S. EPA, Region 6 Water Quality Protection Division Operations Support Service (6WQ-O) 1445 Ross Avenue Dallas, Texas 75202-2733

RE: 2018 Annual Report, NPDES Permit No. NMR04A001

To whom it may concern:

The Southern Sandoval County Arroyo Flood Control Authority (SSCAFCA) is pleased to submit the 2018 Annual Report for NPDES Permit No. NMR04A000. SSCAFCA's permit tracking number, as assigned in our letter from EPA "Coverage under Middle Rio Grande (MRG) Watershed Based Municipal Sewer Separate Storm Sewer System General Permit (NPDES No. NMR04A000) is NMR04A001. This report covers the period from July 1, 2017 to June 30, 2018.

Materials contained within this transmittal include our Annual Report compiled using the EPA's suggested Annual Report Format, a 2018 Annual Report Supplement, the River Xchange 2018 report, reports from both the Arroyo Classroom and the RiverXchange outreach programs, the Summary of Outcomes Report for the Mid Rio Grande Stormwater Quality Team, a profile of water quality projects that have been completed within the reporting period, DMR forms for the reporting period, and memorandums developed on behalf of the Compliance Monitoring Cooperative for the wet season compliance sampling in 2018 and the dry season compliance sampling in 2017-2018. EPA has authorized data entry of sample results for the Compliance Monitoring Cooperative to be entered into NetDMR by a single entity on behalf of other entities. A copy of the memorandum of understanding between SSCAFCA and AMAFCA as well as the letter from EPA authorizing this action are included in this report.

If you have any further questions, please feel free to contact Mr. David Gatterman at <u>dgatterman@sscafca.com</u> or at 505-892-7246.

Sincerely,

Charles Thomas, PE Executive Engineer SSCAFCA

2018 Annual Report Reporting Period – July 1, 2017 – June 30, 2018

TABLE OF CONTENTS

- 2018 Annual Report (in suggested EPA format)
- 2018 Annual Report supplement
- 2018 Sediment Removal quantities from stormwater facilities
- 2018 Arroyo Classroom Program Report
- 2018 RiverXchange Program Report
- 2018 Stormwater Quality Team outcomes report (DRAFT)
- Sampling data entry delegation letter
- Monitoring Activities
 - Memorandum of Understanding for NetDMR data entry by AMAFCA on behalf of SSCAFCA
 - Summary Memorandums and sample results for 2016-2017 wet and dry season sampling (separate download files)
- FY 2018 DMR forms
- Cooperative Agreements
 - Technical Advisory Group
 - Stormwater Quality Team
 - Compliance Monitoring Cooperative

Annual Report Format

National Pollutant Discharge Elin MS4 Annu	nination System Stormwater Program ual Report Form											
Check box if you are submitting an individual Annual Report with cooperative program elements												
Check box if you are submitting an individual Annual Repo	ort with individual program elements											
Check box if this is a new name, address, etc.												
1. MS4(s) Information												
Southern Sandoval County Arroyo Flood Control Authori	ty											
Name of MS4												
David Gatterman	Facility Operations Director											
Name of Contact Person (First) (Last)	(Title)											
505-892-7246 dgatterma	n@sscafca.com											
Telephone (including area code)	E-mail											
1041 Commercial Dr. SE												
Mailing Address												
Rio Rancho	JM 87124											
City S	tate ZIP code											
What size population does your MS4(s) serve? 101,103	NPDES number											
What is the reporting period for this report? (mm/dd/yyyy)	From Jul 1, 2017 to Jun 30, 2018											
Water Quality PrioritiesA. Does your MS4(s) discharge to waters listed as important of the second second	paired on a state 303(d) list? Xes No											
B. If yes, identify each impaired water, the impairment whether the TMDL assigns a wasteload allocation additional pages as necessary.	it, whether a TMDL has been approved by EPA for each, and to your MS4(s). Use a new line for each impairment, and attach											
Impaired Water Impairment	Approved TMDL TMDL assigns WLA to MS4											
Rio Grande, HUC 13020203 eColi	Yes No Yes No											
Rio Grande, HUC 13020203 PCB in fish tissue	Yes No Yes No											
Rio Grande, HUC 13020203 PCB in water column	$\square Yes \square No \square Yes \square No$											
Rio Grande, HUC 13020203 Gross Alpha	$\square Yes \square No \square Yes \square No$											

2. B. Continued

Impair	ed Water	Impairment	Approved	TMDL T	MDL assigns	WLA to MS4				
			Yes	🗌 No	Yes	🗌 No				
			Yes	🗌 No	Yes	🗌 No				
			Yes	🗌 No	Yes	🗌 No				
			Yes	🗌 No	Yes	🗌 No				
C.	What specific sources cont	ributing to the impairment(s) are yo	ou targeting in	your stormy	water program	?				
Pet wa	aste, floatables, illicit discha	rges								
D.	Do you discharge to any hi resource waters, or other st	gh-quality waters (e.g., Tier 2, Tier ate or federal designation)?	3, outstanding	g natural	Yes	🔀 No				
E.	Are you implementing add	tional specific provisions to ensure	their continue	ed integrity?	Yes	🔀 No				
3. А.	Public Education and Public Participation . Is your public education program targeting specific pollutants and sources of those pollutants? \[\begin{bmatrix} Yes & \boxdot No \begin{bmatrix} No \begin{bmatrix} Yes & \boxdot No \boxdot No \begin{bmatrix} Yes & \boxdot No \begin & \boxdot No \begin{bmatrix} Yes & \boxdot No \begin									
В.	If yes, what are the specific	sources and/or pollutants addresse	d by your pub	lic education	n program?					
Pet w	aste, floatables, illicit discha	′ges								
C.	Note specific successful ou fully or partially attributable	tcome(s) (e.g., quantified reduction to your public education program	in fertilizer u during this re	ise; NOT tas	ks, events, pu od.	blications)				
See o	utcomes report from the Mi	ddle Rio Grande Storm Water Qual	ity Team							
D.	Do you have an advisory co stakeholders that provides r	ommittee or other body comprised or egular input on your stormwater pre-	of the public a ogram?	nd other	Yes	🔀 No				
I. A.	Construction Do you have an ordinance	or other regulatory mechanism stip	ulating:							
	Erosion and sediment cont	rol requirements?			🔀 Yes	No No				
	Other construction waste c	ontrol requirements?			Xes Yes	No No				
	Requirement to submit con	struction plans for review?			🔀 Yes	No No				
	MS4 enforcement authority	y?			X Yes	🗌 No				
B.	Do you have written proce	dures for:								
	Reviewing construction pla	ans?			X Yes	🗌 No				
	Performing inspections?				X Yes	No No				
	Responding to violations?				🔀 Yes	🗌 No				
C.	Identify the number of actire reporting period. $\boxed{2}$	ve construction sites ≥ 1 acre in ope	eration in you	jurisdiction	at any time d	uring the				
D.	How many of the sites ider		this reporting	g period?	2					
E.	Describe, on average, the f	requency with which your program	conducts con	struction site	e inspections.					
A	II SSCAFCA-owned sites are	inspected by SSCAFCA personnel	at a minimun	n weekly. Qu	ualified contra	actors inspect th				

	F.	Do you prioritize certain construction	Yes	🔀 No										
		If Yes, based on what criteria?	ed											
	G.	Identify which of the following types activities, indicate the number of acti	s of enforcement actions, or note those for	ons you used du r which you do n	ring the reporting ot have authority	g period for y:	construction							
		Yes Notice of violation		No Authority	\boxtimes									
		Yes Administrative fines		No Authority	\boxtimes									
		Yes Stop Work Orders	\boxtimes											
		Yes Civil penalties		No Authority	\boxtimes									
		Yes Criminal actions		No Authority	\boxtimes									
		Yes Administrative orders		No Authority	\boxtimes									
		Yes Other Contractual me	echanisms fq +											
	H.	I. Do you use an electronic tool (e.g., GIS, data base, spreadsheet) to track the locations, inspection results, and enforcement actions of active construction sites in your jurisdiction?												
	I.	What are the 3 most common types of	of violations documer	nted during this r	eporting period?									
	No	violations noted. SSCAFCA has stop	work authority on S	SCAFCA-owned	projects									
	J.	How often do municipal employees r	receive training on the	e construction pr	ogram? As r	needed								
5.	A.	Illicit Discharge Elimination Have you completed a map of all out system?	falls and receiving w	aters of your stor	rm sewer	X Yes	🗌 No							
	B.	Have you completed a map of all stor sewer system?	rm drain pipes and ot	her conveyances	in the storm	X Yes	🗌 No							
	C.	Identify the number of outfalls in you	ır storm sewer systen	n. 8										
	D.	Do you have documented procedures	s, including frequency	y, for screening o	outfalls?	Yes	🗌 No							
	E.	Of the outfalls identified in 5.C, how	many were screened	for dry weather	discharges durin	g this repor	ting period?							
	8													
	F.	Of the outfalls identified in 5.C, how obtained MS4 permit coverage?	many have been scre	eened for dry we	ather discharges	at any time	since you							
	G.	What is your frequency for screening	goutfalls for illicit dis	scharges? Descri	be any variation	based on s	ize/type.							
	Al	I SSCAFCA facilities are inspected at a	a minimum twice per	r year (pre and p	ost monsoon) fo	or a conditi	on of facility asse ₊							
	H.	Do you have an ordinance or other redischarges?	egulatory mechanism	that effectively j	prohibits illicit	Yes	🔀 No							
	I.	Do you have an ordinance or other re- to take enforcement action and/or rec	egulatory mechanism cover costs for addres	that provides au sing illicit discha	thority for you arges?	Yes	🔀 No							

J. During this reporting period, how many illicit discharges/illegal connections have you discovered?

K.	Of those illicit	lischarges/illegal connections that have been discovered or reported, how many have been
	eliminated?	0

	L.	How often do municipal employees receive training on the illicit discharge program?	As needed	
6.	A.	Stormwater Management for Municipal Operations Have stormwater pollution prevention plans (or an equivalent plan) been developed for:		
	Al	l public parks, ball fields, other recreational facilities and other open spaces	Yes	🔀 No
	Al	l municipal construction activities, including those disturbing less than 1 acre	Yes	🔀 No
	Al	l municipal turf grass/landscape management activities	Yes	🛛 No
	Al	l municipal vehicle fueling, operation and maintenance activities	Yes	🔀 No
	Al	l municipal maintenance yards	Yes	🔀 No
	Al	l municipal waste handling and disposal areas	Yes	🖂 No
	Ot	her		
	B.	Are stormwater inspections conducted at these facilities? \Box Yes \boxtimes No		
	C.	If Yes, at what frequency are inspections conducted?		
	D.	List activities for which operating procedures or management practices specific to storm been developed (e.g., road repairs, catch basin cleaning).	water managemei	nt have
	Pr	e and post monsoon inspection and cleaning of flood control facilities		
	E.	Do you prioritize certain municipal activities and/or facilities for more frequent inspection?	X Yes	🗌 No
	F.	If Yes, which activities and/or facilities receive most frequent inspections? Dams, por	nds, sediment cor	ntrol facilit
	G.	Do all municipal employees and contractors overseeing planning and implementation of stormwater-related activities receive comprehensive training on stormwater management	? Xes	🗌 No
	H.	If yes, do you also provide regular updates and refreshers?	Xes Yes	🗌 No
	I.	If so, how frequently and/or under what circumstances? All technical staff are encou	iraged to seek tra	aining on st
7.	A.	Long-term (Post-Construction) Stormwater Measures Do you have an ordinance or other regulatory mechanism to require:		
	Sit	te plan reviews for stormwater/water quality of all new and re-development projects?	Xes Yes	🗌 No
	Lo	ng-term operation and maintenance of stormwater management controls?	Xes Yes	🗌 No
	Re	trofitting to incorporate long-term stormwater management controls?	Xes Yes	🗌 No
	B.	If you have retrofit requirements, what are the circumstances/criteria?		
	Fo	or all SSCAFCA-owned projects, all site plan reviews		
	C	What are your aritaria for datarmining which a surface data large at stars of a star	······································	a11
		what are your crueria for determining which new/re-development gormwater blang you	WILL TEVIEW LA G	311

C What are your criteria for determining which new/re-development stormwater plans you will review (e.g., all projects, projects disturbing greater than one acre, etc.)?

All SSCAFCA-owned project are reviewed.

8.

D.	Do you require water quality or quantity design standards or performance standards, either directly or by reference to a state or other standard, be met for new development and re-development?	X Yes	🗌 No							
E.	Do these performance or design standards require that pre-development hydrology be met for:									
Flo	ow volumes	Yes	🔀 No							
Pe	ak discharge rates	Xes Yes	🗌 No							
Di	scharge frequency	Yes	🔀 No							
Flo	ow duration	Yes	🔀 No							
F.	Please provide the URL/reference where all post-construction stormwater management standa	rds can be fo	ound.							
W	atershed management plans are located at: http://sscafca.org/watershed-and-drain-manag	ement-plans	/							
G.	How many development and redevelopment project plans were reviewed during the reporting impacts to water quality and receiving stream protection?	period to ass	sess							
H.	How many of the plans identified in 7.G were approved?									
I.	How many privately owned permanent stormwater management practices/facilities were inspe-	ected during	the							
	reporting period? 0									
J.	J. How many of the practices/facilities identified in I were found to have inadequate maintenance?									
K.	How long do you give operators to remedy any operation and maintenance deficiencies identi	fied during								
	inspections? NA									
L.	Do you have authority to take enforcement action for failure to properly operate and maintain stormwater practices/facilities?	Yes 🔀	No							
M.	How many formal enforcement actions (i.e., more than a verbal or written warning) were taken	n for failure t	0							
	adequately operate and/or maintain stormwater management practices?									
N.	Do you use an electronic tool (e.g., GIS, database, spreadsheet) to track post-construction BMPs, inspections and maintenance?	Yes	No							
0.	Do all municipal departments and/or staff (as relevant) have access to this tracking system?	Yes	No							
P.	How often do municipal employees receive training on the post-construction program?	needed								
A.	Program Resources What was the annual expenditure to implement MS4 permit requirements this reporting period	1? 140,77	9							
B.	What is next year's budget for implementing the requirements of your MS4 NPDES permit?	63588								
C.	This year what is/are your source(s) of funding for the stormwater program, and annual reven percentage) derived from each?	ue (amount c	r							
	Source: Property tax mil levy Amount \$	OR %	100							
	Source: Amount \$									
	Source:									

D. How many FTEs does your municipality devote to the stormwater program (specifically for implementing the stormwater program; not municipal employees with other primary responsibilities)?

E.	Do you share program implementation responsibilities with any other entities?	Yes	No	
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Entity	Activity/Task/Responsibility	Your Oversight/Accountability Mechanism
See Attached	Storm Water Quality Team	Signed agreement
See Attached	Compliance Monitoring Cooperative	Signed agreement
See Attached	Technical Advisory Group	Signed agreement

9. Evaluating/Measuring Progress

A. What indicators do you use to evaluate the overall effectiveness of your stormwater management program, how long have you been tracking them, and at what frequency? These are not measurable goals for individual management practices or tasks, but large-scale or long-term metrics for the overall program, such as macroinvertebrate community indices, measures of effective impervious cover in the watershed, indicators of in-stream hydrologic stability, etc.

Indicator	Began Tracking (year)	Frequency	Number of Locations
<i>Example:</i> E. coli	2003	Weekly April–September	20
Various (EPA approved analyte list)	2016	Qualifying Events (up to 7)	2
Various (EPA approved analyte list)	2014	Wet season, anually	8
Please refer to attached Annual Report			
or SSCAFCA website for additional			
information			

B. What environmental quality trends have you documented over the duration of your stormwater program? Reports or summaries can be attached electronically, or provide the URL to where they may be found on the Web.

10. Additional Information

Please attach any additional information on the performance of your MS4 program, including information required in Parts I.C and III.B. If providing clarification to any of the questions on this form, please provide the question number (e.g., 2C) in your response.

Certification Statement and Signature

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Yes	No
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Federal regulations require this application to be signed as follows: **For a municipal, State, Federal, or other public facility**: by either a principal executive or ranking elected official.

Signature

Name of Certifying Official, Title

Date (mm/dd/yyyy)

2018 Annual Report Supplement (Reporting period 7/1/17 – 6/30/18) NPDES Permit NMR04A001 Southern Sandoval County Arroyo Flood Control Authority (SSCAFCA)

This document is being provided as a supplement to the form that was provided by the EPA as the format for the Annual Report. The supplement is being used to provide more explanation to responses provided in the Annual Report form where specific circumstances of SSCAFCA's status require more information to be provided than is allowed on the form. Additionally, responses to permit required

Section 1, NPDES Number: The pdf form provided by the EPA does not allow for non-numeric data entry in this field. The NPDES number for our permit is NMR04A001

Section 4.A, "Do you have an ordinance or other regulatory mechanism stipulating: erosion control requirements; other construction waste control requirements; requirement to submit construction plans for review; and, MS4 enforcement authority?"

Response: On the form, SSCAFCA has indicated "yes" to all of these program elements. It should be noted that SSCAFCA only has jurisdictional authority over SSCAFCA-owned projects. The indication of "yes" on the Annual Report shall be in the context of SSCAFCA-owned projects only.

Section 4.B, "Do you have written procedures for: reviewing construction plans; performing inspections; and, responding to violations?"

Response: On the form, SSCAFCA has indicated "yes" to all of these program elements. It should be noted that SSCAFCA only has jurisdictional authority over SSCAFCA-owned projects. The indication of "yes" on the Annual Report shall be in the context of SSCAFCA-owned projects only.

Section 4.F, "Do you prioritize certain construction sites for more frequent inspections?"

Response: On the form, SSCAFCA has indicated "no" to this program element. Since SSCAFCA only has jurisdiction over SSCAFCA-owned projects, SSCAFCA inspects these projects with the same priority.

Section 4.H, "Do you use an electronic tool (e.g. GIS, data base, spreadsheet) to track locations, inspection results, and enforcement actions of active construction sites in your jurisdiction?"

Response: On the form, SSCAFCA has indicated "no" to this program element. Since SSCAFCA only has jurisdiction over SSCAFCA-owned projects and since there are relatively few of these projects underway at any one time, the usage of an electronic means of tracking was deemed to be not necessary and would provide more burden than assistance with regard to tracking these program items.

Section 4.I, "What are the 3 most common types of violations documented during the reporting period?"

Response: During the reporting period, SSCAFCA had three active SSCAFCA-owned construction projects. This project was inspected by SSCAFCA personnel and contractor personnel frequently and no violations were identified during the project.

Section 6.A, "Have stormwater pollution prevention plans (or an equivalent plan) been developed for: All public parks, ball fields, other recreational facilities and other open spaces; all municipal construction activities including those disturbing less than 1 acre; all municipal turf grass/landscape management activities; all municipal vehicle fueling, operation, and maintenance activities; all municipal maintenance yards; and all municipal waste handling and disposal areas?"

Response: On the form, SSCAFCA has indicated "no" to these program elements. SSCAFCA does not currently own or operate any of the types of facilities indicated in the Annual Report form.

Section 6.B, "Are stormwater inspections conducted at these facilities?"

Response: On the form, SSCAFCA has indicated "no" to this program element. Since SSCAFCA does not own or operate any of these facility types, no inspections have occurred.

Section 7.A, "Do you have an ordinance or other regulatory mechanism to require: Site plan reviews for stormwater/water quality of all new and re-development projects; long-term operation and maintenance of stormwater management controls; retrofitting to incorporate long-term stormwater management criteria?"

Response: On the form, SSCAFCA has indicated "yes" on all program elements. SSCAFCA does not have jurisdiction outside of SSCAFCA-owned projects. SSCAFCA does have internal polices directing staff with regard to the program elements. However, SSCAFCA does participate in some plan reviews with the City of Rio Rancho for those developments that may impact SSCAFCA facilities. During this annual report year, SSCAFCA reviewed four development plans meeting these criteria and identified Low Impact Development opportunities one three of these plans.

Section 7.D, "Do you require water quality or quantity design standards or performance standards, either directly or by reference to a state or other standard, be met for new development and re-development?"

Response: On the form, SSCAFCA has indicated "yes" on this program element. On SSCAFCA-owned projects, SSCAFCA is required by State Law, to abide by the 96 hour rule, requiring all flood control facilities to discharge all detained stormwater within 96 hours. Therefore, all SSCAFCA flood control projects drain within 96 hours.

Section 7.E, "Do these performance or design standards require that pre-development hydrology be met for: flow volumes; peak discharge rates; discharge frequency; and, flow duration?"

Response: On the form, SSCAFCA has indicated "no" on all program elements except for Peak Discharge Rates. SSCAFCA-owned projects are flood control projects that generate little to no excess stormwater on site as the vast majority (>99%) of these projects are not constructed from impermeable materials. These projects are constructed to manage up-stream flows from development and attenuate the hydrograph so that stormwater can be conveyed safely through downstream facilities. However, SSCAFCA-owned projects are designed to provide for attenuation of stormwater hydrographs from upstream and discharge at historical levels to the greatest extent practicable. **Section 7.I**, "How many privately owned permanent stormwater management practices/facilities were inspected during the reporting period?"

Response: On the form, SSCAFCA has indicated "0" for this program element. SSCAFCA does not have statutory authority to regulate private development, including regulation of post-development conditions.

Section 7.J, "How many practices/facilities identified in I were found to have inadequate maintenance?"

Response: On the form, SSCAFCA has indicated "0" for this program element. SSCAFCA does not have statutory authority to regulate private development or post-construction conditions in private development. However, SSCAFCA facilities inspected for routine maintenance during the reporting cycle had maintenance needs identified and carried out.

Section 7.L, "Do you have authority to take enforcement action for failure to property operate and maintain stormwater practices/facilities?"

Response: On the form, SSCAFCA has indicated "No" for this program element. SSCAFCA does not have statutory authority to regulate private development or post-construction conditions in private development.

Section 7.N, "Do you use an electronic tool (e.g. GIS, database, spreadsheet) to track post-construction BMPs, inspections, and maintenance?"

Response: On the form, SSCAFCA has indicated "Yes" for this program element. SSCAFCA uses a spreadsheet for reporting maintenance activities to the U.S. Army Corps of Engineers (USACE) as part of the Letter of Permission for maintenance work within the Waters of the United States. SSCAFCA facilities are, for the most part, considered Waters of the United States by the USACE.

Section 8.A, "What was the annual expenditure to implement the MS4 permit requirements this reporting period?"

Response: On the form, SSCAFCA has indicated a value of \$140,779. This funding went toward, dues to the Stormwater Quality Team, expenditures for operating the Arroyo Classroom program in Sandoval County through Cuidad Soil and Water Conservation District, SSCAFCA's contribution to the Compliance Monitoring Cooperative, travel to the Region 6 EPA Conference in San Antonio, salaries of employees performing MS4 related duties, sponsorship of the Xeriscape conference in Albuquerque, and sponsorship of the Children's Water Festival in Rio Rancho.

Section 8.B, "What is next year's budget for implementing the requirements of your MS4 NPDES permit?"

Response: On the form, SSCAFCA has indicated a value of \$63,588.17. This amount does not include salaries for personnel working on permit compliance issues. There are no projected capital outlay projects targeted at stormwater quality during the 2018-2019 reporting year, hence the reduced number.

Response to Part I.C.2.b.(i).(g) of the permit:

Permit Citation-

- If, by the end of the 3rd year from the effective date of the permit, the permittee observes no progress toward the measurable goal either from program implementation or water quality assessments, the permittee shall identify alternative focused BMPs that address new or increased efforts towards the measurable goal. As appropriate, the MS4 may develop a new approach to identify the most significant sources of the pollutant(s) of concern and shall develop alternative focused BMPs (this may also include information that identifies issues beyond the MS4's control). These revised BMPs must be included in the SWMP and subsequent Annual Reports. Where the permittee originally used a measurable goal based on an aggregated WLA, the permittee may combine or share efforts with other MS4s discharging to the same impaired stream segment to determine an alternative sub-measurable goal for the pollutant(s) of concern for their respective MS4s, as described in Part I.C.2.b.(i).(c).B above. Permittees must document the proposed schedule for the development and subsequent adoption of alternative measurable goals for the pollutant(s) of concern for their respective MS4s, and associated assessment of progress.

Agency Response -

SSCAFCA, in cooperation with the TAG, MSGSQT, and CMC has observed progress towards E.coli controls and measurable goals, as demonstrated by the fact that the impairment for E.coli has been removed from the NMED 303(d) list for 2 of the 3 assessment segments along the river within the Middle Rio Grande corridor.

SSCAFCA will continue to annually assess and evaluate the program and progress in achieving the measurable goals listed above.

SSCAFCA and the Middle Rio Grande MS4 permittees have made significant progress during this permit term related to E. coli controls and measurable goals. In addition to 6 of the 7 Permit required samples collected by the CMC from the runoff for qualifying storm events, the MRGSQT has funded an additional year of dry weather E.coli data collection by college students in the BEMP program to better understand the baseline concentration of E. coli before storm events. The MRGSQT also funded a graduate student's master's thesis that studied the variability of E.coli concentrations in a water column compared to the juxtaposed sediment. A Watershed Protection Plan will continue to be an option as funding becomes available and SSCAFCA will continue the discussion of the possibility of a High Flow Suspension for Recreational uses of river water.

In FY 2018, the COA began a Microbial Source Tracking (MST) study; sample collection is underway for this project.

	Size of Structure (ac)	Sediment Capacity (CYDS)	Sediment Removed (CYDS)	Sediment Removal on Earthen Structures	Sediment Removal on Concrete Structures	Erosion Repair and Control	Concrete Repairs	Vegetation Removal/ Management	Manual Trash Removal	Vactor Cleaning	Access Control	Slide Gate Servicing	Water Monitoring	WQ Structure Cleaning	Bank Restoration
BLACK WATERSHED															
Sugar Channel	3180 Inft				Х		Х		Х						
Sunset Pond	5.2	17,600		Х		Х		Х	Х		Х				Х
Cabezon Channel	1700 Inft	40,800 (3-ft depth)			Х		Х	Х	Х		Х				
Tract 17 Pond	15.9	20,000		Х		Х	Х	Х	Х	Х	Х				Х
Roskos Field Pond	0.7	4000		Х	Х	Х	Х	Х	Х	Х					
Ivory Channel	1322Inft	13872 (3-ft depth)			Х		Х	Х							
Gateway Pond	5.65	800-1200		Х		Х	Х	Х	Х		Х				Х
Environmental Mitigation Area	77.88							Х	Х		Х				
Lisbon Channel (Tarpon Ave to Tulip Rd)	4300lnft			Х		Х		Х	Х		Х				Х
Lisbon Channel (Southern Blvd to Tarpon Ave)	4930lnft			Х		Х		Х	Х		Х				Х
Lisbon Channel (Black Arroyo Trail brdg to Southern)	1262 Inft			Х		Х		Х	Х		Х				Х
Arkansas Channel	4000 Inft			Х		Х		Х	Х						Х
Rodeo Channel	2860 Inft			Х		Х		Х	Х						Х
Pecos Channel	1950 Inft			Х		Х		Х	Х						Х
Baltic Channel	2450 Inft			Х		Х		Х	Х						Х
Bali Channel	1130 Inft			Х		Х		Х	Х						Х
Spur Channel	578 lnft				Х	Х	Х	Х	Х						Х
MONTOYAS WATERSHED				-							-	-	-		
Northern Blvd Sedimentation Basin	4.56	23,000		Х		Х	Х		Х						
Sportsplex Dam Floodpool	33.48	44,500		Х		Х	Х	Х	Х		Х				Х
Lower Montoyas Water Quality		66,000	16025	Х		Х	Х	Х	Х		Х				
Harvey Jones Channel	5067Inft	77,450			Х		X		Х		Х				
Harvey Jones Channel Outlet	8.06			Х	Х	Х	Х	Х	Х		Х				
Lomitas Negras Water Quality Facility	28	45,673		Х	Х	Х	Х	Х	Х		Х				Х
Dulcelina Curtis Channel	5088Inft	38,100			Х		Х		Х		Х				
Corrales Heights Dam 1	35	15,000		Х	Х	Х	Х	Х	Х		Х				Х
Dam 4 to 1 pipeline	3354Inft				Х		Х		Х	Х	Х				
Tree Farm Pond A	1.57	800		Х		Х		Х	Х		Х				Х
Tree Farm Pond B	1.01	600		Х		Х		Х	Х		Х				Х
Urban Pond A	0.95	600		Х		Х		Х	Х		Х				Х
Urban Pond B	6.63	1200		Х		Х		Х	Х		Х				Х
Urban Pond C	0.79	600		Х		Х		Х	Х		Х				Х
Sierra Norte Channel - North Hills	1350lnft			Х	Х	Х	Х	Х	Х		Х				Х
Acadia Court Pond	1.2	1900		Х		Х		Х	Х		Х				Х
Loma Pinon Loop Pond	0.33	530		Х		Х		Х	Х		Х				Х
Lark Pond - High Range Subdivision	0.98	1600		Х		Х	1	Х	Х		Х				Х
Sundt Pond	2.57	2500		Х		Х		Х	Х		Х				Х
Los Rios Lower pond	0.63	400		Х		Х	Х	Х	Х		Х				Х
Los Rios Upper Pond	0.62	350		Х		Х	Х	Х	Х		Х				Х
Pam's Pond	0.26	1200		Х		Х		Х	Х		Х				Х
Pond 116	1.61	800		Х		Х	Х	Х	Х		Х				Х

	Size of Structure (ac)	Sediment Capacity (CYDS)	Sediment Removed (CYDS)	Sediment Removal on Earthen Structures	Sediment Removal on Concrete Structures	Erosion Repair and Control	Concrete Repairs	Vegetation Removal/ Management	Manual Trash Removal	Vactor Cleaning	Access Control	Slide Gate Servicing	Water Monitoring	WQ Structure Cleaning	Bank Restoration
Cielo Norte Pond and Outfall (Michelle Dr. Pond)	1.03	850	<u> </u>	Х		Х	Х	Х	Х		Х	0,			Х
Northern Meadows Channel(S)	2.00								~			I	I		
Los Montoyas	7124lnft				Х	Х	Х	Х	Х						
Ponce De Leon	5157Inft				Х	Х	Х	Х	Х						
Northern Meadows ponds				•											
Wilpett Pond 1	2.37	2500		Х		Х		Х	Х		Х				Х
Wilpett Pond 2	1.5	1200		Х		Х		Х	Х		Х				Х
Wilpett Pond 3	2.52	2700		Х		Х		Х	Х		Х				Х
Wilpett Pond 4	2.22	2500		Х		Х		Х	Х		Х				Х
Wilpett Pond 5	2.51	2500		Х		Х		Х	Х		Х				Х
Wilpett Pond 6	4.98	5000		Х		Х		Х	Х		Х				Х
Clear Creek Pond	1.6	800		Х		Х		Х	Х		Х				Х
Desert Willow Pond	2.36	1600		Х		Х		Х	Х		Х				Х
Flat Iron Pond	3.22	1800		Х		Х		Х	Х		Х				Х
Havasua Falls Pond	1.18	1500		Х		Х		Х	Х		Х				Х
James Road Pond	1.22	1500		Х		Х		Х	Х		Х				Х
Camino de Los Montoyas Pond	1.18	800		Х		Х		Х	Х		Х				Х
Zia Park Pond	0.77	500		Х		Х		Х	Х		Х				Х
King Road Pond(s)	5	5500		Х		Х		Х	Х		Х				Х
Valley Meadows Pond	0.5	500		Х		Х		Х	Х		Х				Х
Tract H Pond	4.18	2500		Х		Х		Х	Х		Х				Х
VENADA WATERSHED	11.1	44.000						X	Y						
Lower Venada Channel (NVIS28 to WQ Feature)	11.1	44,000		^		۸	^	A V	^						
Lower vehada Channel (WQ Feature)	2.1	14.000		v	v	V	v	X	v		v				v
Enchanted Hills Dam 1	8.55	14,000		×	X	Χ	X	X	X	v	Χ	v			X X
Chavete Dond	12.5	1200		v	^	v	^	v	^ V	^	v	^			^
Santa Eo Hills Dond	4.40	2500		× ×		×		^ V	×		× ×				×
Santa re mils Fond	4.05	4000		×		×		×	X		×				X
Marinosa Ponds	5.05	4000		~		Λ		Λ	Λ		~				Λ
Marinosa Pond 1	3 55	1500		x		x		X	X						
Mariposa Pond 2	5.55	1000		x		X		X	X						
Mariposa Pond 3	2 14	800		x		X		X	X						
Mariposa Pond 4	1 96	800		x		X		X	X						
Mariposa Pond 5	2.22	1100		x		X		X	X						
Mariposa Pond 6	2.23	1100		x		×		X	X						
	1 2.23	1100				~	1	~	N			1	1		

	Size of Structure (ac)	Sediment Capacity (CYDS)	Sediment Removed (CYDS)	Sediment Removal on Earthen Structures	Sediment Removal on Concrete Structures	Erosion Repair and Control	Concrete Repairs	Vegetation Removal/ Management	Manual Trash Removal	Vactor Cleaning	Access Control	Slide Gate Servicing	Water Monitoring	WQ Structure Cleaning	Bank Restoration
BARRANCAS WATERSHED	-			•				<u> </u>			<u>-</u>	•	•	•	
Guadalajara Pond	1	800		Х		Х		Х	Х		Х				Х
Campus Dam	24	20000		Х		Х	Х	Х	Х		Х				Х
CORONADO WATERSHED															
Bosque De Bernalillo WQ Feature	0.25	300		Х		Х		Х	Х						Х
Coronado Channel (Sheriff's Posse to east boundary)	1404 Inft			Х		Х		Х	Х						Х
Joiner Pipeline and stilling basin	5.74	400			Х	Х	Х	Х	Х		Х				
CALABACILLAS WATERSHED															

Х

Х

Х

Х

0.61

980

Redwood Pond

		Х

Middle Rio Grande Stormwater Quality Team - Southern Sandoval County Arroyo Flood Control Authority (SSCAFCA)

Professional Water Resources Education Consulting Services – Arroyo Classroom Program Report

Submitted by:

Ciudad Soil and Water Conservation District 100 Sun Ave NE, Ste 160 Albuquerque, NM 87109

Technical Contact:

Melissa McLamb, Education Coordinator (505) 225-RIVR melissa@riverxchange.com

June 30, 2018

Arroyo Classroom Program

The Arroyo Classroom program utilizes our natural arroyos as outdoor classrooms and brings local animals into the classroom to motivate 3rd graders to respect the arroyos as important wildlife habitat. Orilla Consulting, LLC developed the program in 2012 and initially implemented the program for 7 classes at Maggie Cordova Elementary in Rio Rancho. In 2013, the program grew to serve 20 classes. On July 1st, 2015, Orilla Consulting, LLC transferred the program to Ciudad Soil and Water Conservation District as part of the larger education and outreach efforts we are involved in throughout Bernalillo and Sandoval Counties. In the 2017-2018 school year, we served 33 classes within Rio Rancho Public Schools, reaching approximately 33 teachers and 770 students.

Participating Schools:

- Cielo Azul Elementary (6 classes) *
- Enchanted Hills Elementary (7)
- Maggie Cordova Elementary (6) *
- Martin Luther King, Jr. Elementary (4) *
- Puesta del Sol (6) *
- Sandia Vista Elementary (4)
- * Title 1 school

Deliverables to date:

All complete

- Stormwater Presentations: 33:33
- Arroyo Walk: 33:33
- Bat Presentations: 33:33
- Owl Presentations: 33:33



The program consists of a four-part series of lessons, based on grade-level science standards and addressing areas of interest to SSCAFCA, such as bats, burrowing owls, ATV use, pet waste, and arroyo safety. Educator Melissa McLamb delivered two of the lessons – an introductory lesson about watersheds, and a walking field trip to nearby arroyo habitat. Justin Stevenson of RD Wildlife Management, LLC delivered a lesson using live bats. Tavo Cruz of Envirological Services, Inc. delivered presentations with a live Burrowing Owl.

The watershed lesson expounds on the water cycle, already integral in 3rd grade curriculum. This year, we utilized the Enviroscape model to: introduce the concept of a watershed to students, demonstrate stormwater, emphasize arroyo safety and the importance of keeping our arroyos clean.

The arroyo walk is a highlight for students and teachers, as the majority of participating classes only receive one other field trip during the school year, and students always come away learning something new and interesting about the uniqueness of arroyo habitat. This lesson is about the unique adaptations

of arroyo animals and plants, incorporates a walk out to a nearby arroyo (when available) and extensive discussion about arroyo safety *(see lesson plan in Appendix A.)* Melissa first talked to students about the difference between concrete-lined channels and sandy-bottomed arroyos, and emphasized that it is never safe to go into concrete-lined channels, while sandy-bottomed arroyos can be visited when there are no clouds in the sky. Students searched for evidence of animals living in the arroyo banks, learned about how lizards, and other cold-blooded animals, are adapted to the desert environment by moving about to regulate their temperature, and looked for certain adaptations of desert plants to minimize water loss in the desert.

In the lesson about bats, Justin discussed common myths about bats while pointing out how these myths can pose issues for bat populations as he addressed each one. He taught students about species common in their area, including what habitat they prefer, what they eat, the challenges they face, and what to do if one sees an injured bat. He talked about how important bats are in keeping insect populations under control, shared ways to encourage and protect bats and emphasized that kids should not be frightened of them, but also should never touch a bat if they find one. Students were able to view two different species of live microbats.

In the owl presentation, Octavio talked with students about what time of year burrowing owls are in our arroyos, what habitat they need, and what we can do to support and protect them. Tavo emphasized the impact of riding ATVs up the sides of arroyos and encouraged ways to care for burrowing owl habitat. He taught students that burrowing owls are protected by federal law, and that 3rd graders could be ambassadors and protectors for the owls. Each student was able to observe the burrowing owl up close, one at a time. We worked in coordination with Wildlife Rescue to bring in the live burrowing owl for each presentation.

Evaluation:

Teachers continue to thank us for offering this program and comment that it is helpful to them in terms of meeting science standards. They mention an increase in student engagement during all of the experiential lessons and find that students are curious and continue to discuss content post presentations. All 33 participating classes, participated in previous years and each school expressed interest in returning next year.

Our two main staff for the program, both resigned from the District in September. This abrupt change resulted in Education Coordinator, Melissa McLamb, taking the lead on the program and spread presentations throughout the entire school year, rather than in the 3-5 month time frame presentations have traditionally been scheduled within. Surveys which have been used in previous years were



distributed to assess learning after the owl and bat presentations.

For our second year, we have collaborated with Cielo Azul Elementary for an arroyo clean up event with all of their 3rd grade classes. This year, City of Rio Rancho donated gloves and trash bags as well as provided a dumpster on site at Havasu Park, as part of the Great American CleanUp countrywide initiative. Collectively, students, teachers and other adults picked up 1180 pounds of trash at this event!

Post-Survey Metrics:

Bat survey

Total responses: 439

Why do we want to protect bats?

439 responses



If you find an injured bat, what should you do?

439 responses



Which is NOT a good way to help bats?

439 responses



Which of the following is TRUE about the bats that live around Rio **Rancho and Corrales?**

439 responses



Owl survey Total responses: 437



It's important to protect burrowing owls in our arroyos because:

437 responses





- habitat for owls, so if we see them we know we are taking good care of our...
- All of the above

What can we do to help burrowing owls?

437 responses



Survey Summary: Due to the time constraints and loss of programmatic knowledge created by the change in personnel and lack of training, many surveys were taken months after the bat and/or owl presentation. Surveys were shared with biologists for input. Our educators are noticing that questions with an "all of the above" answers seem difficult to determine for this age group. These surveys will be modified to become one survey in future years of programming, intended to assess comprehensive learning outcomes and distributed twice throughout the program -once before any presentations and once after all presentations are complete. Surveys will be revised to assess main conceptual objectives of each presentation. Surveys have been shared with collaborating biologists to improve questions and learning outcomes in the future.

Appendix A contains lesson plans; Appendix B contains supplemental materials; Appendix C contains photos and in-kind figures from the program.

Appendix A: Lesson Plans

Activity Guide for 3rd Grade – Animal and Plant Adaptations

1. What are we trying to teach the students in this activity?

Arroyos are cool places where animals live, animals and plants are adapted to live in the desert.

2. How can we tie this activity to our teaching goals:

Our Goals	Where we can relate our goals to this activity
Animals live in arroyos	Look for evidence of animals.
We should visit arroyos	Talk about when it is safe.
carefully	
Picking up dog poop keeps	We'll probably see poop, talk about how it can make animals sick.
germs out of our river	

Supplies:

- Thermometers
- Clipboards
- Poster of leaf adaptations

- Wax paper
- Paper towels
- Tape

3. How can we tie this activity to standards?

- Measure energy (temperature change)
- Posing a question, using numerical data, various methods to display results
- Animals and plants have adaptations that improve chances of survival
- Classifying animals and plants
- Living things cause changes to their environment, some detrimental, some beneficial

5. How should this activity be organized?

I. Pre-activity (10 minutes)

- Do you ever visit/play in arroyos? What do you do?
- What are arroyos for? Managing stormwater to keep our town from flooding when we get a heavy rain. Show first flush video.
- Talk about arroyo safety don't go into arroyos when you see clouds in the sky.
- Because our arroyos are natural, with sandy sides and bottom, they are safer.
- In Albuquerque, the arroyos have concrete sides and water travels so fast, it is really dangerous to ever go in arroyos. Some arroyos come from the canyon where it might be raining but you can't see.
- Our arroyos are home to all kinds of animals and plants, so they are a wonderful place to enjoy nature. What kinds of animals do you think might live in the arroyo?
- Walk out to arroyo

II. Lizard activity (15 min)

- 5min Look for evidence of animals. What kind of evidence? Scat, tracks, holes.
- What kind of animals live in holes (besides snakes)?
- What do you think makes it difficult to live out here? Heat, sunburn, not much water, cold at night. Animals and plants have special **adaptations** (special things about their bodies) that make it easier for them to live in this habitat.
- How do they get water? From plants, from condensation under rocks.
- How could they avoid heat? Stay in burrows or shade during the day, active at night.
- Some animals love the heat, though! Lizards are cold-blooded, which doesn't mean they are actually cold. It means their body temperature is determined by the environment. They need to absorb heat from their surroundings to function.
- Each student take a thermometer. This is a lizard, and it needs to maintain its body temperature at a certain level: fence lizard 35C (95F), whiptail 38.6C (101F). How can it keep from getting too hot? How can it keep from getting too cold? Lizards regulate their body temperature through behavior.
- Plants do kind of the same thing hold one palm out flat, one sideways. Which feels hotter? Prickly pear cactus pads grow sideways instead of flat to keep themselves cool!

IV. Plant activity (15 min)

- What do plants need in order to survive? Water, sunlight, air, soil
- What makes it difficult for plants in the desert? It's so hot and there's so little rain.
- How do plants get water? **Show evapotranspiration diagram.** It's kind of like when we're hot, we sweat. But if we lose too much water from sweating we get dehydrated.
- How do they keep cool? Remember prickly pear? Show pictures of hedgehog and prickly pear cacti. Desert plants can shade themselves! Hedgehog cactus has lots of spines that shade the surface and also blocks the wind.
- The leaves of many desert plants are **adapted** so that they don't lose too much water.
- Show leaf adaptations poster (fuzzy, small, curled, waxy, green stems but no leaves)

If weather is ok:

- Out in arroyo, we'll do an investigation.
- How many of the plants we see will have these adaptations? Hypothesize.
- To be fair, we can't just pick the plants we like. Standing in one spot, collect the first 6 *different* leaves you see.
- Draw each one, and describe what adaptation it has.
- How many of your 6 leaves have one of the adaptations listed?
- Why don't all have it? Some plants avoid the heat by just growing and producing seed really fast before the weather gets hot, and then they just die off and leave their seeds to grow next year!
- Search for seeds.

If windy, inside activity:

- Let's investigate one way they keep water. **Dab water on board, cover one spot with paper towel, one spot with wax paper.** Which do you think will evaporate faster?
- Show prickly pear picture. Make model of prickly pear pad: paper towels with wax paper taped around the outside. Show cut prickly pear pad.
- Maybe do experiment: soak wax-covered and non wax-covered leaves in water and time how long they take to dry.

V. Conclusion (10 min)

- Arroyos are for flood control, and we shouldn't play in them when clouds are in the sky.
- But they are cool places where animals and plants live, and we can visit when it's clear weather.
- Animals and plants are adapted to live in the desert climate.
- What we do in arroyos affects the plants, and animals' habitats. Should we ride ATVs up the sides? That's something humans do to change our environment for the worse.
- Picking up dog poop is important because it can make animals sick. Where does the water go when it flows down the arroyo? The Rio Grande! Keeping dog poop out of the river is one way humans can change our environment for the better.
- Walk back to classroom

Leaf Adaptations

- **1.** Fuzzy leaves or lots of spines
- **2.** Small leaves
- **3.** Curled leaves
- 4. Waxy leaves
- 5. Green stems but no leaves!





Enviroscape Activity Guide for Arroyo Classroom

1. What are we trying to teach the students in this activity?

What is a watershed? How does the water cycle work? What are different forms of pollution and how does it impact our river? Arroyos lead to the river and carries different types of pollution with it.

NM State Science Standards:

3 rd Grade				
Water cycles through the atmosphere, plants, soil, and bodies of water in				
various forms.				
Describe pollution and identify different types (can be naturally				
occurring or human made materials). Pollutants can get into our water				
and harm living things.				
Some animals can survive better in certain environments, some will not				
survive at all.				
Describe how roots take up water and soil nutrients, and leaves make				
food from sunlight.				

2. How can we tie this activity to our teaching goals:

Our Goals	Where we can relate our goals to this activity		
How does the water cycle	Describe the processes of the water cycle: evaporation, condensation,		
work?	precipitation, collection, run-off and infiltration.		
What is a watershed?	A watershed is all the land that drains into a river or other body of		
	water, from mountain forests to riparian zone.		
What makes water dirty?	Pollution comes from all over the watershed, and erosion is one form		
	of pollution.		
Why are arroyos	Arroyos provide important drainage in a storm event and provide		
important?	unique and critical habitat for wildlife and plants.		
How does vegetation help	Forests, wetlands and healthy arroyos help keep the river clean and		
our river?	prevent flash floods. Plants in these areas slow the runoff of water		
	into the river, reducing erosion and flooding. They can also remove		
	nasty chemicals from the water by taking them up through their		
	roots.		

3. What is effective in this activity? Kids enjoy playing with the model and discussing what they are observing.

4. What makes this activity difficult to teach? Kids want to touch everything on the model and play while you are talking.

Activity Materials and Preparation

- Enviroscape model + toy houses, cars, buildings
- chocolate sprinkles to represent dog poop

- bits of paper and/or rainbow sprinkles to represent trash
- black frosting to represent oil
- sugar sprinkles or food coloring (red or green) to represent pesticides, fertilizer and/or chemicals
- Set up model
- Draw sketch of the water cycle

I. Intro – 5-10 minutes

- 1. What is the water cycle and how does it work? Reference the water cycle sketch and/or sing the "Water Cycle" song.
- 2. What is a model and what is its purpose?
- 3. Introduce Enviroscape as a model of a watershed. What is a watershed?
 -Describe a watershed using the metaphor of a tree (branches as arroyos, trunk as river, leaves as land, roots as ocean)
 -Introduce students to different areas on the watershed.

II. Activity – 20-30 minutes

- 1. What is pollution? What kind of trash/pollution have you seen in your neighborhood, local arroyo or along the street? As students are identifying different forms of pollution, place the imitation pieces on the model, as you bring their attention to different areas on the model such as residential, roadways, parking lots, farm, etc.
- 2. Discuss how erosion can be a form of pollution, even though dirt is natural. *Ask students can there be too much dirt in the river?*
- 3. Describe how humans have made changes to the river over the past century, such as straightening the channel, removing wetlands, building houses near it, and creating lots of impermeable surfaces such as parking lots. Note that this means faster flow and more erosion, which can make it hard for native fish to survive. Silvery minnow needs slower flow and more shallow side channels to lay its eggs, sediment can clog up fishes' gills.
- 4. Talk about how forests play a role in the watershed and can affect the health of a river. Use watering cans to sprinkle water over the forest and see how it sinks in, not causing much erosion. *Ask students why they think this happens.* Discuss how forests slow the runoff when it rains, because the roots hold the soil in place and take up some of the water.
- 5. Farm (sediment, run-off, fertilizer, livestock waste, turbidity as a sand storm, impact on fish)
- 6. Factory (chemicals, waste, management, proximity to arroyo)
- 7. Houses (dog poop, grease, oil, trash)
- 8. Roads (oil, trash)
- 9. Observe the water's path to the river (through arroyos), and erosion below rooflines and at parking lot edges. *Ask students what they think might be in that runoff. How would you like to drink that if you were a fish?*
- 10. Notice what happens to water that falls on a hard surface like a street compared to when it falls on a grassy area. Discuss the importance of vegetation. Examine the wetland and discuss how riparian vegetation slows runoff into the river, preventing flooding. Use the watering cans to sprinkle water directly above the wetland and observe how the wetland traps some of the sediment.
- 11. On the man-made side, use berms to retain hillsides and riverbanks, add buffer strips to parking lots, and construct another wetland. Discuss with students ways in which they can

protect and support the health of arroyos and the river.

III. Discussion – 10 minutes

- Re-emphasize the concept of a watershed.
- What can we do? Why is it important? Clean up after your dog, utilize trash cans and dispose of waste properly.
- Re-emphasize how arroyos help carry stormwater away from the places where we live, work and play and that they are connected to the river.
- Talk about the importance of keeping our arroyos clean and how to be safe when playing in and around them.

Appendix B: Supplemental Materials

-SSCAFCA Activity Book and Educational Videos:



-SSCAFCA handouts:



Did you know?



SSCAFCA protects our community from flooding and erosion caused by big rain storms, and works to keep stormwater Clean. Stormwater flows down arroyos into the Rio Grande.

Bugs like to live in stagnant water that collects in ponds and low places in the arroyos. Insects like mosquitoes can carry diseases that make us sick.

Almost all U.S. bats feed exclusively on bugs, and 1 bat Can eat between 600 and 1,000 mosquitoes and other insect pests in just one hour. One bat Can eat its own weight in insects in a single night!

SSCAFCA provides bat houses to encourage bats to make their homes near our arroyos, and especially near detention ponds where stormwater runoff is Captured and allowed to slowly drain.

The more we help bats, the more pests they eat, so we don't have to spray pesticide that could wash down to the Rio Grande and pollute it.

Brought to you by:

SSCAFCA



SSCAFCA watershed map:



Appendix C: Program Photos



Justin Stevenson showing two microbats in rehabilitation to a class at Maggie Cordova Elementary.



Justin discussing the importance of bats and sharing video footage of their resting behavior.



Teacher at Cielo Azul Elementary disposing of trash picked up in the arroyo on the Arroyo Clean Up Day, May 17th.



Wildlife Rescue, Inc.'s burrowing owl, unable to survive in the wild, now shared for educational purposes.



Octavio Cruz elaborating on unique biological adaptations and answering questions for students at Cielo Azul Elementary.



Students at Enchanted Hills elementary pick up trash on our way back to school from the arroyo walk.

Cielo Azul Arroyo Clean Up	
Event - May 17, 2018	
City of Rio Rancho -	
Utilities Dept - coloring	
books, \$2/ea, 150 books	\$300.00
City of Rio Rancho - Parks,	
Rec and Community	
Services Dept (PRCSD) -	
Waste Management 40 yd	
dumpster, including	
delivery	\$275.50
City of RR PRCSD- trash	
have $150 19/62$	\$28 50
bays, 150, 15/ea	φ20.30
City of RR PRCSD-	
reusable gloves, \$.81/pair,	
150 pairs	\$121.50
88 students, 2 hours of	
service at \$24.14/hr	\$4,245.12
13 adults 2 hours of	
13 adults, 2 Hours of	¢607 64
Seivice al \$24.14/11	₽0∠1.04
	\$5 598 26
	ψ0,000.20


Innovative Outreach Program for Upper Elementary Students Integrating Water Resources Topics with Language Arts & Science

2018 Report

Presented by Ciudad Soil & Water Conservation District

June 2018

EXECUTIVE SUMMARY

This year, funding enabled 39 NM classes (1,188 students and 42 teachers) to participate. The majority of participating schools were Title I schools. Each NM class was partnered with another NM class and one or more classes outside the state for a total of over 1,412 participants. All program costs and coordination are provided free of charge to NM teachers. Training, technical support, and curriculum materials are provided free of charge to partner teachers. The program required \$51,639.06 in cash and generated total match valued at \$93,152.09 in the form of in-kind contributions including workshop space, classroom resources, presenters' time in the classroom, field trip docents, donated trees and shrubs as well as the teachers' and students' time.

Ciudad SWCD faced some unexpected challenges during the 2017-2018 school year. The District Coordinator, a main support for our educational programs, resigned unexpectedly in September, leaving a major gap in personnel at the start of school year. We hired on a contractor, Jessica Garduño, in December to assist with programming as needed. This change impacted the RiverXchange process flow as training for Jessica had to occur mid-school year, but we successfully completed the program at participating schools with only three exceptions (see below).

Teachers also continued to face challenges this year with mandatory computer based testing such as the PARCC test, which made it more difficult to access computer labs. We're noticing a pattern of teachers being interested in the blogging concept but having difficulty incorporating it as part of their curriculum throughout the school year.

Despite these challenges, we continue to receive feedback from teachers that they love the presentations and students learn a lot from them. Teachers enjoyed the extension activities and critical question prompts delivered after each one, commenting that it helped them further explore content with their classes. We continued to encourage group participation this school year by setting up reflection groups in each participating class, and distributing critical thinking prompts and follow-up activities to each presentation.

Most of our presenters have worked with us for years and know the program thoroughly, strengthening the correlation between their educational objectives and the goals of the RiverXchange program. We had difficulty scheduling individual presentations for our single participating online classroom and referred them to video presentations as they were available.

Program presentations were completed as follows:

Stormwater: 38/38	Agriculture: 37/38
Drinking Water: 37/38	Field Trips: 37/38
Wastewater: 38/38	

We were unable to reschedule one field trip, which was cancelled by a teacher, due to mandatory

testing and it being the end of the school year.

This school year, we helped fund an additional field trip for three participating classes in collaboration with US Fish & Wildlife Service. 3 RiverXchange classes also participated in USFWS Native Fish in the Classroom program and RiverXchange was able to fund the buses for their fish release. On these dates, students released approximately 130 native fish to the Middle Rio Grande, including flathead chub, longnose dace, and red shiners.

CONTENTS

PROGRAM DESCRIPTION	4
Mission	4
The Big Water Questions	4
Background	5
Program Management and Financial Support	5
Participant Selection	7
Teacher Professional Development Workshop	7-8
Curriculum	8-9
EVALUATION	9
Student Surveys	9-18
Student Writing	19

PROGRAM DESCRIPTION

Mission

The mission of RiverXchange is to deepen students' and teachers' understanding and appreciation for their local river ecosystem, motivate participants to protect local water resources by conserving water and keeping their source water clean, and to provide a high quality, high impact outreach opportunity for funders and in-kind contributors.

The Big Water Questions

The optional curriculum frames program outcomes as "guiding questions," known as *Big Water Questions*. A long term goal of RiverXchange is that students understand these questions and can formulate logical, fact-based answers by the time they finish elementary school. We believe that students who can synthesize water facts to understand larger water issues will have the proper critical thinking skills and foundation for further discussion in middle and high school so that they will become informed citizens and voters on water issues.

Understanding a Watershed

- Is every place in the world part of a watershed?
- Where does your community's stormwater go?
- How can surface water become polluted?
- How does the water cycle relate to weather?
- How are groundwater and surface water connected?
- How can groundwater become polluted?
- What actions can all of us take to keep water clean?

Water in Our Society

- In what ways does our society use water?
- Where does your community's drinking water come from?
- Does everyone have the right to use as much water as they want?
- Where does your community's wastewater go?
- What actions can all of us take to conserve water?

River Ecosystem

- How does water affect living things in an ecosystem?
- What role do forests play in a watershed?
- What role do wetlands play in a watershed?
- What are some of the ways scientists can determine the health of a river, lake, bay or ocean?
- What actions can all of us take to improve the health of our ecosystem?

Background

As producers of children's water festivals and other grade K12 water resources outreach in NM since 2007, we observed early on that NM elementary teachers rarely incorporated water concepts in the classroom beyond what is required by the state (e.g., water cycle), and that most elementary teachers considered "water" strictly as a science topic. While teachers personally acknowledged the importance of conserving water and keeping source water clean, we continued to find that upper elementary students had little or no understanding of major water resources topics unless the teacher specifically integrates a wide range of water topics into the curriculum. For this reason, as well as our successful festival work with upper elementary students, this age level was selected as the focus for the RiverXchange program.

We created RiverXchange to provide a free program that is fun, interesting, and easy to integrate into the normal curriculum. Our hope was to motivate participants to explore water resources topics in depth. The program is carried out over eight months so that students spend more time developing a sense of pride and personal connection to their own river ecosystem, as well as a personal connection to a distant river ecosystem and the students who live near it.

RiverXchange began in 2007 as a pilot project of Experiential EE, LLC (under a services agreement with the New Mexico Water Conservation Alliance) and the National Great Rivers Research and Education Center, featuring partnerships between two fourth grade classes in Albuquerque, NM, and two fifth grade classes in Godfrey, IL. A curriculum was developed, a field trip to the river was coordinated, and partner classes "met" three times during the year via video tele-conferencing to present what they had learned. The upper elementary level was chosen because of our successful festival work with this age group.

After the pilot project, we transitioned to a web-based technology called a wiki. This enabled us to overcome limitations such as the high cost, availability, and time zone logistical issues associated with video teleconferencing – and easily involve more classes. The curriculum was updated to incorporate the writing component and we introduced classroom guest speakers to reduce teacher workload and bring up-to-date technical information into the classroom.

In 2012, ownership of RiverXchange transferred to Amy White of Orilla Consulting, LLC, who managed the program through July 2015. In August 2015, RiverXchange became part of the Ciudad Soil & Water Conservation District. Since 2007, we have served nearly 17,000 students!

This year, the program featured the following components:

- Optional standards-based curriculum including hands on science and social studies lessons, as well as writing assignments
- Coordination of class partnerships
- KidBlog online posting and communication
- Teacher training on curriculum implementation and use of KidBlog
- Ongoing technical and motivational support
- Online class postings
- End of year teacher survey
- Pre and post student surveys (NM only)
- Payment for teacher workshop substitute teachers (NM only)

- Coordination of at least four guest speakers into the classroom (NM only)
- Coordination of a field trip to the local river or important watershed feature (NM only)
- Field trip bus transportation payment (NM only)
- Field trip leadership and activity planning (NM only)

Program Management and Financial Support

The program timeframe was July 1, 2017 through June 30, 2018. All components including fundraising, design, planning, implementation, and analysis were carried out by employees and contractors of Ciudad Soil & Water Conservation District, including:

Jennifer Moss Connie Crandall Melissa McLamb Jessica Garduño

Sponsors

- Southern Sandoval County Arroyo and Flood Control Authority
- Middle Rio Grande Stormwater Quality Team

Sponsors provided \$51,639.06 in cash. Program expenses included:

- Substitute teachers for NM teacher workshops
- Teacher workshop space rental and meals
- Field trip bus transportation for NM classes
- Field trip portable toilet rentals for NM classes
- Technology services
- Office supplies
- Coordination services (planning, implementing and assessing all program components)

New Mexico In-Kind Partners

- Albuquerque Water Utility Authority
- Bernalillo County Cooperative Extension, 4H
- Bernalillo County Master Naturalist Program
- Bernalillo County Public Works Division
- Bosque Ecosystem Monitoring Program
- CDM Smith, Inc.
- City of Albuquerque Open Space Division
- City of Rio Rancho Environmental Programs Office
- City of Rio Rancho Parks, Recreation and Community Services Department
- Daniel B. Stephens and Associates
- New Mexico Museum of Natural History and Science
- Sandoval County Cooperative Extension
- Southern Sandoval County Arroyo and Flood Control Authority

In-Kind contributions totaled \$93,152.09. For NM classes, in-kind contributions included classroom guest speakers, field trip docents, planting materials, workshop space and computer lab use, classroom

resources, and teachers' and students' time attending the presentations and field trips. For partner classes, in-kind contributions were not calculated this year. Sponsors and in-kind partners were recognized on our website and in presentations.

Participant Selection

All 39 participating NM classes were fifth grade classes, distributed as follows:

Bernalillo County	Sandoval County
Bandelier Elementary (2 classes)	Colinas del Norte Elementary (5 classes) *
Cochiti Elementary (2 classes) *	Martin Luther King, Jr. Elementary (6 classes)*
Duranes Elementary *	Rio Rancho Elementary School (4 classes) *
Georgia O'Keeffe Elementary (3 classes)	Sandia Vista Elementary (1 class)
John Baker Elementary (4 classes)	Bernalillo Elementary (1 class) *
Monte Vista Elementary (3 classes)	Placitas Elementary (1 class)
Osuna Elementary (3 classes)	
Zia Elementary (1 classes) *	
NM Connections (Online statewide class)	
20 classes, 612 students	19 classes, 576 students
* Title 1 school	

All but one partner classes were located in the continental United States, the other was located in South Africa. Partner classes included approximately 308 students and 14 teachers. We have found that partner teachers are highly motivated and come to the program with a willingness to participate even though our NM based funding cannot be used to help coordinate their classroom guest speakers, arrange a field trip, or pay for any direct costs.

Teacher Professional Development Workshop

Although preparation began many months earlier, RiverXchange officially kicked off in October with two teacher workshops for NM teachers and online training sessions for partner teachers. Teachers learned how to implement the activities in the curriculum and how to operate and manage their class blog.

This year, educators from Bosque Ecosystem Monitoring Project gave a professional development talk to RiverXchange teachers, emphasizing ways to incorporate environmental education and citizen science projects into the classroom.

KidBlog Technology

One of the challenging aspects of program implementation continued to be the training of teachers on how to use the KidBlog and encouraging them to do so throughout the year. This was our second year using Reflection Groups for blogging and activities. These groups minimize teachers' time in monitoring posts. To strengthen learning outcomes in the future, educators intend to coordinate presentations over a shorter time frame (3-4 months) and assist classrooms with 1-2 posts throughout the program.

Online Partner Training

Many teachers contacted us if they had technical difficulties and we also checked in with many of them mid Fall to answer any questions and troubleshoot any issues.

Curriculum

A component of RiverXchange is the hands on optional curriculum, which is offered to all participating teachers. It was developed to help students reach for deeper meaning through hands-on learning and reinforce what they have learned through the process of writing to their pen pals. Organizers strive to incorporate emerging water resources issues into the curriculum, increase networking opportunities for teachers, reduce teacher workload, and align the curriculum with public school curriculum priorities.

Each class learns about its own local water resources issues through hands-on activities, classroom guest speakers, and a field trip. Students write about what they are learning via a private educational website that can be viewed by their partner classes. The computer technology and writing components provide a unique opportunity to reinforce what was learned, increase student motivation to learn, and collect valuable metrics about student performance.

Through RiverXchange, students take pride in sharing their knowledge of the local ecosystem and learning from their peers about another river ecosystem. Comparing the two geographical areas gives students a broader understanding of the importance of a river ecosystem to human and other life. Students gain the unique opportunity to share personal experiences and ask questions about a distant place. Teachers feel this kind of personal connection is a big deal for kids – many of whom have never traveled beyond their city limits.

All activities are correlated to NM state standards and benchmarks for Science and Social Studies. All activities (because they require that students communicate information on the KidBlog) address Common Core Language Arts standards for writing. Some activities also address Common Core Mathematics and Science standards. For a summary of the RiverXchange Curriculum, see Appendix 1.

Guest Speakers

We coordinated four guest presentations to visit each NM classroom. In all cases, guest speakers were water resources professionals from local agencies. Topics included:

• watershed/nonpoint source pollution

- drinking water
- wastewater
- water and agriculture

Field Trips

The program requires that all classes attend at least one field trip to their local river or important watershed feature, which should incorporate a service learning component if possible. We coordinated all NM field trips. Throughout the winter and spring, students planted over 500 native trees and shrubs and helped restore critical riparian habitat along the Rio Grande in Albuquerque. Several spring field trips included a water quality monitoring component.

New Mexico Field Trip Locations

Gabaldon Trailhead- Open Space

Managed by City of Albuquerque Open Space, this property is located on the east side of the Rio Grande, immediately north of I-40 and Rio Grande Blvd. While students planted native trees, they learned about the history of the Bosque, the significance of invasive species and conservation efforts, and observed porcupines, sandhill cranes, coyotes and other bosque animals.

Tingley Wetland

This 18 acre tract, adjacent to the Bosque in downtown Albuquerque, is owned by the City of Albuquerque, and features a restored constructed pond and peripheral wetlands including native and nonnative aquatic habitat. Students took a hike into the Bosque, observed macroinvertebrates and tested water quality.

Partner Field Trip Locations

Since program funding is NM based, we were not able to assist partner teachers with coordinating a field trip; however, we did provide partner teachers with names of agencies located in most parts of the U.S. that may be able to assist. We know that many of them implement water quality testing. Many also go on field trips to relevant places including water treatment plants, local reservoirs, dams and river/watershed museums.

Evaluation Student Surveys

A key component of RiverXchange is its measurable goals relating to student performance. We collected quantitative data on student performance by way of a pre and post survey and qualitative data by reading what students submitted on KidBlog. We also surveyed students about their actions before and after participating in RiverXchange.

Pre/Post Behavior Survey

In order to quantify the learning outcomes achieved through RiverXchange, we ask our teachers to have their students fill out a survey prior to, and upon completion of the program. Below, you will find a series of graphs used to illustrate the change in responses between the pre and post surveys. This year, 812 students completed the pre-survey, while 623 completed the post-survey. In order to account for this

discrepancy in participation, the number of each given answer has been calculated as a percent of the total number of responses received for each given survey. We continue to refine the survey and our programming year after year based on teacher feedback and metrics gathered from these surveys.



This graph illustrates a significant increase in all the above listed positive behaviors after having received the RiverXchange presentations. For example, the question "How often do you pick up your dog's poop?" saw a 6.1% decrease in the answer "almost never," and an 8.21% increase in the answer "nearly always."



This graph illustrates a significant decrease in all the above listed negative behaviors after having received the RiverXchange presentations. For example, the question "How often do you apply more fertilizer and/or pesticide than the label says to use?" saw a 9.25% decrease in the answer "sometimes," and an 12.17% increase in the answer "almost never."

Change in Negative Behaviors



Change in Answer to the Question: "Where does the Rio Grande start and eventually end?"



Change in Positive Responses to the Question "What actions can all of us take to improve the health of our ecosystem? Choose all answers that apply."





Change in Negative Responses to the Question "What actions can all of us take to improve the health of our ecosystem? Choose all answers that apply."

What is a watershed (also known as a catchment or drainage basin)?



How much precipitation does your community receive each year?





When it rains, where does your community's stormwater go?

Where does your community's wastewater go?







Responses to the Question: "How can surface water (like a river, lake, bay or ocean) become polluted? Choose all answers that apply."



Responses to the Question: "Along with condensation, evaporation and precipitation, identify three other major components of the water cycle."



Change in Positive Responses to the Question: "How do forests affect our river ecosystem? Choose all answers that apply."





Change in Negative Responses to the Question: "How do forests affect our river ecosystem? Choose all answers that apply."

This decrease in negative responses indicates that our students have gained a better understanding of the effects of forests on our river ecosystem after participating in RiverXchange.







Change in Correct Responses to the Directions to "Match the definitions for drinking water, stormwater and wastewater."



Change in Response to the Question: "From what local source does your community get its drinking water? Choose all answers that apply."

Change in Responses to the Question: "Which of these things use our precious, clean drinking water? Choose all answers that apply."



What are some of the ways scientists can determine the health of a river, lake, bay or ocean? Choose all answers that apply.





Change in Responses to the Question: "What can farmers do to conserve water or prevent pollution of our water resources? Choose all answers that apply."

Change in Response to the Question: " How does water affect living things in an ecosystem? Choose all answers that apply."



Change in Responses to the Question: "What are some of the ways that humans have changed river ecosystems? Choose all answers that apply."





Change in Responses to the Question: "What actions can all of us take to conserve water? Choose all answers that apply."

Change in Responses to the Question: "How do wetlands (low lying areas where the soil is soaked with water) affect our river ecosystem? Choose all answers that apply."



Student Writing

The writing component is one of the most valuable aspects of the program, yet it continues to be our biggest challenge. We are continually striving to improve participation in this area because it helps teachers integrate writing in the content areas and reinforces student understanding of key water resources concepts. Teachers continued to face major challenges this year in getting efficient internet access in the classroom and/or access to computer labs, which are tied up for much of the year for NM teachers with the PARCC and other computer based tests.

Many teachers joined the program this year planning to use RiverXchange as a major component of their writing program to meet Common Core Language Arts standards, which require teachers to focus more on writing within content areas. Each year, we strongly encourage teachers to have students write and edit paragraphs before going to the computer lab because this promotes higher quality thinking and writing. When students do go through this process, it shows. We also encouraged teachers to use various forms of communication in addition to writing, such as videos, PowerPoint presentations, or audio files.

We had a couple of partner classes from different regions of NM. This encouraged a greater understanding of different sections of the Rio Grande for students.Many partner teachers register for the program having already prioritized the need to organize classroom time to blog throughout the school year, so as to ensure they have a successful experience as participants. In contrast, many NM teachers register for the program to receive the beneficial learning experiences of the presentations and field trip; the blogging and partnership aspect is not as strong of an incentive for their participation as it is the main incentive for the partner teachers.

We know from discussions with teachers over the years that the absence of student writing does not mean they did not do the activities, or that no learning took place. Many teachers were dealing with issues unrelated to the program, such as new curriculum in other areas, school reorganization, construction which prevented access to the computer lab for a portion of the year, or personal life changes that conflicted with engaging more with the program. We did our best to foster successful online partnerships. Even though some blogs had minimal to no activity, NM students still benefited from the guest speakers and the field trip.

Appendix 1 includes the RiverXchange curriculum, Appendix 2 includes post presentation questions and follow up activities, Appendix 3 includes photos.

Appendix 1 Curriculum



Welcome to RiverXchange... exploring watersheds through global collaboration!

RiverXchange is about communication and developing 21st Century Skills while learning about our watersheds! Each class will be partnered with one or more classes in a different state. The big idea is to communicate with your partners *at least twice each semester* by posting projects on your shared private educational blog and responding to what your partners have posted.

The Big Water Questions

Understanding a Watershed

- What is a watershed?
- Where does your community's stormwater go?
- How can surface water become polluted?
- How does the water cycle relate to weather?
- What role do forests play in a watershed?
- What role do wetlands play in a watershed?
- What actions can all of us take to keep water clean?

Water in Our Society

- In what ways does our society use water?
- From what source does your community get its drinking water?
- Does everyone have the right to use as much water as they want?
- What actions can all of us take to conserve water?
- How are groundwater and surface water connected?
- How can groundwater become polluted?
- Where does your community's wastewater go?
- What is the difference between wastewater, stormwater, and drinking water?

River Ecosystem

- How does water affect living things in an ecosystem?
- What are some of the ways scientists can determine the health of a river, lake, bay or ocean?
- What are some of the ways humans have changed rivers or other aquatic ecosystems?
- What actions can all of us take to improve the health of our ecosystem?

Student Assignments:

All of the lessons in our curriculum include a "Student Assignment" which can be expressed through writing, photos, video, audio, powerpoint, or other projects. **The only requirement is that you post two projects each semester, and respond to what your partners have posted.** This new format supports the essence of our program - meaningful sharing between classes.

Suggestions include:

- Create a public service announcement
- Create a news cast with various reporters discussing different areas
- Create a short documentary
- Write a environmental journalistic piece based on water challenges in your community
- Create an animation (using a tool such as kid pix)
- Create a powerpoint presentation
- Write a poem
- Write a book report for one of the suggested books
- Create a poster and post a photo of it on the wiki

We know that with all the other pressures in schools today, it may be difficult to find time to share on the wiki. Here are some suggestions we have gathered over many years of working with teachers on this great program.

Strategies for making the most of limited computer time:

- 1. Take videos on your smartphone, then post them yourself to group pages
- 2. Take pictures of posters or hand written assignments, then post to group pages.
- 3. Do a whole class project/posting using the Promethean or Smart Board. For instance, write down all the things that can pollute our river, group them by source/non-source, identify which ones the kids can help prevent, save and post the final diagram in each of the groups on the wiki.
- 4. **Read postings from partners using Promethean or Smart Board, as a "Friday fun day" activity** on the weeks they have posted. This could be done as a reading aloud/public speaking exercise.
- 5. Identify and train one student from each group to be the "tech leader." Have just these students use the limited classroom computers to post the group projects.
- 6. Encourage posting from home as homework. Just be sure to monitor what was posted the next day. Even if not all students have computers at home, some will. Consider dividing students up so that at least one person in each group has computer access at home, and they could become the "tech leader."

Strategies for planning and integrating with other curriculum:

- 1. When looking at your plans for the year, for all subjects, keep RiverXchange in mind. Remember, if you want to post "out of order" that is fine!
- 2. Modify the style of writing to match what you are planning to cover at that point in the year.
- 3. Posting shortly after a guest speaker comes to your class is recommended, so you could also consider rearranging your language arts curriculum (and scheduling your computer lab time) to coordinate with times when presenters are scheduled.
- 4. Whatever subject you enjoy the most, see how you can use RiverXchange to enhance it.
 - a. Social studies: history of why early settlers lived where they did, economic impact of rivers and water, use of water by industries
 - b. Math: calculate water use, waste, length of rivers, etc
 - c. Science: volume, density, states of matter
 - d. Language arts: writing is obvious but also poetry, reading informational texts, public

speaking

e. Other specialized topics such as engineering, careers, art, music

New Mexico Curriculum Overview

Remember, partners in other states may be doing their own curriculum, but we hope you will be able to have good discussion on several of these topics over the course of the year. You may also want to combine some of the lessons so that students do a project that incorporates elements of multiple topics from the curriculum. For example, you could have students write about their river's geography while also talking about its watershed and ways to keep pollution out of it.

Unit 1: Understanding a Watershed

- 1. River Geography
- 2. Watershed Model
- 3. Infiltration and Runoff
- 4. Forests and Wetlands

Unit 2: Water in Our Society

- 5. Commercial Uses of Our Rivers
- 6. Drinking Water
- 7. Groundwater
- 8. Wastewater

Unit 3: River Ecosystems

9. Field Trip (with pre and post activities)

Unit 1: Understanding a Watershed

Project 1: River Geography

Student Assignment

- Write a friendly letter to your partners or create another type of project, explaining:
- a) what a watershed is
- b) the name of your river this is also the name of your watershed!
- c) the journey of your river from its headwaters to the ocean
- d) what the river is like in your area big/small, clear/muddy, fast/slow?
- e) how much precipitation your area receives each year, and what season gets the most precipitation

Informational Texts

- Follow the Water from Brook to Ocean, by Arthur Dorros or Paddle-to-the-Sea, by Holling C. Holling
- KRQE news. "Moisture Makes One-Third of New Mexico Drought-Free" <u>http://krqe.com/2015/05/26/moisture-makes-one-third-of-new-mexico-drought-free/</u>

<u>Classroom Activity</u> – Flexible! Just do as much as you want, and feel free to substitute other activities.

- 1. Read the book, *Follow the Water from Brook to Ocean*, by Arthur Dorros (about the Colorado River) OR *Paddle-to-the-Sea*, by Holling C. Holling (most U.S. School or public libraries have one or the other, or they can be purchased online). Explain how water flows from smaller bodies of water into a larger body.
- 2. Show the *All About Watersheds* poster (see link below.) Introduce the concept of a **watershed** as the land area that drains into a body of water, and explain that this is where **surface water** comes from.
- 3. Show students the *U.S. Watersheds Map* (see link below), pointing out your watershed and your partners' watershed. Talk about the significance of the *Continental Divide* (see link below) in North America, and show them where it is in New Mexico. Ask students "Is every place in the world part of a watershed?" Even if there are no hills or mountains, and there is no visible surface water, every place IS in a watershed because precipitation that falls on that land area eventually drains somewhere.
- 4. Have students identify your river or stream on a large classroom map, and show them where your school is located in relation to your river (north, south, east, west). Figure out where your river or stream starts (headwaters), what tributaries flow into it, and what ocean it flows into at its delta (many students may not know that the Gulf of Mexico is part of the Atlantic Ocean).
- 5. Point out what towns (if any) are upstream from you and discuss how they could affect your water (quantity and quality) either positively or negatively. Discuss what towns are downstream (if any) and how your town could affect their water, either positively or negatively. Trace your river's path to the ocean, recording each body of water it passes through.
- 6. Locate your school and your partners' school on the *Precipitation Map* (see link below). How many inches of precipitation does your area receive? Compare with your partner's ecosystem. You may want to read the Albuquerque Journal article (see link above) about the drought in New Mexico.
- 7. Discuss seasons, timing of your area's precipitation, the altitude of your area and how these affect weather. Explain how **precipitation** and **snowpack** affect the river.
- 8. Show students the *Major Cities and Rivers Map* (see link below), and ask them why they think so many big cities are located near major bodies of water.
- 9. *Optional:* If you have time, students (or groups of students) could research major flora and fauna in different regions along the length of your river or tributaries and create a picture postcard from that place. Or, they could write a story about a journey down the river.
- 10. Optional: New Mexico classes -- for more information about the Rio Grande watershed in New Mexico, show students the Everything is Connected in a Watershed poster (in teacher packet), then visit the All About Watersheds website (see link below) to explore the interactive version.

11. *Optional:* Learn about the Great Pacific Garbage Patch and ocean gyres, using the PBS lesson plan and video (see link below). You may also want to show photos taken by Chris Jordan on Midway Atoll demonstrating the effects of wildlife consuming plastic.

<u>Materials</u>

- U.S. Watersheds map: <u>http://maps.howstuffworks.com/united-states-watersheds-map.htm</u>
- Basic information about the Continental Divide: <u>http://education.nationalgeographic.com/encyclopedia/continental-divide/</u>
- Precipitation Map: <u>http://www.wrcc.dri.edu/pcpn/us_precip.gif</u>
- Major Cities and Rivers Map: <u>http://cgee.hamline.edu/rivers/Resources/watershedmaps/quiz3.htm</u>
- *Everything is Connected in a Watershed* poster and *All About Watersheds* website link: <u>http://allaboutwatersheds.org/poster/poster_view</u>
- *Optional:* Great Pacific Garbage Patch lesson plan <u>http://www.pbs.org/kqed/oceanadventures/video/gyre</u> and Laysan Albatross photos <u>http://ocean.si.edu/slideshow/laysan-albatrosses%E2%80%99-plastic-problem</u> (Caution these photos are pretty graphic, so be sure to preview before sharing with students.)

<u>Vocabulary</u>

- Watershed: The land area from which snowmelt and rain drain into a river, lake or other body of water. Also known as a drainage basin or catchment.
- Surface water: Water collected on the ground or in a waterbody such as a stream, river, lake, wetland or ocean.
- **Continental Divide:** A drainage divide on a continent (in the U.S., the Rocky Mountains) such that the drainage basin on one side of the divide feeds into one ocean or sea, and the basin on the other side either feeds into a different ocean or sea.
- Headwaters: The source of a river (where it starts).
- Tributary: A creek, stream, or river which feeds a larger stream or river or a lake.
- **Delta:** The mouth of a river (so named because it is triangle-shaped like the Greek capital letter Delta).
- **Desert:** A region that receives less than 10" of precipitation per year.
- **Precipitation:** All the water that falls from the sky, in solid or liquid form, such as rain, snow or hail.
- Snowpack: The amount of snow that accumulates annually in a mountainous area.
- **Floodplain:** Land that may be submerged by flood waters, or a plain built up by materials deposited by a river.

Project 2: Watershed Model

For NM classes, this is presented by a guest speaker. For partner classes, we encourage you to see if you can find someone from a local agency who has a watershed model, such as the Enviroscape.

Student Assignment

Write a *persuasive* paragraph, or create another type of project, about why it is important to keep stormwater clean and what we should do.

Informational Texts

- Science News for Kids article. "Suffocating Waters" http://www.d123.org/olhms/dedie/documents/suffocatingwaters.pdf
- *CNN* article. "Garbage Man of the River" <u>http://www.cnn.com/2013/04/18/us/cnnheroes-pregracke-rivers-garbage</u>

<u>Classroom Activity</u> – Flexible! Just do as much as you want, and feel free to substitute other activities.

- 1. Watch *The Human Solution to Water Pollution* video (see link below).
- 2. Schedule a guest speaker to bring a model of a **watershed**, OR make your own using the activity on the back of the USGS poster *Watersheds: Where We Live* (the poster can be shown on a smartboard see link below, and a printable copy of the activity is on the RiverXchange Curriculum Page).
- **3.** Discuss how the gutters in our streets lead to **storm drains**, which often lead directly to the nearest body of water. Discuss the difference between **stormwater** and **wastewater** (from household drains and toilets). Find out how your community handles stormwater is it combined with a municipal wastewater (sewage) system?
- 4. Read news articles (see links above) about garbage in rivers and dead zones caused by nutrients in agricultural runoff. Review the *Top Ten Ways to Protect Our Precious Water* handout (in teacher packet), and brainstorm other ways to reduce **nonpoint-source pollution**.
- 5. *Optional:* For a great math-based extension activity, try *Don't Trash Our Rio* (in teacher packet) where students learn how much trash is pulled from Albuquerque's storm drain system yearly, and calculate how many trash bags or classrooms it would fill. Even though it is based on an Albuquerque news article, this activity is applicable to any area that has a storm drain system.
- 6. Optional: Watch The Majestic Plastic Bag video (see link below).
- 7. *Optional: New Mexico classes,* watch *Segment 3* of the Mid Rio Grande Stormwater Quality Team's educational video (link below) to learn about Albuquerque's and Rio Rancho's stormwater system.
- 8. *Optional: Partner classes,* Google "stormwater" in your area and see what information is there. Water districts, the Departments of Health and Environment etc. have many educational resources.

<u>Materials</u>

- The Human Solution to Water Pollution video (to right of screen): <u>http://sscafca.org/teacher-resources/</u>
- Top Ten Ways to Protect Our Precious Water handout (in teacher packet and on wiki Curriculum page)
- Watershed model such as Enviroscape, **OR** USGS poster *Watersheds: Where We Live* (the poster is available at <u>http://water.usgs.gov/outreach/Posters/watersheds/grade.html</u> and a printable copy of the activity is on the RiverXchange Curriculum Page) and supplies:
 - Butcher paper (or newspaper) and plastic wrap
 - Several large baking pans or plastic containers (clear ones can be reused for Project 4: Groundwater)
 - Waterproof marker
 - Spray bottles filled with water
 - Small plastic houses, cows and cars (or little pieces of modeling clay to represent these)
 - Cocoa powder and colored drink powders
- *Optional:* Don't Trash Our Rio activity (in teacher packet)
- Optional: The Majestic Plastic Bag video: <u>https://vimeo.com/14221747</u>

• *Optional:* Watch *Segment 3* (16:05-end) of the Mid Rio Grande Stormwater Quality Team's educational video: <u>http://www.keeptheriogrand.org/keeping-the-rio-grand/</u>

<u>Vocabulary</u>

- Watershed: The land area from which snowmelt and rain drain into a river, lake or other body of water. Also known as a drainage basin or catchment.
- **Point-source pollution:** Water pollution coming from a single point, such as a sewage-outflow pipe or a factory.
- **Nonpoint-source pollution:** Water pollution coming from a wide land area, not from one specific location. Occurs when rainwater, snowmelt, or irrigation runs off plowed fields, city streets, or suburban backyards, picking up soil particles and pollutants, such as nutrients, pesticides, and other chemicals.
- Storm drain: A drain, often under sidewalks, designed to collect excess rain and ground water from impermeable surfaces such as streets, parking lots, sidewalks, and roofs. Also known as a storm sewer.
- **First flush:** The first surface runoff of a rainstorm. This is when we see the highest levels of pollution in water entering the storm drains.
- **Stormwater:** Runoff from a storm which either flows directly into a water body or is channeled into storm drains, which eventually discharge to surface waters.
- Wastewater: All the water that goes down a drain into a municipal sewer system or septic system. Also known as sewage.

Project 3: Infiltration and Runoff

<u>Student Assignment</u>

Where does rainwater go when it falls on your school grounds? Write a *RACE* paragraph, or create another type of project, using evidence from your mini-field trip around the school.

Informational Texts

- USA Today article. "La Niña Brings Flood Risks, Drought to the West" http://usatoday30.usatoday.com/weather/news/2011-05-12-west-floods-drought_n.htm
- *LA Times* article. "3 days after rain, beach water can still make swimmers ill, study says" <u>http://www.latimes.com/science/sciencenow/la-sci-sn-beach-advisories-storm-runoff-20140303-story.html#ax</u> <u>zz2v99eazt7</u>.

<u>Classroom Activity</u> – Flexible! Just do as much as you want, and feel free to substitute other activities.

- 1. Listen to the *Water Cycle Song* (see link below). You may want to print out the lyrics for students (a printable copy is on the RiverXchange Curriculum Page). Review the six major components of the water cycle: **precipitation, runoff, infiltration, evaporation, transpiration,** and **condensation.**
- 2. Discuss how the sun's energy starts the whole process, and how the water cycle relates to weather, recalling the amount and timing of your area's precipitation.
- **3**. Point out that when precipitation hits the ground, it can either run off, sink in (infiltration, also known as percolation) or evaporate back into the air. Explain how all plants move water from the ground to the air through the process of transpiration.
- 4. Read the *USA Today* article (see link above) and discuss how **La Niña** and **El Niño** bring dry weather or wet weather to your area. Discuss what happens in different areas of the school when you have too much rain are there areas that flood?
- 5. Using *Investigating the School Grounds* (a printable copy is on the RiverXchange Curriculum Page) as a guide, take students on a "mini field trip" to investigate where rainwater goes on your school grounds to observe changes in land contours, and the location of downspouts and catchment areas. Discuss where runoff appears to be occurring, what affects infiltration, and the difference between **permeable** and **impermeable** surfaces.
- 6. Discuss how storm drains carry pollution from impermeable surfaces into the nearest body of water, whereas the process of infiltration into permeable surfaces helps filter out pollution. You may want to read the LA Times article (see link above) about pollution from stormwater.
- 7. Discuss how runoff can cause flash floods. In Albuquerque, concrete-lined arroyos are very dangerous because runoff comes from a larger area and the water moves very fast people have drowned. In Rio Rancho, the arroyos in their natural state are generally safe unless rain clouds are visible.
- 8. *Optional:* For a math-based extension, test infiltration on various surfaces, using *Does it Soak Right In?* (a printable copy is on the RiverXchange Curriculum Page) as a guide. Graph the data as a class to build data analysis skills.

<u>Materials</u>

- Investigating the School Grounds activity (a printable copy is on the RiverXchange Curriculum Page)
- Water Cycle Song: <u>http://www.abcwua.org/education/music/water%20cycle%20song.mp3</u>
- *Water Cycle Song* lyrics (a printable copy is on the RiverXchange Curriculum Page)
- *Optional: Does It Soak Right In?* activity (a printable copy is on the RiverXchange Curriculum Page)
 - A soup can for each group, all the same size, with both ends cut off
 - Stopwatches
 - Rulers
 - Measuring cups

Vocabulary

- **Precipitation:** All the water that falls from the sky, in solid or liquid form, such as rain, snow or hail.
- **Runoff:** The rain or snow that does NOT sink into the ground, that runs off the land into a river, lake or other body of water (often carrying dirt and pollution with it).
- Infiltration: The process of water sinking down into the ground to refill the aquifer. Also called percolation.
- **Evaporation:** The process by which water changes from liquid to vapor (water in a puddle, river, lake, ocean, or other body of water evaporates into the air).
- **Transpiration:** The process by which water comes out of the leaves of plants, primarily through openings in the leaves, and goes into the air.
- **Condensation:** The process by which water changes from vapor to liquid (water in clouds condenses to form rain).
- Impermeable surface: A material that water can NOT soak into (or infiltrate); also called an impervious surface.
- Permeable surface: A material that water can soak (or infiltrate) into; also called a pervious surface.
- Flash flood: A rapid flooding (less than six hours) of low-lying areas (such as washes, rivers, dry lakes, basins), caused by heavy rain, snow or sudden ice melt in surrounding areas.
- Arroyo: A Spanish word for a drainage ditch, gully or ravine which was carved by water drainage.

Project 4: Forests and Wetlands

<u>Student Assignment</u>

Write a *persuasive* paragraph, or create another type of project, about why wetlands and forests are important in our watersheds.

Informational Texts

- *ABQ Journal* article. "River Diversions Halted Due to Burn Scar Runoff" <u>http://www.abgjournal.com/45855/abqnewsseeker/river-diversions-halted-due-to-burn-scar-runoff.html</u>
- American Forests. "Forests and Water" <u>https://www.americanforests.org/conservation-programs/forests-and-water/</u>
- Rapid City Journal article. "Federal Government Confirms Wetland Channels Are Keeping Rap id Creek Cleaner" <u>http://rapidcityjournal.com/news/local/federal-government-confirms-wetland-channels-are-keeping-rapid-cree</u> k-cleaner/article b2a2e469-5100-5a66-866d-0733f183b0ee.html

<u>Classroom Activity</u> – Flexible! Just do as much as you want, and feel free to substitute other activities.

- 1. Watch *The Adventures of Junior Raindrop* video (see link below) to learn about how vegetation helps prevent **erosion**.
- 2. Read the *ABQ Journal* article (see link above) about erosion from wildfires polluting the Rio Grande.
- 3. Do the *Wetland Model* activity from the back of the USGS poster *Wetlands: Water, Wildlife, Plants* (the poster can be shown on a smartboard see link below, and a printable copy of the activity is on the RiverXchange Curriculum Page) to examine the effects of a **wetland** in reducing erosion and controlling flooding.
 - To model forests in the watershed, stick cotton balls in the clay and repeat the experiment again to see that the muddy water gets even cleaner as it travels through the "forest."
- 4. Even in desert areas like New Mexico, there are wetlands, and **riparian areas**. Many are constructed (man-made) specifically for cleaning stormwater. Read the *Rapid City Journal* article (see link above) on how constructed wetlands help keep their creek clean. Discuss how these areas also support a diverse community of living things, and how many people used to think wetlands were not important. In fact, they would fill them in with soil and build right on top of them!
- 5. Find books from your library on different kinds of wetlands, and discuss the differences in wildlife and plant communities they support *OR* watch the *NatureWorks* video (see link below).
- 6. *Optional:* Do the *Water Treatment Plants* activity (see link below) to see how celery sticks, like wetland plants, can help filter water by absorbing pollution. This activity is very quick to set up, then just wait one day to see what happens.
- 7. *Optional: New Mexico classes*, watch the section about Sanchez Farm in the Mid Rio Grande Stormwater Quality Team's educational video (link below) to learn how a constructed wetland helps clean stormwater.

<u>Materials</u>

- The Adventures of Junior Raindrop video: <u>http://www.archive.org/details/Adventur1948</u>
- USGS poster *Wetlands: Water, Wildlife, Plants.* The poster is available at <u>http://water.usgs.gov/outreach/Posters/wetlands/middle.html</u>, and a printable copy of the activity is on the RiverXchange Curriculum Page.
- Supplies:
 - Small rectangular plastic storage containers, or baking pans or paint trays
 - Modeling clay
 - Small pieces of carpet
 - Cotton balls

- *NatureWorks* video <u>http://video.nhptv.org/video/1491178229</u>
- *Optional: Water Treatment Plants* activity (a printable copy is on the RiverXchange Curriculum Page)
 - Celery sticks
 - Cups of colored water
- *Optional: Keeping the Rio Grand* <u>http://www.keeptheriogrand.org/keeping-the-rio-grand/</u>, the Mid Rio Grande Stormwater Quality Team's educational video (the part about the constructed wetland is from 13:12 16:01)

Vocabulary

- **Erosion:** The process in which a material (such as a river bank) is worn away by water or air, often due to the presence of abrasive particles in the stream.
- Wetland: An area such as a marsh or swamp that is covered with shallow water or where the soil is naturally soaked with water.
- **Riparian area:** The area around the banks of a natural body of fresh water, where the vegetation and landscape is directly influenced by that water.

Unit 2: Water in Our Society

Project 5: Commercial Uses of Our Waterways

For NM classes, this is presented by a guest speaker from the county's Cooperative Extension. For partner classes, we encourage you to see if you can find someone from a local agency or business who can present on this topic.

Student Assignments

- Write an *informational* paragraph or a *friendly letter* to your partners, or create another type of project, explaining:
- a) How was the river (or other waterway) important when people first settled in your community?
- b) How has your waterway been used by people for commerce (to make money) in your community's history?
- c) Do some people still rely on the waterway for their jobs, such as farming, fishing, shipping, or recreation?
- d) What technologies have people developed to solve water problems in your area (like drilling wells, building dams, locks, and fish ladders, different kinds of irrigation, or technologies to conserve water or prevent pollution?)

Informational Texts

- ABQ Journal article. "Deal Allows Farmers to Sell Irrigation Water"
 <u>http://www.abqjournal.com/221194/news/deal-allows-farmers-to-sell-irrigation-water.html</u>
- *National Geographic* article. "Parched: A New Dust Bowl Forms in the Heartland" <u>http://news.nationalgeographic.com/news/2014/05/140516-dust-bowl-drought-oklahoma-panhandle-food/</u>

<u>Classroom Activity</u> – Flexible! Just do as much as you want, and feel free to substitute other activities.

- Research the major commercial use(s) of your river/waterway (such as agricultural irrigation, shipping/transportation, electricity, fisheries and/or recreation) and invite a guest speaker to present, or find an activity that relates. In New Mexico, the <u>only major</u> commercial use of the Rio Grande is agriculture – 80% of the water goes to irrigation!
- 2. Discuss how these commercial uses influenced the location/history of your community, and how these users can also help a community conserve water and keep water clean (such as conserving water when irrigating, controlling **erosion**, keeping boat engines in good repair).
- 3. Discuss how people have developed technological solutions to solve water problems. For example, many ancient settlements in the West were abandoned because of lack of water, but irrigation technology has made it easier to survive. Dams have made it easier to control the flow of rivers, reservoirs store water, and fish ladders are built so that dams don't prevent their migration. High-efficiency toilets and other appliances help conserve water.
- 4. In NM, discuss the **acequia** system which was put in place by the Pueblo people and early Spanish settlers. Watch one of the YouTube videos if possible (see links below) or read the *Albuquerque Journal* article about water rights (see link above).
- 5. Show students the USGS poster *Navigation: Traveling the Water Highways* (the poster can be shown on a smartboard see link below, and a printable copy of the activity is on the RiverXchange Curriculum Page). Discuss how some communities use their river for transportation, while New Mexico rivers are used mainly for agricultural irrigation. New Mexico students may not be familiar with **dams**, **locks** and boats traveling on the river. If your river is used for transportation, you may want to do the *River Profile* activity on the back of the poster.
- 6. *Optional: Water Ripples games* (see link below). Review ways our society uses water, particularly in agriculture.
- 7. *Optional: Water Rights.* Using the *Pass the Jug* activity guide (see link below), act out the two different methods of assigning water rights to all the water users. Discuss the difference between the Riparian Rights and Prior Appropriation doctrines. Research the history of water rights in your community and compare the

differences in water rights issues with your partners' area. Prior Appropriation is used in the western states, which receive far less precipitation. Revisit the *Precipitation Map* and discuss why this makes a difference. Read about farmers being allowed to sell their water rights to allow more water for the ecosystem.

<u>Materials</u>

- USGS poster *Navigation: Traveling the Water Highways.* The poster is available at http://water.usgs.gov/outreach/Posters/navigation/grade.html, and a printable copy of the activity is on the RiverXchange Curriculum Page.
- *Optional: Water Ripples games.* http://aces.nmsu.edu/ces/watertaskforce/water%20ripples%20gameshow%20quiz/index.html
- Optional: Water Rights
 - Prior Appropriation Game <u>http://www.troutintheclassroom.org/sites/www.troutintheclassroom.org/files/documents/PriorAppropriationGame.doc</u>
 - Precipitation Map: <u>http://www.wrcc.dri.edu/pcpn/us_precip.gif</u>
 - Ancient Irrigation video: <u>http://www.youtube.com/watch?v=RUv2Tz1ayTc</u>
 - Ditch Cleaning at Arroyo Hondo video: <u>http://www.youtube.com/watch?v=YyqxdbsEObU</u>

<u>Vocabulary</u>

- Irrigation: Watering crops. When natural precipitation is not enough for crops, farmers use flood irrigation (common in New Mexico), drip irrigation and/or overhead sprinklers.
- Acequia: An irrigation ditch used to distribute water from rivers to farms. Most are simple ditches with dirt banks, but they can be lined with concrete. An important form of irrigation in the development of agriculture in the American Southwest.
- **Erosion:** The process in which a material (such as a river bank) is worn away by water or air, often due to the presence of abrasive particles in the stream.
- **Dam:** A barrier built across a river to hold water back; sometimes used to generate electricity.
- Lock: A chamber with gates that close off for raising and lowering boats on a river or canal.

Project 6: Drinking Water

For NM classes, this is presented by a guest speaker from the water utility. For partner classes, we encourage you to see if your local utility can send someone to present.

Student Assignments

Write a *persuasive* paragraph (or create another type of project) explaining why it is important to conserve water, and what we should do.

Informational Texts

- Santa Fe drinking water article (a printable copy is on the RiverXchange Curriculum Page)
- Albuquerque drinking water article (a printable copy is on the RiverXchange Curriculum Page)
- *LA Times* article. "Americans use twice as much water as they think they do, study says" <u>http://www.latimes.com/science/sciencenow/la-americans-underestimate-personal-water-usage-study-says-20</u> <u>140227-story.html#axzzv99eazt7</u>
- *A Long Walk to Water*, by Linda Sue Park (2010: Clarion Books, 128 pages)
- "How Does Water Use in the United States Compare to That in Africa?" <u>https://www.awf.org/blog/how-does-water-use-united-states-compare-africa</u>

<u>Classroom Activity</u> – Flexible! Just do as much as you want, and feel free to substitute other activities.

- Discuss the *Indoor Water Use* graph (see link below), emphasizing that all of these activities use clean drinking water. Explain that in homes and other buildings there is <u>one set of pipes</u> that bring clean drinking water into the home and a different set of pipes that takes the dirty water away. Be sure to mention that in many parts of the country (like in NM) people use almost as much for watering plants outdoors as all their indoor water use combined. Discuss how **xeriscape** and watering during the coolest part of the day can help.
- 2. Schedule a guest speaker to present on where your drinking water comes from, how it is treated to make it safe for drinking, and/or ways to conserve water. OR research where your drinking water comes from, and do *The Value of Water* activity from the back of the USGS poster *Water: The Resource That Gets Used & Used & Used For Everything* (the poster can be shown on a smartboard see link below, and a printable copy of the activity is on the RiverXchange Curriculum Page). Students will examine their water use by using play money to record their daily usage, then brainstorm how to conserve. For a math-based extension activity, you can graph the data as a class to build data analysis skills.
- **3**. Discuss how flooding or drought can affect your community's drinking water. Look for articles in your local paper, or read one of the suggested articles (see links above).
- 4. *Optional: Water Footprint.* Calculate your impact using an online tool (see link below).
- 5. *Optional: Water Use in Other Countries.* To learn more about water use in other countries, read the article about water use in Africa (see link above), invite a guest speaker from Water for People (see link below) and/or watch the *Water for Life* video, and/or read the book *A Long Walk to Water*, by Linda Sue Park. Compare average indoor water use in the U.S. to that in other nations.
- 6. *Optional: The Water-Energy Connection.* Show students the *Power Couple* video and/or water-energy posters to learn about the connection between electricity and water use, then do the activity (see links below.).

<u>Materials</u>

- Indoor Water Use Graph <u>http://www.epa.gov/WaterSense/pubs/indoor.html</u>
- USGS Poster *Water: The Resource That Gets Used & Used & Used For Everything.* The poster is available at <u>http://water.usgs.gov/outreach/Posters/water_use/grade.html</u>, printable copy of the activity is on the RiverXchange Curriculum Page.
- Optional: Water Footprint Calculator
 - <u>http://environment.nationalgeographic.com/environment/freshwater/change-the-course/water-footprint-cal</u> <u>culator/</u>

- Optional: Water Use in Other Countries
 - Find a guest speaker from your local Water for People Committee: <u>http://www.waterforpeople.org/take-action/volunteer</u>
 - OR Water for Life video: <u>http://www.archive.org/details/Unworks-MTV-WFL</u>

• Optional: The Water-Energy Connection

- *Power Couple: The Shocking True Story of Water and Electricity* video, with viewers' guide and posters. <u>http://www.abcwua.org/education/Energy_Water_Nexus.html</u>
- Understanding the Energy Demand of Bottled Water. http://www.earthday.org/sites/default/files/3.%20Understanding%20the%20Energy%20Demand%20of% 20Bottled%20Water_5-8%20Lesson%20Plan.pdf

Vocabulary

- Drinking water: Water that has been purified to standards set for human consumption.
- Xeriscape: The use of low water use plants in landscape (not "zeroscape".) Xeros is Greek for "dry."
- **Conserve:** To use something wisely; not wasting.
- La Niña: An irregularly occurring movement of deep cold water to the ocean surface along the western coast of South America that brings less precipitation to the southern U.S. and more to the northern U.S.
- El Niño: An irregularly occurring flow of unusually warm surface water along the western coast of South America that brings more precipitation to the southern U.S. and less to the northern U.S.

Project 7: Groundwater

Student Assignment

How are groundwater and surface water connected? Write a *RACE* paragraph, or create another type of project, using what you learned from the aquifer model.

Informational Texts

- ABQ Journal article. "State: Kirtland Jet Fuel Leak Massive" http://www.abqjournal.com/upfront/042254588838upfront05-04-10.htm
- *ABQ Journal* article. "KAFB Ramps Up Fuel Spill Cleanup" <u>http://www.abqjournal.com/161358/news/kafb-ramps-up-fuel-spill-cleanup.html</u>
- LA Times article. "Groundwater contamination a growing problem in L.A. County wells" <u>http://www.latimes.com/visuals/graphics/la-me-g-drought-wells-20150520-htmlstory.html</u>

<u>Classroom Activity</u> – Flexible! Just do as much as you want, and feel free to substitute other activities.

- 1. Watch *The Story of Groundwater* video (see link below) to learn the difference between **groundwater** and **surface water**.
- 2. Show students the *Major U.S. Aquifers* map (see link below) and locate your **aquifer**.
- 3. Do the activity *Recharge-Discharge* from the back of the USGS poster *Groundwater: The Hidden Resource* (the poster can be shown on a smartboard see link below, and a printable copy of the activity is on the RiverXchange Curriculum Page). Students build a simple aquifer model to learn about the water table, how a well works, and how groundwater and surface water are connected. Discuss how if we pump too much of surface water it can deplete groundwater, and vice versa. Also, if one person pumps too much groundwater from their well, it can affect their neighbors' wells.
- 4. Leaking underground tanks (such as septic tanks or gas tanks beneath gas stations) are a major source of groundwater pollution. This can be demonstrated using small plastic cups with holes poked in the bottom. Sink a cup into the gravel of the model and fill it with colored water to see how pollution spreads through groundwater. Note that contaminated groundwater can pollute surface water and vice versa.
- 5. Read articles from the Albuquerque Journal about a jet fuel leak from Kirtland Air Force Base (see links above) or find articles about similar issues in your area. Discuss what types of pollution can get into groundwater and what can't. Solids such as trash and dog poop on the earth's surface cannot travel down to the aquifer. Dissolved chemicals, heavy metals, and very large amounts of farm animal waste can, however.
- 6. Read the resources about groundwater from the Groundwater Foundation (see links below). Review the *Top Ten Ways to Protect Our Precious Water* handout (in teacher packet). Brainstorm other ways to prevent groundwater pollution.

<u>Materials</u>

- The Story of Groundwater video. <u>https://archive.org/details/Groundwater_Animation</u>
- Major U.S. Aquifers map: <u>http://pubs.usgs.gov/ha/ha730/ch_a/gif/A004_us.gif</u>
- Top Ten Ways to Protect Our Precious Water handout (in teacher packet)
- USGS poster *Groundwater: The Hidden Resource*. The poster is available at <u>http://water.usgs.gov/outreach/Posters/groundwater/grade.html</u> and a printable copy of the activity is on the RiverXchange Curriculum Page.
- Supplies:
 - Several clear baking pans or plastic containers
 - Gravel to fill containers 2/3 full
 - Several pump tops from soft-soap or hand-lotion containers
 - Paper cups with holes punched in the bottom to sprinkle water
 - Colored drink powder

- *The Groundwater Foundation* Uses of groundwater including chart <u>http://www.groundwater.org/get-informed/basics/groundwater.html</u>
- The Groundwater Foundation Contamination http://www.groundwater.org/get-informed/groundwater/contamination.html

<u>Vocabulary</u>

- Aquifer: A wet underground layer of water-bearing rock or materials (gravel, sand, silt or clay) from which groundwater can be extracted using a well.
- **Groundwater:** Water located beneath the earth's surface in cracks between soil particles and fractures in rock formations. A large and usable quantity of groundwater is called an aquifer.
- Surface water: Water collected on the ground or in a waterbody such as a stream, river, lake, wetland or ocean.
- Water table: The top surface of an aquifer (how far you have to dig down to find water).
- Well: A man-made hole with a pipe that goes down to the water table. A pump helps bring the groundwater up.
Project 8: Wastewater

For NM classes, this is presented by a guest speaker from the water utility. For partner classes, we encourage you to see if your local utility can send someone to present.

Student Assignment

Write a *narrative* or *creative* paragraph, or create another type of project, explaining the journey of your community's wastewater.

Informational Texts

- *KOAT* news. "Aging Pipes Mean Higher Water Bills" <u>http://www.koat.com/news/aging-pipes-could-mean-water-bill-hike/34284754</u>
- Combined sewer overflows article, by Anne Jefferson, a geology professor from Kent State. <u>http://all-geo.org/highlyallochthonous/2013/03/combined-sewer-overflows-solving-a-19th-century-problem-in</u> <u>-the-21st-century/</u>

<u>Classroom Activity</u> – Flexible! Just do as much as you want, and feel free to substitute other activities.

- 1. Invite a guest speaker to learn about where your community's **wastewater** goes, *OR* if your community has a municipal sewer system, do the activity *Where Does Your Used Water Go?* on the back of the USGS poster *How Do We Treat Our Wastewater?* (the poster can be shown on a smartboard see link below; printable copy is on the RiverXchange Curriculum Page).
- 2. Read the article about Albuquerque's crumbling sewer infrastructure, and/or the article about combined sewer overflows (see links above), or find news articles about issues in your area. If possible, you may want to watch the YouTube video, *A Drop's Life*, about combined sewer overflows in the Washington, DC water system.
- 3. Show students the *Septic System* poster (the poster can be shown on a smartboard, and a printable copy is on the RiverXchange Curriculum Page) and explain the difference between a **sewer system** and a **septic system** they both treat wastewater essentially the same way, but a septic tank is right by the house and uses a drainfield in rural areas. If desired, watch the *Dirty Jobs* video (see link below). If your community has mostly septic systems, discuss how important it is to have the tanks pumped out regularly to avoid groundwater pollution.
- 4. Discuss what kinds of things NOT to put down the drain or toilet for example, fats, oils, and grease can solidify in pipes and cause a backup. Discuss how treated wastewater is recycled in many communities (such as watering golf courses), and how a community's treated wastewater will be used by downstream communities.
- 5. Review the differences between **stormwater**, **drinking water**, and **wastewater**, emphasizing how different sets of pipes are involved, and that the "quality" of the water being transported is very different.

<u>Materials</u>

- USGS poster *How Do We Treat Our Wastewater*? The poster is available at http://water.usgs.gov/outreach/Posters/wastewater/grade.html, and a printable copy of the activity is on the RiverXchange Curriculum Page.
- Supplies:
 - 14 feet of yarn, string or rope
 - Shredded paper or packing peanuts and a cardboard box
- *Septic System* poster (on the RiverXchange Curriculum Page).
- Combined Sewer Overflow video: *A Drop's Life*. Applies to certain cities only, mostly in the eastern US, find out if your city has this type of system. <u>https://www.youtube.com/watch?v=5Ug1hravb9Q</u>
- *Dirty Jobs: Septic Tank Technician* video (Caution this video has one bad word at 1:16) <u>http://home.howstuffworks.com/home-improvement/plumbing/sewer2.htm</u>

Vocabulary

- **Wastewater:** All the water that goes down a drain into a municipal sewer system or septic system. Also known as sewage.
- Sewer system: A system of underground pipes used to transport human waste. In some communities, the sewer system is combined with the storm system (known as a combined sewer).
- **Septic system:** A small-scale sewage treatment system common in areas with no connection to a municipal wastewater system. A septic tank is a key component of a septic system.
- **Stormwater:** Runoff from a storm which either flows directly into a water body or is channeled into storm drains, which eventually discharge to surface waters.
- Drinking water: Water that has been purified to standards set for human consumption.

Unit 3: River Ecosystem Field Trip

Project 9: Field Trip

Student Assignment

Write a *narrative* paragraph or a *friendly letter* to your partners, or create another type of project, about your field trip:

- a) If you tested the water, explain why we collect water quality data and what it means.
- b) If you planted trees or did another service learning project, explain how your project will help the river ecosystem.

Informational Texts

- *A Waterproof Case* (in teacher packet)
- The Water Down Under booklet (in teacher packet)
- Local ecosystem articles (These are for NM teachers in other areas should search local newspapers for articles about their own ecosystem).
 - *ABQ Journal* article. "Battle with Beavers" <u>http://www.abqjournal.com/45685/north/battle-with-beavers.html</u>
 - Santa Fe New Mexican article. "Crews complete restoration project at Buckman recreation area" <u>http://www.santafenewmexican.com/news/local_news/crews-complete-restoration-project-at-buckman-recreation-area/article_284dd705-05e8-59bb-8585-f00934e93516.html</u>
 - The Washington Times article. "NM water release aims to help silvery minnow" <u>http://www.washingtontimes.com/news/2014/may/6/water-release-aims-to-help-silvery-minnow/?page</u> <u>=all</u>

Pre-Field Trip Activities

- 1. Define an **ecosystem** (the physical environment together with all the species that live there). Discuss how living things depend on the nonliving things, such as water, air, soil/rocks, and the sun.
- 2. Read *The Water Down Under* booklet to learn more about macroinvertebrates and water quality. Discuss the role of **aquatic macroinvertebrates** in the **food web** and what they can tell us about the health of our ecosystem. Many animals depend on them for food. Some aquatic macroinvertebrates are sensitive to pollution, so one way scientists can tell how healthy a river ecosystem is by looking at which types of macroinvertebrates are living in the water. Many spend only part of their lives in the water, so if the water is polluted, it has far-reaching effects on the ecosystem. Discuss **producers, consumers** and **decomposers**, and where aquatic macroinvertebrates fit (some are consumers, some are decomposers).
- 3. Talk about the field trip and location, and what students can expect.
- 4. *Optional: Frogline News*. Watch a newscast by frogs (see link below) to revisit how pollution gets into surface water. Discuss the significance of frogs (i.e., the frog is a biological **indicator species** because it is very sensitive to water pollution). Remind students of the watershed model and how they can prevent nonpoint-source pollution.
- 5. Optional: Acid Rain. Watch the video How Acid Rain Works (see link below).

<u>Field Trip</u>

- 1. For New Mexico Classes: Field trips may include a service learning project, such as tree planting or an agricultural activity. Otherwise, they will incorporate hands-on lessons about **riparian areas**, wetlands, macroinvertebrates and water quality, and students will use a field journal. On the field trip, students will gather data about pH, temperature, turbidity and dissolved oxygen.
- 2. For Partner Classes: We strongly encourage you to take any water-related field trip available in your area, and we can help if you have trouble finding one.

Post-Field Trip Activity

- 1. Review how land use affects water quality and what the water quality data tells us about the ecosystem.
 - Increased river temperature can be caused by many things including low river flow, large areas of impermeable surfaces, lack of vegetation, and stormwater that is warm from flowing over roads.
 - High temperature and/or fertilizers (including pet waste) can cause algae bloom, which reduces dissolved oxygen.
 - Erosion or algae bloom can cause turbidity, leading to higher temperature.
 - Acid rain, mine drainage or algae bloom can cause low pH (normally pH is determined by the types of • rocks or trees present in the watershed).
- 2. Read news articles about issues in your local ecosystem. A few articles for NM are provided (see links above).
- 3. Optional: River Food Web. Make a food web for your local ecosystem, identifying producers, consumers and decomposers, native species and invasive species, as well as local endangered species. Discuss how wildlife are "water users" too. Like humans, wildlife needs clean water to live, so as a community we must consider their needs when making choices about water. NM Classes: use Bosque plant and animal cards to do The Web activity (a printable copy is on the RiverXchange Curriculum Page), discussing how all living things depend on each other. For Partner Classes: The Web activity can be applied to any ecosystem and is a fun way to get kids thinking "on their feet".

Materials

Pre-Field Trip Activities:

- Frogline News video: <u>http://www.dailymotion.com/video/x2qhkrw</u>
- Optional: Acid Rain. How Acid Rain Works video, http://science.howstuffworks.com/nature/climate-weather/atmospheric/acid-rain.htm

Field Trip:

- *Macroinvertebrate Data Sheets* (if desired, printable copies are on the RiverXchange Curriculum Page). **Post-Field Trip Activities:**
- World Water Monitoring Challenge website http://worldwatermonitoringchallenge.com/ •
- *Optional: The Web* food web activity (a printable copy is on the RiverXchange Curriculum Page).

Vocabulary

- **Ecosystem:** All the living and nonliving things that interact in a particular place. •
- **Bosque:** A Spanish word for woodlands, it refers to the riparian areas of stream and river banks in the • southwestern US.
- **pH:** A measure of the acidity or alkalinity of water (or a solution) on a scale that ranges from 0 (extremely • acidic) to 14 (extremely alkaline). Pure water has a pH of 7 (neutral).
- Turbidity: A measure of water clarity based on the amount of particles suspended in it. •
- Dissolved oxygen: The concentration of oxygen dissolved in water, expressed in milligrams per liter or as a • percent saturation.
- **Riparian area:** The area around the banks of a natural body of fresh water, where the vegetation and landscape is directly influenced by that water.
- Aquatic macroinvertebrates: Animals that have no backbone, are visible with the naked eye, and spend all • or part of their life in water. This diverse group includes worms, mollusks, arachnids, crustaceans, and insects.
- **Food web:** A representation of the predator-prey relationships between species within an ecosystem.
- Producers: Organisms, generally plants, that make their own food (using only the sun's energy, water, and • inorganic compounds), and are the foundation of the food chain.
- **Consumers:** Organisms that obtain nutrients by eating other organisms (such as plants or other animals).
- **Decomposers:** Organisms (such as bacteria, fungi, other plants and animals) that break down the remains of • dead organisms, releasing the substances that can be used by other members of the ecosystem.
- Native species: A species that naturally occurs in a particular ecosystem. •

- **Invasive species:** A plant or animal introduced from a different area that competes with native species that is taking over an area.
- Endangered species: A plant or animal species existing in such small numbers that it is in danger of becoming extinct (dying out completely).

Appendix 2

Extension Questions and Activities

Field Trip:

Extension Activities:

- Write a *narrative* paragraph or a *friendly letter* to your partners, or create another type of project, about your field trip: Explain how your project will help the river ecosystem and what you learned. Describe what was difficult for you on the field trip and what was enjoyable.
- Make a food web for your local ecosystem, identifying producers, consumers and decomposers, native species and invasive species, as well as local endangered species. Discuss how wildlife are "water users" too. Like humans, wildlife needs clean water to live, so as a community we must consider their needs when making choices about water. Use Bosque plant and animal cards to do *The Web* activity (a printable copy is on the RiverXchange Curriculum Page), discussing how all living things depend on each other.
- Learn about The STRAW Project. An ongoing watershed restoration project first inspired by 4th graders in 1992, based in Marin Co. California! Add it to your school's library and show the documentary in class.
 http://www.pointblue.org/our-science-and-services/conservation-science/conservation-training/straw-program or read about the project in this article and discuss:

http://www.marinij.com/article/NO/20150325/NEWS/150329872

- What did you learn about the history of the Rio Grande River and the floodplain we planted in? How does this history impact the future of cottonwoods in the area?
- Identify some common invasive species. Where did they come from and how are they impacting the Bosque?
- What is the process of planting cottonwoods and willows and why do we do it in the wintertime?
- After this field trip, how may you see and understand the Bosque differently?
- What did you most enjoy being down in the Bosque?
- How can you apply what you learned or enjoyed on your field trip in your everyday life?

Stormwater:

Extension Activities: For a math extension activity try the "Does it Soak Right In?" lesson "Don't Trash Our Rio!" is another great extension activity for this presentation. That activity sheet can be found in your RX welcome folder.

You can also review the <u>"Top Ten Ways To Protect Our Precious Water</u>" handout in your teacher packet or within the Project 2 section on the curriculum webpage. Here you can zoom in and explore your watershed and the watershed that family and friends live in, perhaps

Interactive Topographical Watershed Map of Earth

Reflection Questions:

- What is stormwater and where does your community's stormwater go?
- What did you learn about stormwater that was surprising to you?

even your RiverXchange partners who live outside of New Mexico!:

- How does what happens in your yard or your neighbor's yard impact the watershed?
- What have you noticed about stormwater in your own neighborhood? What are things you can do to clean up stormwater?
- How can surface water become polluted?
- What's happens when rain falls on a pervious surface compared to an impervious surface? Give examples of impervious surfaces.
- How are groundwater and surface water connected?
- What are ways you can minimize stormwater pollution?
- What role do forests and wetlands play in a watershed?

Wastewater:

Extension Activities:

Through the ABQ Water Utility Authority's website you can navigate virtually through Albuquerque's wastewater system: <u>http://www.abcwua.org/Education/SWRP_home.html</u> or the overall water system:<u>http://www.abcwua.org/education/el_WSD_2.html</u> Want to add a project-based learning component to this exercise? Use these questions and activities to go along with your tour: <u>http://www.abcwua.org/education/educators_WSDcur2_quest.html</u>

Maybe even create a PSA with your class inspired by all you've learned!

Discuss what kinds of things NOT to put down the drain or toilet – for example, fats, oils, and grease can solidify in pipes and cause a backup. Discuss how treated wastewater is recycled in many communities (such as watering golf courses), and how a community's treated wastewater will be used by downstream communities.

Watch one of these videos in class to review the process of wastewater and what students can do to take care of wastewater:

-<u>https://www.youtube.com/watch?v=Ldz29NqwK78</u> (An animation narrated by a young student) -<u>https://www.youtube.com/watch?v=tuYB8nMFxQA</u> (A video on the water treatment process created by New Jersey American Water)

- What is wastewater and how does it impact your community?
- What is the difference between wastewater, stormwater and drinking water?
- . How can you use what you've learned to make a difference at home and at school?
- What is the process of treating wastewater in your community?
- What surprised you about the process of treating wastewater from the presentation?
- Since our wastewater gets cleaned and recycled at the wastewater treatment plant, why is it important to do what we can to keep it clean before it arrives there?

Drinking Water:

Extension Activities:

-Create a filter in class to clean contaminated water and investigate your findings with this lesson. This can be done over the course of a few days in class or you can demonstrate how a filter works with our class in a shorter lesson.: <u>http://seplessons.ucsf.edu/node/1754</u>

-A short article and video comparing the average consumption of water per day per person in Africa compared to in the U.S.

https://www.awf.org/blog/how-does-water-use-united-states-compare-africa

-A great lesson, learning about the issue of water scarcity and importance of conservation. Students log their personal use of and observation of water use over two days. Students can discuss their findings and talk about what would happen if water scarcity were an issue. There is also a TRUE/FALSE game to learn about water and how it impacts the human body and communities. <u>https://thewaterproject.org/resources/WaterLogs_5to8.pdf</u>

- Where does your drinking water come from and what communities rely on it?
- Drinking water is used for much more than bathing, flushing toilets and drinking. What are other ways you and your community use drinking water? Did you learn anything surprising about how we use drinking water, if so - what?
- What percentage of the Earth is covered in water? Out of that amount, how much is accessible fresh water? How much is available as drinking water and why is it important to conserve it?
- One-third of the world's population does not have access to clean drinking water. How would your life be different if you had to walk miles to bring back water to your family?

Agriculture:

Extension Activities:

To explore more about the Dust Bowl with your students: http://www.pbs.org/kenburns/dustbowl/educators/overview/

<u>Out of the Dust- Karen Hesse</u> (This book is in the voice of 14 year old Billie Jo. She narrates her struggle to help her family in the years of the Depression from the Dust Bowl. Takes place in Oklahoma, written as a poem. This book helped me fall in love with reading when I was in 5th grade!)

Extension activity: Interview a grandparent or an adult friend who knows about the Depression through personal experience or through stories told by their parents and relatives. Share with class members.

Soil is Not Trivial lesson plan

- What was the Dust Bowl and how did it impact people?
- What do you think are the major agricultural lessons for us from the Dust Bowl?
- How may we be able to prevent a dust bowl from occurring?
- What is important for farmers to consider when planning how to irrigate their farm and why?
- How does agriculture relate to water and to our daily lives?
- What did you discover in your planting activity about the different types of irrigation?

Appendix 3 Photos











Outcomes Report

for

Fiscal Year 2017-2018

(July 1, 2017 - June 30, 2018)

presented by

Phyllis Baker





During the period from July 1, 2017 through June 30, 2018, the Mid Rio Grande Stormwater Quality Team (MRGSQT) continued its educational partnerships with the Bosque Ecosystem Monitoring Program (B.E.M.P.) and RiverXchange. The team continued to post relevant information to its website and Facebook page, and also participated in a number of high-profile community events, including the Corrales Harvest Festival, New Mexico's Animal Humane Society's Doggie Dash and Dawdle, and the KOB TV Health & Wellness Fair. The team's interactive kiosk continued its successful run at Rio Rancho's Loma Colorado Public Library. Community outreach continued with various events throughout the year. The team rewrote and produced new print materials on a variety of MS4-related topics, including proper hazardous waste disposal, proper pet waste disposal, stormwater pollution reduction and awareness of hazardous on-the-job chemicals. Updates and improvements to the team's website **keeptheriogrand.com** began.

Team partners and supporters disseminated information on stormwater quality and pollution prevention through municipal water quality reports to stakeholders. Specialty advertising giveaways relating to stormwater quality awareness were ordered/reordered for use at public events. MRGSQT's annual budget for all these activities, excluding Type 9 items, donated hours by team members, and funding for Arroyo Classroom, RiverXchange and B.E.M.P., is \$50,000. The contractor, CWA Strategic Communications, donated \$2,328.19 in services during the 12-month period. We have summarized the activities below and on the following pages:

WEBSITE (www.keeptheriogrand.org)

The Team contracted with CWA Strategic Communications to redesign the website and the new site is expected to roll out in October 2018. Content and links have been updated and new material added. The site will be more user-friendly and offer Team members an easy way to upload, store and share materials.

FACEBOOK PAGE

In conjunction with the SQT website, a Facebook page contains posts and updated information at: (https://www.facebook.com/Keeptheriogrand). The page has 141 "Likes" and the Team occasionally boosts posts during events to obtain more visibility.

Estimated number of individuals reached by this activity: 141 **Permit Reference(s):** General SWP, Construction, Pet Waste Audience(s): Children, Adults

EVENTS

Between July 1, 2017 and June 30, 2018, MRGSQT members and their partner agencies reported participating in a total of 72 community outreach/educational events reaching 26,626 adults and children. *Details can be found in Exhibit 1 at the end of this report.*

Estimated number of individuals reached by these community outreach/education events (with duplications): 26,626 **Permit Reference(s):** General SWP, Construction, Pet Waste, Construction, Household Hazardous Waste, Illicit Discharge and Animal Sources Audience(s): Children, Adults

GENERAL MATERIALS DISTRIBUTION

As appropriate, team members distribute materials at events. Following are inventories of materials on hand from July 1, 2017 through June 30, 2018.

Total estimated number of people reached by these activities: 4,181 Cost per person reached (may be some duplication): \$0.60 **Permit Reference(s):** General SWP, Pet Waste, Household Hazardous Waste Audience(s): Children, Adults

STORMWATER QUALITY TEAM Inventory						
Item	Starting Qty as of 7/1/2017	Quantity	Distributed	Ending Qty as of 6/30/2018	Cost of Materials Distributed	
"Keep the Rio Grand" Bumper Stickers	798		48	750	\$48.00	
"Reduce Stormwater Pollution at Home" brochure	170		70	100	\$10.00	
SQT Brochure - "New Dog or Cat"	2,620		510	2,110	\$76.50	
Dog-shaped Poop Bag Dispensers	426		340	2,586	\$638.66	
"Don't Contaminate the River" stickers	1,040		780	260	\$148.20	
Poo Emoji Squeezies	4,570		430	3,840	\$656.61	
Morphing Fish Bags (added 1500 more on 8/31/2017)	187	1,500	770	917	\$2,816.12	
Silicone Pet Food Can lids (added 8/31/2017)		2,500	733	1,767	\$833.86	
New Pet Rack Cards (added 6/1/18)		5,000	100	4,900	\$8.45	
FOG Rack Cards (added 6/1/18)		5,000	100	4,900	\$8.45	
No Poop Fairy Rack Cards (added 6/1/18)		5,000	100	4,900	\$8.45	
Professionals Harmful Chemicals Rack Card (added 6/1/18)		5,000	100	4,900	\$8.45	
Reduce Stormwater Pollution at Home Rack Card (added 6/1/18)		5,000	100	4,900	\$8.45	
Large Stormwater display - 8 ft (updated 6/1/18)	1				\$1,155.00	
Tabletop Stormwater display - 6 ft (added 6/1/18)	1				\$480.00	
Stormwater Que	ALITY TERM		4,181		\$2,511.11	



The SQT invested in a smaller tabletop display to take to events with limited space. The larger 8 ft. standing display was also updated with new panels featuring updated information.

Mid Rio Grande Stormwater Team Outcomes Report • 2017-2018

EDUCATIONAL ACTIVITIES

Educational Kiosk at Rio Rancho's Main Loma Colorado Library.

The kiosk remained at Rio Rancho's main library through April 2018 and continued to educate citizens (primarily children) about stormwater issues. The kiosk features:

- An interactive stormwater system map where children can press various points to learn the roles arroyos and channels play in the stormwater system and how to keep from polluting that system. The system stretches from Bernalillo on the north through Rio Rancho and into Albuquerque.
- A "Scoop the Poop" game that lets children choose one of three dogs and learn how to properly pick up after that dog. This is important because pet waste is a major source of *E coli* contamination in the Rio Grande.
- An educational panel on common types of trash, debris and chemicals that pollute the Rio Grande including appliances and electronics, automotive products such as oil, batteries and gasoline, glass and cement, household cleaners, yard waste, prescription and overthe-counter medicines.
- A touch screen that includes facts about each arroyo and the Rio Grande.

Stormwater Quality Team Creates Interactive Kiosk for Children

Maps, Games and Videos Highlight Stormwater Runoff System and Its Link to Rio Grande. The Mid Rio Grande Stormwater Quality Team has created a kiosk to teach children about our area's stormwater runoff system and what they can do to keep from polluting that system and the Rio Grande. The three-sided kiosk, which debuted at the Downtown Children's Library. uses touch and video screens to engage and teach children that everything entering the stormwater system can end up in the Rio Grande - and provides practical tips on what they can do to keep our river clean.

The three-sided kiosk uses interactive screens to engage and teach kids that "all roads lead to the Rio Grande" and offers information on how people can help keep the river clean.



JULY	AUG	SEPT	ост	NOV	DEC	JAN	FEB	MAR	APRIL	MAY/ JUNE	TOTAL
18,456	19,712	16,147	16,173	14,877	12,411	17,274	18,470	18,428	15,486	N/A	167,434

Total number of children and adults viewing the kiosk from July 1, 2017 through April 30, 2018. Numbers for May and June, 2018 were not available at the time this report was compiled.

Plans are in the works to upgrade the kiosk, change the software platform of the games for easier access and analytic tracking and conduct some repairs on existing hardware.

STUDENTS AND TEACHERS REACHED THROUGH PARTNER EDUCATIONAL PROGRAMS – ARROYO CLASSROOM, RIVERXCHANGE AND BOSQUE ECOSYSTEM MONITORING PROGRAM (B.E.M.P.)

Arroyo Classroom

The Arroyo Classroom program utilizes natural arroyos as outdoor classrooms and brings local animals into the classroom to motivate third graders to respect the arroyos as important wildlife habitat. In the 2017-2018 school year, the program served 33 classes within the Rio Rancho Public School System, reaching approximately 33 teachers and 770 students.

For more information, see Exhibit 2, Arroyo Classroom's 2017-2018 report to the Mid Rio Grande Stormwater Quality Team.

RiverXchange

RiverXchange is an innovative, long-term outreach program that integrates water resource topics with computer technology, student writing, and a hands-on curriculum to meet specific, measurable outcomes.

Since 2007, the program has enabled upper elementary classes from New Mexico to become "high tech pen pals" with classes outside the state to share what they learn about the geography, culture, and ecology of their local river and watershed. Including these partner classes, the program has served over 14,000 students. Each student spends about 25 hours engaged with the program over the course of the school year. The curriculum incorporates hands-on activities, and multiple classroom presentations by local water resources experts. During the 2017-2018 season, 39 fifth-grade classes, most of which were Title I schools (1,188 students and 42 teachers) participated in New Mexico. RiverXchange conducted 20 classes (612 students) in Bernalillo County and 19 classes (576 students) in Sandoval County

For more information, see Exhibit 3, RiverXchange's 2017-2018 report to the Mid Rio Grande Stormwater Quality Team.

B.E.M.P.

The main objective of the *Stormwater Science* outreach education program of the Bosque Ecosystem Monitoring Program (B.E.M.P.) is to teach students that the health of the Rio Grande is directly related to the health of the surrounding watershed. The *Stormwater Science* program includes a one and one-half hour classroom activity, and a 4-5 hour study trip to the Rio Grande. During the 2017-2018 school-year 2,247 students participated in *Stormwater Science* activities in their classrooms, in the field or both. The classroom program was delivered to 1,517 students in 30 classrooms at 19 different schools in Rio Rancho, Albuquerque, and Belen. See *Exhibit 5* for the BEMP Report on the 2017-2018 school year and its *Stormwater Science* report.

For more information, see Exhibit 4, B.E.M.P.'s 2017-2018 report to the Mid Rio Grande Stormwater Quality Team.

Total estimated number of people reached by these educational activities: 174,419

Permit Reference(s): General SWP, Pet Waste, Animal Sources, Household Hazardous Waste, Illicit Discharges Audience(s): Children, Adults



PUBLIC EDUCATION CAMPAIGNS ON PROPER DISPOSAL OF FATS, OILS & GREASE

In November and December 2016, the City of Rio Rancho and the Albuquerque Bernalillo County Water Utility Authority (ABCWUA) planned and implemented public education campaigns on how to dispose of cooking grease properly. The campaigns were timed to coincide with the holiday cooking season (Thanksgiving through Christmas). The City of Rio Rancho campaign included:

Print Ads – Two (red, green) small ads ran twice in one issue of the *Observer* the Sunday before Thanksgiving (11/19) reaching approximately 60,000 readers (with duplication). **Digital Outdoor Boards** – 5 digital outdoor boards ran one week in November (11/20-11/26), alternating the red and green boards. Two of those boards ran an additional week (11/27-12/3). 7 boards ran in December the week before Christmas (12/18-12/24). A total estimated audience of 181,648 adults (18 years of age and older) with duplication was reached.

Movie Theaters – One 30-second spot played 750 times in Rio Rancho's 14-plex Premiere Theater for one week in November (12/15-12/21) and two weeks in December (12/15-12/28) reaching approximately 30,000 people with duplication.

In addition, the City of Rio Rancho published an article in its Fall 2017 newsletter. "Beware the Holiday FOG!" offered information about the damage fats, oils and grease can do to sewer mains to the newsletter's 37,000 mail recipients.

Total estimated audience reached (with duplication): 308,648





The Albuquerque Bernalillo Water Utility Authority (a Stormwater Team supporter) expanded its annual holiday campaign on Fats, Oils & Grease in the fall of 2017 to include messages about what not to flush down the toilet (trash and flushable wipes) as well as what not to place down the sink (grease). New outdoor boards, a new television spot and a new radio spot were created, along with a bill insert stuffer mailed to the Water Authority's customers. The campaign, which ran in November, December, January and February, reached the following audiences:



Bill Insert – ran in December, January and February – estimated reach 210,000 bill inserts per month = 630,000 adults with duplication.

Radio spot – 600 30-second radio spots reaching a targeted audience of women 25-64, with a total reach of 180,200 with duplication.

Television spot – 1,418 spots reaching an estimated audience of 1,098,510 with duplication.

Outdoor - Digital messages ran on 4 outdoor boards for 2 weeks in November (around Thanksgiving) and in December (around Christmas). Total estimated reach was 1,013,420 with duplication.

Reduce Stormwater

Pollution at Home

KEEP THE RIO GRAND

Vehicles

Stormwater Quality Term

KEEP THE RIO GRAND!

ose of wash water at a sanita

Take leftover paints, solvents, oils aterials to a v

als to the street ter storm drains.

Stormwäter Quality Team

KEEP THE RIO GRAND!

osal center NOT wash, sweep or blow an

Total audience reached (with duplication): 2,922,130

PRINT MATERIALS

The Stormwater Quality Team created a series of rack cards addressing specific MS4 Permit issues:

- Reducing Stormwater Pollution at Home for residential use
- Keep Harmful Chemicals from Entering Storm Drains for professionals dealing with hazardous chemicals
- Dispose of Fats, Oils & Grease (FOG) Properly - for residential and professional use
- Don't Poo-Poo the Rio! a handout for new pet owners, to be distributed at animal control and animal rescue organizations
- There IS NO Poop Fairy! a general handout about proper pet waste disposal

These materials are distributed at public events and also at appropriate venues such as animal rescue organizations, libraries, city halls, etc.

Permit Reference(s):

General SWP, Pet Waste, Animal Sources, Household Hazardous Waste, Illicit Discharges

Audience(s): Children, Adults



SSCAFCA, a MRSQT member, produced several brochures as part of its Arroyo Safety campaign.



7

SSCAFCA also produced two animations for children. One is entitled Arroyo Safety and the other is called "Respect Your Arroyos." The videos are shown in elementary school classes and are accompanied by an activity workbook that reinforces the information addressed in the animations with coloring pages and word games.







8 Mid Rio Grande Stormwater Team Outcomes Report •

HOUSEHOLD HAZARDOUS WASTE COLLECTION

Household Hazardous Waste Diverted from Landfill

MONTH	MEMBER	POUNDS COLLECTED	POUNDS RECYCLED	
2017				
July	City of Albuquerque	52,381	50,506	
August	"	39,319	36,897	
September	"	29,165	27,875	
October	"	44,614	42,504	
November	"	35,360	33,106	
December	"	26,745	24,647	
2018				
January	"	27,592	24,527	
February	"	22,297	20,314	
March	"	32,635	31,366	
April	"	49,004	43,673	
Мау	"	37,907	36,152	
June	"	28,498	25,876	
TOTAL	"	425,517	350,136	

Stormwater Debris Diverted from Rio Grande

MONTH	MEMBER CUBIC YARDS REMOVED					
2017						
July	AMAFCA	10				
August	"	1,690				
September	"	1,919				
October	"	9,246				
November	"	15,628				
December	"	9,045				
2018						
January	"	10,002				
February	"	21,697				
March	"	22,811				
April	"	7,532				
June	"	4,551				
TOTAL	"	112,743				

DONATIONS/SPONSORSHIPS

The City Of Albuquerque donated \$65,000 to organizations for additional educational and training programs:

MEMBER	AMOUNT DONATED	RECIPIENT	PURPOSE
City of Albuquerque	\$45,000	The Nature Conservancy	For Education and Outreach
"	\$20,000	Earth Force	For Education and Outreach
AMAFCA	\$5,000	Land and Water Summit	For Public Involvement and Participation
SSCAFCA	\$5,000	Land and Water Summit	For Public Involvement and Participation

ESTIMATED TOTAL NUMBER OF PEOPLE REACHED THROUGH ALL ADVERTISING, EDUCATIONAL AND PUBLIC OUTREACH ACTIVITIES DURING 2017-2018:

Social Media	141
Distributed Materials	4,181
Kiosk	167,434
Classes (Arroyo Classroom, RiverXchange and BEMP)	174,419
RR FOG	308,648
ABC FOG	2,922,130
Events	26,626
	3,603,579

Obviously, some people were reached by more than one activity, but in gross numbers an estimated **3,603,579** people were reached with a stormwater quality/stormwater pollution prevention message during the 2017-2018 fiscal year.



Exhibit 1 Event Participation 2017-2018

NAME OF PROGRAM/EVENT	EVENT DATE	TYPE OF AUDIENCE	MS4 CATEGORY	TOTAL REACHED	NOTES
2017		,			
Earth Day Puesta Del Sol Elementary-Enviroscape Demo	4/20/17	Elementary School students	SWP	600	
MS4 permit presentation- Rotary Club in Albuquerque	4/20/17	Adults	SWP	40	
Enviroscape Presentation- Mom's Group at Tijeras Creek Restoration Project	7/11/17	Adults	SWP	20	
Rolling River Presentation- Isleta Pueblo Environmental Fair	7/15/17	All Ages	SWP	50	
Rolling River Presentation- Water Day at Railyards Market	7/16/17	All Ages	SWP	100	
Household Hazardous Waste Collection, joint effort with ACT Environmental Svcs, COA and Bernalillo County from the 500 Balloon Fiesta Pkwy NE area	8/19/17	Adults	ннw	401	Collected, segregated, packaged, labeled, transported and disposed of 26,218 pounds of Household Hazardous Waste, and 3,600 pounds of Non- Regulated Solid Waste (an average of 74.35 pounds of waste per customer).
Enviroscape Presentation-East Mountain Celebration (with TCRP tours)	9/24/17	All Ages	SWP	50	
Rolling River Presentation- Valle de Oro 5th Birthday	9/30/17	All Ages	SWP	125	
Corrales Harvest Fest	9/30/17	All Ages	SWP	8,000	
Rolling River Presentation- RMYC at TCRP	10/2/17	All Ages	SWP	125	
Rolling River Presentation- RMYC at TCRP	10/3/17	All Ages	SWP		
Rolling River Presentation- John Adams and Jimmy Carter MS at Valle de Oro	10/6/17	Middle School students	SWP	33	
Rolling River Presentation- Atrisco Academy HS, Ernie Pyle MS at Valle de Oro	10/9/17	Middle School students	SWP	50	
Rolling River Presentation-Van Buren HS at Valle de Oro	10/11/17	High School students	SWP	39	
Rolling River Presentation- TCRP field trip tour - Carlito Springs	10/19/17	All Ages	SWP		
Rolling River Presentation- Rio Rancho Children's Water Festival	10/23/17	Fourth grade students	SWP	75	
Rio Rancho Children's Water Festival	10/23- 24/2017	Elementary Students and Teachers	SWP	1,672	
Enviroscape Presentation- TCRP field trip tour - Carlito Springs	10/25/17	All Ages	SWP		
Animal Humane's Doggie Dash and Dawdle	10/31/17	All Ages	AS, PW, SWP	4,000	Animal Humane's signature event and largest fundraiser
Rolling River Presentation- RMYC at TCRP	11/13/17	All Ages	SWP		
UNM Water Student Group	11/30/17	College Students	SWP	35	

AS: Animal Sources CON: Construction HHW: Household Hazardous Waste ID: Illicit Discharges PW: Pet Waste SSS: Septic & Sanitary Sewer Systems SWP: General Stormwater Pollution Prevention

NAME OF PROGRAM/EVENT	EVENT DATE	TYPE OF AUDIENCE	MS4 CATEGORY	TOTAL REACHED	NOTES	
RiverXChange, Georgia O'Keefe	12/14/17	Students, Adults	SWP	52	75 Shrubs Planted	
2018						
RiverXChange, Vista Elem.	1/11/18	Students, Adults	SWP	66	78 Shrubs Planted	
Holy Ghost	1/18/18	Students, Adults	SWP	47	42 Shrubs, 10 Cottonwoods Planted	
RiverXChange, Monte Vista	1/25/18	Students, Adults	SWP	31	14 Cottonwoods Planted	
RiverXChange, Bern Co/ O'Keefe	1/26/18	Students, Adults	SWP	59	29 Cottonwoods Planted	
Assisted MRGCD with planting	1/27/18	Youth, Adults	SWP	184	Cottonwoods, Coyote Willows and Goodings Willows Planted	
MRGCD/Fish & Wildlife at Glass Gardens	1/27/18	All Ages	SWP	184	110 Plants and caging	
KOB Health and Wellness Fair at EXPO NM	1/27/18- 1/28/2018	All Ages	HHW, PW, SWP	8,000	Annual event focusing on wellness; handed out giveaways,surveys	
Nahalat Jewish Congregation	1/28/18	Adult		1	8 Cottonwoods Planted	
Rolling River Presentation- Jefferson Middle School - Science Night	1/29/18	Middle School students	SWP			
GIOS Hubert Humphrey Elem. 4th grade	2/2/18	Students, Adults	SWP	26	20 Cottonwoods Planted	
Former Peace Corps	2/3/18	Youth, Adults	SWP	83	100 Cottonwoods, 30 Shrubs Planted	
RiverXChange, Colinas del Norte	2/6/18	Students, Adults	SWP	57	23 Cottonwoods Planted	
RiverXChange, Martin Luther King	2/8/18	Students, Adults	SWP	56	40 Cottonwoods Planted	
RiverXChange, John Baker	2/9/18	Students, Adults	SWP	53	48 Cottonwoods Planted	
Roots and Shoots	2/10/18	Youth, Adults	SWP	15	25 Cottonwoods/9 Shrubs Planted	
GIOS Helen Cordero School	2/16/18	Children, Adults	SWP	27	45 Twigs Planted	
GIOS Explore Academy	2/19/18	Students, Adults	SWP	10	37 Cottonwoods Planted	
RiverXChange, Sandia Vista	2/20/18	Students, Adults	SWP	32	30 Cottonwoods Planted	
RiverXChange, NM Connections	2/21/18	Students, Adults	SWP	24	25 Cottonwoods Planted	
Holy Ghost	2/22/18	Students, Adults	SWP	31	100 Cottonwoods Planted	
RiverXChange, John Baker	2/23/18	Students, Adults	SWP	63	50 Cottonwoods Planted	
UNM Pathways	2/24/18	Youth, Adults	SWP	69	105 Cottonwoods/30 shrubs Planted	
GIOS Inez Elem. 5th grade	2/26/18	65 students/9 adults	SWP	74	45 Cottonwoods Planted	
RiverXChange, Osuna	2/28/18	54 students/8 adults	SWP	62	40 Cottonwoods Planted	
RiverXChange, Rio Rancho Elem	3/1/18	54 students/7 Adults	SWP	61	40 Cottonwoods Planted	
Family and Friends	3/1/18	Children, Adults	SWP	10	30 Cottonwoods & Black Willows Planted	
RiverXChange, Rio Rancho Elem	3/2/18	57 students/9 Adults	SWP	56	33 Cottonwoods Planted	
RiverXChange, MLK	3/6/18	54 students/9 Adults	SWP	63	39 Cottonwoods & Black Willows Planted	
Bosque School	3/8/18	17 Students/3 Adults	SWP	20	12 Cottonwoods & Black Willows Planted	
Bosque School	3/8/18	18 Students/4 Adults	SWP	22	12 Cottonwoods & Black Willows Planted	
Bosque School	3/9/18	18 Students/4 Adults	SWP	22	13 Cottonwoods & Black Willows Planted	
Bosque School	3/9/18	18 Students/3 Adults	SWP	21	20 Cottonwoods & Black Willows Planted	

AS: Animal Sources CON: Construction HHW: Household Hazardous Waste ID: Illicit Discharges PW: Pet Waste SSS: Septic & Sanitary Sewer Systems SWP: General Stormwater Pollution Prevention

NAME OF PROGRAM/EVENT	EVENT DATE	TYPE OF AUDIENCE	MS4 CATEGORY	TOTAL REACHED	NOTES
Sandia Civitans	3/10/18	1 Youth/ 11 Adults	SWP	12	36 Cottonwoods & Black Willows Planted
RR Schools	3/10/18	46 Students/6 Adults	SWP	52	22 Cottonwoods & Black Willows Planted
RiverXChange, Rio Rancho Elem	3/13/18	Students, Adults	SWP	31	50 Cottonwoods Planted
RiverXChange, MLK	3/20/18	Students, Adults	SWP	58	24 Cottonwoods Planted
RiverXChange, Osuna/ Bandelier	3/21/18	Students, Adults	SWP	45	35 Cottonwoods Planted
RiverXChange, Colinas del Norte	3/22/18	Students, Adults	SWP	59	26 Cottonwoods Planted
RiverXChange, Colinas del Norte	3/23/18	Students, Adults	SWP	31	20 Cottonwoods Planted
Rolling River Presentation-Taft and Taylor MS at Valle de Oro	4/6/18	Middle School students	SWP	46	
Rolling River Presentation- UNM Sustainability Expo	4/19/18	College students	SWP	250	
Rolling River Presentation- Earth Day at Annunciation Catholic School	4/20/18	Elementary and Middle School students	SWP		
Rolling River Presentation- Cancer Services of NM Spring Retreat	4/21/18	All Ages	SWP	30	
Household Hazardous Waste Collection, joint effort with ACT Environmental Svcs, COA and Bernalillo County from the 6137 Edith Blvd. NE area at	4/21/18	Adults	ннw	415	Collected, segregated, packaged, labeled, transported and disposed of 27,017 pounds of Household Hazardous Waste, and 3,200 pounds of Non- Regulated Solid Waste (an average of 72.81 pounds of waste per customer).
Rolling River Presentation- BEMP Student Congress	4/27/18	High School students	SWP		
Rolling River Presentation- Native Fish in the Classroom Field Trip (Santa Ana Pueblo)	5/8/18	Middle School students	SWP	48	
Rolling River Presentation-Amy Biehl HS, Garfield MS at Valle de Oro	5/10/18	Middle School students	SWP	32	
Rolling River Presentation- Cielo Azul Elementary - Arroyo Clean Up Field Day	5/18/18	Elementary School students	SWP	87	
Rolling River Presentation- Explora Science Fiesta	5/19/18	Elementary and Middle School students	SWP	400	
Rolling River Presentation-Ace Leadership HS at Valle de Oro	5/22/18	High School students	SWP	34	
TOTAL PEOPLE INVOLVED IN EVENT ACTIVITIES					

ID: Illicit Discharges PW: Pet Waste SSS: Septic & Sanitary Sewer Systems SWP: General Stormwater Pollution Prevention

Exhibit 2 ARROYO CLASSROOM 2017-2018

Arroyo Classroom Program

The Arroyo Classroom program utilizes our natural arroyos as outdoor classrooms and brings local animals into the classroom to motivate 3rd graders to respect the arroyos as important wildlife habitat. Orilla Consulting, LLC developed the program in 2012 and initially implemented the program for 7 classes at Maggie Cordova Elementary in Rio Rancho. In 2013, the program grew to serve 20 classes. On July 1st, 2015, Orilla Consulting, LLC transferred the program to Ciudad Soil and Water Conservation District as part of the larger education and outreach efforts we are involved in throughout Bernalillo and Sandoval Counties. In the 2017-2018 school year, we served 33 classes within Rio Rancho Public Schools, reaching approximately 33 teachers and 770 students.

Participating Schools:

- Cielo Azul Elementary (6 classes) *
- Enchanted Hills Elementary (7)
- Maggie Cordova Elementary (6) *
- Martin Luther King, Jr. Elementary (4) *
- Puesta del Sol (6) *
- Sandia Vista Elementary (4)
- * Title 1 school

Deliverables to date:

All complete

- Stormwater Presentations: 33:33
- Arroyo Walk: 33:33
- Bat Presentations: 33:33
- Owl Presentations: 33:33



The program consists of a four-part series of lessons, based on grade-level science standards and addressing areas of interest to SSCAFCA, such as bats, burrowing owls, ATV use, pet waste, and arroyo safety. Educator Melissa McLamb delivered two of the lessons – an introductory lesson about watersheds, and a walking field trip to nearby arroyo habitat. Justin Stevenson of RD Wildlife Management, LLC delivered a lesson using live bats. Tavo Cruz of Envirological Services, Inc. delivered presentations with a live Burrowing Owl.

The watershed lesson expounds on the water cycle, already integral in 3rd grade curriculum. This year, we utilized the Enviroscape model to: introduce the concept of a watershed to students, demonstrate stormwater, emphasize arroyo safety and the importance of keeping our arroyos clean.

The arroyo walk is a highlight for students and teachers, as the majority of participating classes only receive one other field trip during the school year, and students always come away learning something new and interesting about the uniqueness of arroyo habitat. This lesson is about the unique adaptations

of arroyo animals and plants, incorporates a walk out to a nearby arroyo (when available) and extensive discussion about arroyo safety *(see lesson plan in Appendix A.)* Melissa first talked to students about the difference between concrete-lined channels and sandy-bottomed arroyos, and emphasized that it is never safe to go into concrete-lined channels, while sandy-bottomed arroyos can be visited when there are no clouds in the sky. Students searched for evidence of animals living in the arroyo banks, learned about how lizards, and other cold-blooded animals, are adapted to the desert environment by moving about to regulate their temperature, and looked for certain adaptations of desert plants to minimize water loss in the desert.

In the lesson about bats, Justin discussed common myths about bats while pointing out how these myths can pose issues for bat populations as he addressed each one. He taught students about species common in their area, including what habitat they prefer, what they eat, the challenges they face, and what to do if one sees an injured bat. He talked about how important bats are in keeping insect populations under control, shared ways to encourage and protect bats and emphasized that kids should not be frightened of them, but also should never touch a bat if they find one. Students were able to view two different species of live microbats.

In the owl presentation, Octavio talked with students about what time of year burrowing owls are in our arroyos, what habitat they need, and what we can do to support and protect them. Tavo emphasized the impact of riding ATVs up the sides of arroyos and encouraged ways to care for burrowing owl habitat. He taught students that burrowing owls are protected by federal law, and that 3rd graders could be ambassadors and protectors for the owls. Each student was able to observe the burrowing owl up close, one at a time. We worked in coordination with Wildlife Rescue to bring in the live burrowing owl for each presentation.

Evaluation:

Teachers continue to thank us for offering this program and comment that it is helpful to them in terms of meeting science standards. They mention an increase in student engagement during all of the experiential lessons and find that students are curious and continue to discuss content post presentations. All 33 participating classes, participated in previous years and each school expressed interest in returning next year.

Our two main staff for the program, both resigned from the District in September. This abrupt change resulted in Education Coordinator, Melissa McLamb, taking the lead on the program and spread presentations throughout the entire school year, rather than in the 3-5 month time frame presentations have traditionally been scheduled within. Surveys which have been used in previous years were



distributed to assess learning after the owl and bat presentations.

For our second year, we have collaborated with Cielo Azul Elementary for an arroyo clean up event with all of their 3rd grade classes. This year, City of Rio Rancho donated gloves and trash bags as well as provided a dumpster on site at Havasu Park, as part of the Great American CleanUp countrywide initiative. Collectively, students, teachers and other adults picked up 1180 pounds of trash at this event!

Post-Survey Metrics:

Bat survey

Total responses: 439

Why do we want to protect bats?

439 responses



If you find an injured bat, what should you do?

439 responses



Which is NOT a good way to help bats?

439 responses



Which of the following is TRUE about the bats that live around Rio Rancho and Corrales?

439 responses



Owl survey Total responses: 437





33.4%

437 responses





- habitat for owls, so if we see them we know we are taking good care of our...
- All of the above

What can we do to help burrowing owls?

437 responses



Survey Summary: Due to the time constraints and loss of programmatic knowledge created by the change in personnel and lack of training, many surveys were taken months after the bat and/or owl presentation. Surveys were shared with biologists for input. Our educators are noticing that questions with an "all of the above" answers seem difficult to determine for this age group. These surveys will be modified to become one survey in future years of programming, intended to assess comprehensive learning outcomes and distributed twice throughout the program -once before any presentations and once after all presentations are complete. Surveys will be revised to assess main conceptual objectives of each presentation. Surveys have been shared with collaborating biologists to improve questions and learning outcomes in the future.

Appendix A contains lesson plans; Appendix B contains supplemental materials; Appendix C contains photos and in-kind figures from the program.

Appendix A: Lesson Plans

Activity Guide for 3rd Grade – Animal and Plant Adaptations

1. What are we trying to teach the students in this activity?

Arroyos are cool places where animals live, animals and plants are adapted to live in the desert.

2. How can we tie this activity to our teaching goals:

Our Goals	Where we can relate our goals to this activity
Animals live in arroyos	Look for evidence of animals.
We should visit arroyos	Talk about when it is safe.
carefully	
Picking up dog poop keeps	We'll probably see poop, talk about how it can make animals sick.
germs out of our river	

Supplies:

- Thermometers
- Clipboards
- Poster of leaf adaptations

- Wax paper
- Paper towels
- Tape

3. How can we tie this activity to standards?

- Measure energy (temperature change)
- Posing a question, using numerical data, various methods to display results
- Animals and plants have adaptations that improve chances of survival
- Classifying animals and plants
- Living things cause changes to their environment, some detrimental, some beneficial

5. How should this activity be organized?

I. Pre-activity (10 minutes)

- Do you ever visit/play in arroyos? What do you do?
- What are arroyos for? Managing stormwater to keep our town from flooding when we get a heavy rain. Show first flush video.
- Talk about arroyo safety don't go into arroyos when you see clouds in the sky.
- Because our arroyos are natural, with sandy sides and bottom, they are safer.
- In Albuquerque, the arroyos have concrete sides and water travels so fast, it is really dangerous to ever go in arroyos. Some arroyos come from the canyon where it might be raining but you can't see.
- Our arroyos are home to all kinds of animals and plants, so they are a wonderful place to enjoy nature. What kinds of animals do you think might live in the arroyo?
- Walk out to arroyo

II. Lizard activity (15 min)

- 5min Look for evidence of animals. What kind of evidence? Scat, tracks, holes.
- What kind of animals live in holes (besides snakes)?
- What do you think makes it difficult to live out here? Heat, sunburn, not much water, cold at night. Animals and plants have special **adaptations** (special things about their bodies) that make it easier for them to live in this habitat.
- How do they get water? From plants, from condensation under rocks.
- How could they avoid heat? Stay in burrows or shade during the day, active at night.
- Some animals love the heat, though! Lizards are cold-blooded, which doesn't mean they are actually cold. It means their body temperature is determined by the environment. They need to absorb heat from their surroundings to function.
- Each student take a thermometer. This is a lizard, and it needs to maintain its body temperature at a certain level: fence lizard 35C (95F), whiptail 38.6C (101F). How can it keep from getting too hot? How can it keep from getting too cold? Lizards regulate their body temperature through behavior.
- Plants do kind of the same thing hold one palm out flat, one sideways. Which feels hotter? Prickly pear cactus pads grow sideways instead of flat to keep themselves cool!

IV. Plant activity (15 min)

- What do plants need in order to survive? Water, sunlight, air, soil
- What makes it difficult for plants in the desert? It's so hot and there's so little rain.
- How do plants get water? **Show evapotranspiration diagram.** It's kind of like when we're hot, we sweat. But if we lose too much water from sweating we get dehydrated.
- How do they keep cool? Remember prickly pear? Show pictures of hedgehog and prickly pear cacti. Desert plants can shade themselves! Hedgehog cactus has lots of spines that shade the surface and also blocks the wind.
- The leaves of many desert plants are **adapted** so that they don't lose too much water.
- Show leaf adaptations poster (fuzzy, small, curled, waxy, green stems but no leaves)

If weather is ok:

- Out in arroyo, we'll do an investigation.
- How many of the plants we see will have these adaptations? Hypothesize.
- To be fair, we can't just pick the plants we like. Standing in one spot, collect the first 6 *different* leaves you see.
- Draw each one, and describe what adaptation it has.
- How many of your 6 leaves have one of the adaptations listed?
- Why don't all have it? Some plants avoid the heat by just growing and producing seed really fast before the weather gets hot, and then they just die off and leave their seeds to grow next year!
- Search for seeds.

If windy, inside activity:

- Let's investigate one way they keep water. **Dab water on board, cover one spot with paper towel, one spot with wax paper.** Which do you think will evaporate faster?
- Show prickly pear picture. Make model of prickly pear pad: paper towels with wax paper taped around the outside. Show cut prickly pear pad.
- Maybe do experiment: soak wax-covered and non wax-covered leaves in water and time how long they take to dry.

V. Conclusion (10 min)

- Arroyos are for flood control, and we shouldn't play in them when clouds are in the sky.
- But they are cool places where animals and plants live, and we can visit when it's clear weather.
- Animals and plants are adapted to live in the desert climate.
- What we do in arroyos affects the plants, and animals' habitats. Should we ride ATVs up the sides? That's something humans do to change our environment for the worse.
- Picking up dog poop is important because it can make animals sick. Where does the water go when it flows down the arroyo? The Rio Grande! Keeping dog poop out of the river is one way humans can change our environment for the better.
- Walk back to classroom

Leaf Adaptations

- **1.** Fuzzy leaves or lots of spines
- **2.** Small leaves
- **3.** Curled leaves
- 4. Waxy leaves
- 5. Green stems but no leaves!




Enviroscape Activity Guide for Arroyo Classroom

1. What are we trying to teach the students in this activity?

What is a watershed? How does the water cycle work? What are different forms of pollution and how does it impact our river? Arroyos lead to the river and carries different types of pollution with it.

NM State Science Standards:

3 rd Grade		
Water cycles through the atmosphere, plants, soil, and bodies of water in		
various forms.		
Describe pollution and identify different types (can be naturally		
occurring or human made materials). Pollutants can get into our water		
and harm living things.		
Some animals can survive better in certain environments, some will not		
survive at all.		
Describe how roots take up water and soil nutrients, and leaves make		
food from sunlight.		

2. How can we tie this activity to our teaching goals:

Our Goals	Where we can relate our goals to this activity
How does the water cycle	Describe the processes of the water cycle: evaporation, condensation,
work?	precipitation, collection, run-off and infiltration.
What is a watershed?	A watershed is all the land that drains into a river or other body of
	water, from mountain forests to riparian zone.
What makes water dirty?	Pollution comes from all over the watershed, and erosion is one form
	of pollution.
Why are arroyos	Arroyos provide important drainage in a storm event and provide
important?	unique and critical habitat for wildlife and plants.
How does vegetation help	Forests, wetlands and healthy arroyos help keep the river clean and
our river?	prevent flash floods. Plants in these areas slow the runoff of water
	into the river, reducing erosion and flooding. They can also remove
	nasty chemicals from the water by taking them up through their
	roots.

3. What is effective in this activity? Kids enjoy playing with the model and discussing what they are observing.

4. What makes this activity difficult to teach? Kids want to touch everything on the model and play while you are talking.

Activity Materials and Preparation

- Enviroscape model + toy houses, cars, buildings
- chocolate sprinkles to represent dog poop

- bits of paper and/or rainbow sprinkles to represent trash
- black frosting to represent oil
- sugar sprinkles or food coloring (red or green) to represent pesticides, fertilizer and/or chemicals
- Set up model
- Draw sketch of the water cycle

I. Intro – 5-10 minutes

- 1. What is the water cycle and how does it work? Reference the water cycle sketch and/or sing the "Water Cycle" song.
- 2. What is a model and what is its purpose?
- 3. Introduce Enviroscape as a model of a watershed. What is a watershed?
 -Describe a watershed using the metaphor of a tree (branches as arroyos, trunk as river, leaves as land, roots as ocean)
 -Introduce students to different areas on the watershed.

II. Activity – 20-30 minutes

- 1. What is pollution? What kind of trash/pollution have you seen in your neighborhood, local arroyo or along the street? As students are identifying different forms of pollution, place the imitation pieces on the model, as you bring their attention to different areas on the model such as residential, roadways, parking lots, farm, etc.
- 2. Discuss how erosion can be a form of pollution, even though dirt is natural. *Ask students can there be too much dirt in the river?*
- 3. Describe how humans have made changes to the river over the past century, such as straightening the channel, removing wetlands, building houses near it, and creating lots of impermeable surfaces such as parking lots. Note that this means faster flow and more erosion, which can make it hard for native fish to survive. Silvery minnow needs slower flow and more shallow side channels to lay its eggs, sediment can clog up fishes' gills.
- 4. Talk about how forests play a role in the watershed and can affect the health of a river. Use watering cans to sprinkle water over the forest and see how it sinks in, not causing much erosion. *Ask students why they think this happens.* Discuss how forests slow the runoff when it rains, because the roots hold the soil in place and take up some of the water.
- 5. Farm (sediment, run-off, fertilizer, livestock waste, turbidity as a sand storm, impact on fish)
- 6. Factory (chemicals, waste, management, proximity to arroyo)
- 7. Houses (dog poop, grease, oil, trash)
- 8. Roads (oil, trash)
- 9. Observe the water's path to the river (through arroyos), and erosion below rooflines and at parking lot edges. *Ask students what they think might be in that runoff. How would you like to drink that if you were a fish?*
- 10. Notice what happens to water that falls on a hard surface like a street compared to when it falls on a grassy area. Discuss the importance of vegetation. Examine the wetland and discuss how riparian vegetation slows runoff into the river, preventing flooding. Use the watering cans to sprinkle water directly above the wetland and observe how the wetland traps some of the sediment.
- 11. On the man-made side, use berms to retain hillsides and riverbanks, add buffer strips to parking lots, and construct another wetland. Discuss with students ways in which they can

protect and support the health of arroyos and the river.

III. Discussion – 10 minutes

- Re-emphasize the concept of a watershed.
- What can we do? Why is it important? Clean up after your dog, utilize trash cans and dispose of waste properly.
- Re-emphasize how arroyos help carry stormwater away from the places where we live, work and play and that they are connected to the river.
- Talk about the importance of keeping our arroyos clean and how to be safe when playing in and around them.

Appendix B: Supplemental Materials

-SSCAFCA Activity Book and Educational Videos:



-SSCAFCA handouts:



Did you know?



SSCAFCA protects our community from flooding and erosion caused by big rain storms, and works to keep stormwater Clean. Stormwater flows down arroyos into the Rio Grande.

Bugs like to live in stagnant water that collects in ponds and low places in the arroyos. Insects like mosquitoes can carry diseases that make us sick.

Almost all U.S. bats feed exclusively on bugs, and 1 bat Can eat between 600 and 1,000 mosquitoes and other insect pests in just one hour. One bat Can eat its own weight in insects in a single night!

SSCAFCA provides bat houses to encourage bats to make their homes near our arroyos, and especially near detention ponds where stormwater runoff is Captured and allowed to slowly drain.

The more we help bats, the more pests they eat, so we don't have to spray pesticide that could wash down to the Rio Grande and pollute it.

Brought to you by:





SSCAFCA watershed map:



Appendix C: Program Photos



Justin Stevenson showing two microbats in rehabilitation to a class at Maggie Cordova Elementary.



Justin discussing the importance of bats and sharing video footage of their resting behavior.



Teacher at Cielo Azul Elementary disposing of trash picked up in the arroyo on the Arroyo Clean Up Day, May 17th.



Wildlife Rescue, Inc.'s burrowing owl, unable to survive in the wild, now shared for educational purposes.



Octavio Cruz elaborating on unique biological adaptations and answering questions for students at Cielo Azul Elementary.



Students at Enchanted Hills elementary pick up trash on our way back to school from the arroyo walk.

Cielo Azul Arroyo Clean Up	
Event - May 17, 2018	
City of Rio Rancho -	
Utilities Dept - coloring	
books, \$2/ea, 150 books	\$300.00
City of Rio Rancho - Parks,	
Rec and Community	
Services Dept (PRCSD) -	
Waste Management 40 yd	
dumpster, including	
delivery	\$275.50
City of RR PRCSD- trash	
have $150 19/62$	\$28 50
bays, 150, 15/ea	φ20.30
City of RR PRCSD-	
reusable gloves, \$.81/pair,	
150 pairs	\$121.50
88 students, 2 hours of	
service at \$24.14/hr	\$4,245.12
13 adults 2 hours of	
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Exhibit 3 RiverXchange 2017-2018



Innovative Outreach Program for Upper Elementary Students Integrating Water Resources Topics with Language Arts & Science

2018 Report

Presented by Ciudad Soil & Water Conservation District

June 2018

EXECUTIVE SUMMARY

This year, funding enabled 39 NM classes (1,188 students and 42 teachers) to participate. The majority of participating schools were Title I schools. Each NM class was partnered with another NM class and one or more classes outside the state for a total of over 1,412 participants. All program costs and coordination are provided free of charge to NM teachers. Training, technical support, and curriculum materials are provided free of charge to partner teachers. The program required \$51,639.06 in cash and generated total match valued at \$93,152.09 in the form of in-kind contributions including workshop space, classroom resources, presenters' time in the classroom, field trip docents, donated trees and shrubs as well as the teachers' and students' time.

Ciudad SWCD faced some unexpected challenges during the 2017-2018 school year. The District Coordinator, a main support for our educational programs, resigned unexpectedly in September, leaving a major gap in personnel at the start of school year. We hired on a contractor, Jessica Garduño, in December to assist with programming as needed. This change impacted the RiverXchange process flow as training for Jessica had to occur mid-school year, but we successfully completed the program at participating schools with only three exceptions (see below).

Teachers also continued to face challenges this year with mandatory computer based testing such as the PARCC test, which made it more difficult to access computer labs. We're noticing a pattern of teachers being interested in the blogging concept but having difficulty incorporating it as part of their curriculum throughout the school year.

Despite these challenges, we continue to receive feedback from teachers that they love the presentations and students learn a lot from them. Teachers enjoyed the extension activities and critical question prompts delivered after each one, commenting that it helped them further explore content with their classes. We continued to encourage group participation this school year by setting up reflection groups in each participating class, and distributing critical thinking prompts and follow-up activities to each presentation.

Most of our presenters have worked with us for years and know the program thoroughly, strengthening the correlation between their educational objectives and the goals of the RiverXchange program. We had difficulty scheduling individual presentations for our single participating online classroom and referred them to video presentations as they were available.

Program presentations were completed as follows:

Stormwater: 38/38	Agriculture: 37/38
Drinking Water: 37/38	Field Trips: 37/38
Wastewater: 38/38	

We were unable to reschedule one field trip, which was cancelled by a teacher, due to mandatory

testing and it being the end of the school year.

This school year, we helped fund an additional field trip for three participating classes in collaboration with US Fish & Wildlife Service. 3 RiverXchange classes also participated in USFWS Native Fish in the Classroom program and RiverXchange was able to fund the buses for their fish release. On these dates, students released approximately 130 native fish to the Middle Rio Grande, including flathead chub, longnose dace, and red shiners.

CONTENTS

PROGRAM DESCRIPTION	4
Mission	4
The Big Water Questions	4
Background	5
Program Management and Financial Support	5
Participant Selection	7
Teacher Professional Development Workshop	7-8
Curriculum	8-9
EVALUATION	9
Student Surveys	9-18
Student Writing	19

PROGRAM DESCRIPTION

Mission

The mission of RiverXchange is to deepen students' and teachers' understanding and appreciation for their local river ecosystem, motivate participants to protect local water resources by conserving water and keeping their source water clean, and to provide a high quality, high impact outreach opportunity for funders and in-kind contributors.

The Big Water Questions

The optional curriculum frames program outcomes as "guiding questions," known as *Big Water Questions*. A long term goal of RiverXchange is that students understand these questions and can formulate logical, fact-based answers by the time they finish elementary school. We believe that students who can synthesize water facts to understand larger water issues will have the proper critical thinking skills and foundation for further discussion in middle and high school so that they will become informed citizens and voters on water issues.

Understanding a Watershed

- Is every place in the world part of a watershed?
- Where does your community's stormwater go?
- How can surface water become polluted?
- How does the water cycle relate to weather?
- How are groundwater and surface water connected?
- How can groundwater become polluted?
- What actions can all of us take to keep water clean?

Water in Our Society

- In what ways does our society use water?
- Where does your community's drinking water come from?
- Does everyone have the right to use as much water as they want?
- Where does your community's wastewater go?
- What actions can all of us take to conserve water?

River Ecosystem

- How does water affect living things in an ecosystem?
- What role do forests play in a watershed?
- What role do wetlands play in a watershed?
- What are some of the ways scientists can determine the health of a river, lake, bay or ocean?
- What actions can all of us take to improve the health of our ecosystem?

Background

As producers of children's water festivals and other grade K12 water resources outreach in NM since 2007, we observed early on that NM elementary teachers rarely incorporated water concepts in the classroom beyond what is required by the state (e.g., water cycle), and that most elementary teachers considered "water" strictly as a science topic. While teachers personally acknowledged the importance of conserving water and keeping source water clean, we continued to find that upper elementary students had little or no understanding of major water resources topics unless the teacher specifically integrates a wide range of water topics into the curriculum. For this reason, as well as our successful festival work with upper elementary students, this age level was selected as the focus for the RiverXchange program.

We created RiverXchange to provide a free program that is fun, interesting, and easy to integrate into the normal curriculum. Our hope was to motivate participants to explore water resources topics in depth. The program is carried out over eight months so that students spend more time developing a sense of pride and personal connection to their own river ecosystem, as well as a personal connection to a distant river ecosystem and the students who live near it.

RiverXchange began in 2007 as a pilot project of Experiential EE, LLC (under a services agreement with the New Mexico Water Conservation Alliance) and the National Great Rivers Research and Education Center, featuring partnerships between two fourth grade classes in Albuquerque, NM, and two fifth grade classes in Godfrey, IL. A curriculum was developed, a field trip to the river was coordinated, and partner classes "met" three times during the year via video tele-conferencing to present what they had learned. The upper elementary level was chosen because of our successful festival work with this age group.

After the pilot project, we transitioned to a web-based technology called a wiki. This enabled us to overcome limitations such as the high cost, availability, and time zone logistical issues associated with video teleconferencing – and easily involve more classes. The curriculum was updated to incorporate the writing component and we introduced classroom guest speakers to reduce teacher workload and bring up-to-date technical information into the classroom.

In 2012, ownership of RiverXchange transferred to Amy White of Orilla Consulting, LLC, who managed the program through July 2015. In August 2015, RiverXchange became part of the Ciudad Soil & Water Conservation District. Since 2007, we have served nearly 17,000 students!

This year, the program featured the following components:

- Optional standards-based curriculum including hands on science and social studies lessons, as well as writing assignments
- Coordination of class partnerships
- KidBlog online posting and communication
- Teacher training on curriculum implementation and use of KidBlog
- Ongoing technical and motivational support
- Online class postings
- End of year teacher survey
- Pre and post student surveys (NM only)
- Payment for teacher workshop substitute teachers (NM only)

- Coordination of at least four guest speakers into the classroom (NM only)
- Coordination of a field trip to the local river or important watershed feature (NM only)
- Field trip bus transportation payment (NM only)
- Field trip leadership and activity planning (NM only)

Program Management and Financial Support

The program timeframe was July 1, 2017 through June 30, 2018. All components including fundraising, design, planning, implementation, and analysis were carried out by employees and contractors of Ciudad Soil & Water Conservation District, including:

Jennifer Moss Connie Crandall Melissa McLamb Jessica Garduño

Sponsors

- Southern Sandoval County Arroyo and Flood Control Authority
- Middle Rio Grande Stormwater Quality Team

Sponsors provided \$51,639.06 in cash. Program expenses included:

- Substitute teachers for NM teacher workshops
- Teacher workshop space rental and meals
- Field trip bus transportation for NM classes
- Field trip portable toilet rentals for NM classes
- Technology services
- Office supplies
- Coordination services (planning, implementing and assessing all program components)

New Mexico In-Kind Partners

- Albuquerque Water Utility Authority
- Bernalillo County Cooperative Extension, 4H
- Bernalillo County Master Naturalist Program
- Bernalillo County Public Works Division
- Bosque Ecosystem Monitoring Program
- CDM Smith, Inc.
- City of Albuquerque Open Space Division
- City of Rio Rancho Environmental Programs Office
- City of Rio Rancho Parks, Recreation and Community Services Department
- Daniel B. Stephens and Associates
- New Mexico Museum of Natural History and Science
- Sandoval County Cooperative Extension
- Southern Sandoval County Arroyo and Flood Control Authority

In-Kind contributions totaled \$93,152.09. For NM classes, in-kind contributions included classroom guest speakers, field trip docents, planting materials, workshop space and computer lab use, classroom

resources, and teachers' and students' time attending the presentations and field trips. For partner classes, in-kind contributions were not calculated this year. Sponsors and in-kind partners were recognized on our website and in presentations.

Participant Selection

All 39 participating NM classes were fifth grade classes, distributed as follows:

Bernalillo County	Sandoval County
Bandelier Elementary (2 classes)	Colinas del Norte Elementary (5 classes) *
Cochiti Elementary (2 classes) *	Martin Luther King, Jr. Elementary (6 classes)*
Duranes Elementary *	Rio Rancho Elementary School (4 classes) *
Georgia O'Keeffe Elementary (3 classes)	Sandia Vista Elementary (1 class)
John Baker Elementary (4 classes)	Bernalillo Elementary (1 class) *
Monte Vista Elementary (3 classes)	Placitas Elementary (1 class)
Osuna Elementary (3 classes)	
Zia Elementary (1 classes) *	
NM Connections (Online statewide class)	
20 classes, 612 students	19 classes, 576 students
* Title 1 school	

All but one partner classes were located in the continental United States, the other was located in South Africa. Partner classes included approximately 308 students and 14 teachers. We have found that partner teachers are highly motivated and come to the program with a willingness to participate even though our NM based funding cannot be used to help coordinate their classroom guest speakers, arrange a field trip, or pay for any direct costs.

Teacher Professional Development Workshop

Although preparation began many months earlier, RiverXchange officially kicked off in October with two teacher workshops for NM teachers and online training sessions for partner teachers. Teachers learned how to implement the activities in the curriculum and how to operate and manage their class blog.

This year, educators from Bosque Ecosystem Monitoring Project gave a professional development talk to RiverXchange teachers, emphasizing ways to incorporate environmental education and citizen science projects into the classroom.

KidBlog Technology

One of the challenging aspects of program implementation continued to be the training of teachers on how to use the KidBlog and encouraging them to do so throughout the year. This was our second year using Reflection Groups for blogging and activities. These groups minimize teachers' time in monitoring posts. To strengthen learning outcomes in the future, educators intend to coordinate presentations over a shorter time frame (3-4 months) and assist classrooms with 1-2 posts throughout the program.

Online Partner Training

Many teachers contacted us if they had technical difficulties and we also checked in with many of them mid Fall to answer any questions and troubleshoot any issues.

Curriculum

A component of RiverXchange is the hands on optional curriculum, which is offered to all participating teachers. It was developed to help students reach for deeper meaning through hands-on learning and reinforce what they have learned through the process of writing to their pen pals. Organizers strive to incorporate emerging water resources issues into the curriculum, increase networking opportunities for teachers, reduce teacher workload, and align the curriculum with public school curriculum priorities.

Each class learns about its own local water resources issues through hands-on activities, classroom guest speakers, and a field trip. Students write about what they are learning via a private educational website that can be viewed by their partner classes. The computer technology and writing components provide a unique opportunity to reinforce what was learned, increase student motivation to learn, and collect valuable metrics about student performance.

Through RiverXchange, students take pride in sharing their knowledge of the local ecosystem and learning from their peers about another river ecosystem. Comparing the two geographical areas gives students a broader understanding of the importance of a river ecosystem to human and other life. Students gain the unique opportunity to share personal experiences and ask questions about a distant place. Teachers feel this kind of personal connection is a big deal for kids – many of whom have never traveled beyond their city limits.

All activities are correlated to NM state standards and benchmarks for Science and Social Studies. All activities (because they require that students communicate information on the KidBlog) address Common Core Language Arts standards for writing. Some activities also address Common Core Mathematics and Science standards. For a summary of the RiverXchange Curriculum, see Appendix 1.

Guest Speakers

We coordinated four guest presentations to visit each NM classroom. In all cases, guest speakers were water resources professionals from local agencies. Topics included:

• watershed/nonpoint source pollution

- drinking water
- wastewater
- water and agriculture

Field Trips

The program requires that all classes attend at least one field trip to their local river or important watershed feature, which should incorporate a service learning component if possible. We coordinated all NM field trips. Throughout the winter and spring, students planted over 500 native trees and shrubs and helped restore critical riparian habitat along the Rio Grande in Albuquerque. Several spring field trips included a water quality monitoring component.

New Mexico Field Trip Locations

Gabaldon Trailhead- Open Space

Managed by City of Albuquerque Open Space, this property is located on the east side of the Rio Grande, immediately north of I-40 and Rio Grande Blvd. While students planted native trees, they learned about the history of the Bosque, the significance of invasive species and conservation efforts, and observed porcupines, sandhill cranes, coyotes and other bosque animals.

Tingley Wetland

This 18 acre tract, adjacent to the Bosque in downtown Albuquerque, is owned by the City of Albuquerque, and features a restored constructed pond and peripheral wetlands including native and nonnative aquatic habitat. Students took a hike into the Bosque, observed macroinvertebrates and tested water quality.

Partner Field Trip Locations

Since program funding is NM based, we were not able to assist partner teachers with coordinating a field trip; however, we did provide partner teachers with names of agencies located in most parts of the U.S. that may be able to assist. We know that many of them implement water quality testing. Many also go on field trips to relevant places including water treatment plants, local reservoirs, dams and river/watershed museums.

Evaluation Student Surveys

A key component of RiverXchange is its measurable goals relating to student performance. We collected quantitative data on student performance by way of a pre and post survey and qualitative data by reading what students submitted on KidBlog. We also surveyed students about their actions before and after participating in RiverXchange.

Pre/Post Behavior Survey

In order to quantify the learning outcomes achieved through RiverXchange, we ask our teachers to have their students fill out a survey prior to, and upon completion of the program. Below, you will find a series of graphs used to illustrate the change in responses between the pre and post surveys. This year, 812 students completed the pre-survey, while 623 completed the post-survey. In order to account for this

discrepancy in participation, the number of each given answer has been calculated as a percent of the total number of responses received for each given survey. We continue to refine the survey and our programming year after year based on teacher feedback and metrics gathered from these surveys.

10



This graph illustrates a significant increase in all the above listed positive behaviors after having received the RiverXchange presentations. For example, the question "How often do you pick up your dog's poop?" saw a 6.1% decrease in the answer "almost never," and an 8.21% increase in the answer "nearly always."



This graph illustrates a significant decrease in all the above listed negative behaviors after having received the RiverXchange presentations. For example, the question "How often do you apply more fertilizer and/or pesticide than the label says to use?" saw a 9.25% decrease in the answer "sometimes," and an 12.17% increase in the answer "almost never."

Change in Negative Behaviors



Change in Answer to the Question: "Where does the Rio Grande start and eventually end?"



Change in Positive Responses to the Question "What actions can all of us take to improve the health of our ecosystem? Choose all answers that apply."





Change in Negative Responses to the Question "What actions can all of us take to improve the health of our ecosystem? Choose all answers that apply."

What is a watershed (also known as a catchment or drainage basin)?



How much precipitation does your community receive each year?





When it rains, where does your community's stormwater go?

Where does your community's wastewater go?





Does everyone have the right to use as much water as they want?



Responses to the Question: "How can surface water (like a river, lake, bay or ocean) become polluted? Choose all answers that apply."



Responses to the Question: "Along with condensation, evaporation and precipitation, identify three other major components of the water cycle."



Change in Positive Responses to the Question: "How do forests affect our river ecosystem? Choose all answers that apply."





Change in Negative Responses to the Question: "How do forests affect our river ecosystem? Choose all answers that apply."

This decrease in negative responses indicates that our students have gained a better understanding of the effects of forests on our river ecosystem after participating in RiverXchange.









Change in Response to the Question: "From what local source does your community get its drinking water? Choose all answers that apply."

Change in Responses to the Question: "Which of these things use our precious, clean drinking water? Choose all answers that apply."



What are some of the ways scientists can determine the health of a river, lake, bay or ocean? Choose all answers that apply.





Change in Responses to the Question: "What can farmers do to conserve water or prevent pollution of our water resources? Choose all answers that apply."

Change in Response to the Question: " How does water affect living things in an ecosystem? Choose all answers that apply."



Change in Responses to the Question: "What are some of the ways that humans have changed river ecosystems? Choose all answers that apply."





Change in Responses to the Question: "What actions can all of us take to conserve water? Choose all answers that apply."

Change in Responses to the Question: "How do wetlands (low lying areas where the soil is soaked with water) affect our river ecosystem? Choose all answers that apply."



Student Writing

The writing component is one of the most valuable aspects of the program, yet it continues to be our biggest challenge. We are continually striving to improve participation in this area because it helps teachers integrate writing in the content areas and reinforces student understanding of key water resources concepts. Teachers continued to face major challenges this year in getting efficient internet access in the classroom and/or access to computer labs, which are tied up for much of the year for NM teachers with the PARCC and other computer based tests.

Many teachers joined the program this year planning to use RiverXchange as a major component of their writing program to meet Common Core Language Arts standards, which require teachers to focus more on writing within content areas. Each year, we strongly encourage teachers to have students write and edit paragraphs before going to the computer lab because this promotes higher quality thinking and writing. When students do go through this process, it shows. We also encouraged teachers to use various forms of communication in addition to writing, such as videos, PowerPoint presentations, or audio files.

We had a couple of partner classes from different regions of NM. This encouraged a greater understanding of different sections of the Rio Grande for students.Many partner teachers register for the program having already prioritized the need to organize classroom time to blog throughout the school year, so as to ensure they have a successful experience as participants. In contrast, many NM teachers register for the program to receive the beneficial learning experiences of the presentations and field trip; the blogging and partnership aspect is not as strong of an incentive for their participation as it is the main incentive for the partner teachers.

We know from discussions with teachers over the years that the absence of student writing does not mean they did not do the activities, or that no learning took place. Many teachers were dealing with issues unrelated to the program, such as new curriculum in other areas, school reorganization, construction which prevented access to the computer lab for a portion of the year, or personal life changes that conflicted with engaging more with the program. We did our best to foster successful online partnerships. Even though some blogs had minimal to no activity, NM students still benefited from the guest speakers and the field trip.

Appendix 1 includes the RiverXchange curriculum, Appendix 2 includes post presentation questions and follow up activities, Appendix 3 includes photos.

Appendix 1 Curriculum



Welcome to RiverXchange... exploring watersheds through global collaboration!

RiverXchange is about communication and developing 21st Century Skills while learning about our watersheds! Each class will be partnered with one or more classes in a different state. **The big idea is to communicate with your partners** *at least twice each semester* **by posting projects on your shared private educational blog and responding to what your partners have posted.**

The Big Water Questions

Understanding a Watershed

- What is a watershed?
- Where does your community's stormwater go?
- How can surface water become polluted?
- How does the water cycle relate to weather?
- What role do forests play in a watershed?
- What role do wetlands play in a watershed?
- What actions can all of us take to keep water clean?

Water in Our Society

- In what ways does our society use water?
- From what source does your community get its drinking water?
- Does everyone have the right to use as much water as they want?
- What actions can all of us take to conserve water?
- How are groundwater and surface water connected?
- How can groundwater become polluted?
- Where does your community's wastewater go?
- What is the difference between wastewater, stormwater, and drinking water?

River Ecosystem

- How does water affect living things in an ecosystem?
- What are some of the ways scientists can determine the health of a river, lake, bay or ocean?
- What are some of the ways humans have changed rivers or other aquatic ecosystems?
- What actions can all of us take to improve the health of our ecosystem?

Student Assignments:

All of the lessons in our curriculum include a "Student Assignment" which can be expressed through writing, photos, video, audio, powerpoint, or other projects. **The only requirement is that you post two projects each semester, and respond to what your partners have posted.** This new format supports the essence of our program - meaningful sharing between classes.

Suggestions include:

- Create a public service announcement
- Create a news cast with various reporters discussing different areas
- Create a short documentary
- Write a environmental journalistic piece based on water challenges in your community
- Create an animation (using a tool such as kid pix)
- Create a powerpoint presentation
- Write a poem
- Write a book report for one of the suggested books
- Create a poster and post a photo of it on the wiki

We know that with all the other pressures in schools today, it may be difficult to find time to share on the wiki. Here are some suggestions we have gathered over many years of working with teachers on this great program.

Strategies for making the most of limited computer time:

- 1. Take videos on your smartphone, then post them yourself to group pages
- 2. Take pictures of posters or hand written assignments, then post to group pages.
- 3. Do a whole class project/posting using the Promethean or Smart Board. For instance, write down all the things that can pollute our river, group them by source/non-source, identify which ones the kids can help prevent, save and post the final diagram in each of the groups on the wiki.
- 4. **Read postings from partners using Promethean or Smart Board, as a "Friday fun day" activity** on the weeks they have posted. This could be done as a reading aloud/public speaking exercise.
- 5. Identify and train one student from each group to be the "tech leader." Have just these students use the limited classroom computers to post the group projects.
- 6. Encourage posting from home as homework. Just be sure to monitor what was posted the next day. Even if not all students have computers at home, some will. Consider dividing students up so that at least one person in each group has computer access at home, and they could become the "tech leader."

Strategies for planning and integrating with other curriculum:

- 1. When looking at your plans for the year, for all subjects, keep RiverXchange in mind. Remember, if you want to post "out of order" that is fine!
- 2. Modify the style of writing to match what you are planning to cover at that point in the year.
- 3. Posting shortly after a guest speaker comes to your class is recommended, so you could also consider rearranging your language arts curriculum (and scheduling your computer lab time) to coordinate with times when presenters are scheduled.
- 4. Whatever subject you enjoy the most, see how you can use RiverXchange to enhance it.
 - a. Social studies: history of why early settlers lived where they did, economic impact of rivers and water, use of water by industries
 - b. Math: calculate water use, waste, length of rivers, etc
 - c. Science: volume, density, states of matter
 - d. Language arts: writing is obvious but also poetry, reading informational texts, public

speaking

e. Other specialized topics such as engineering, careers, art, music

New Mexico Curriculum Overview

Remember, partners in other states may be doing their own curriculum, but we hope you will be able to have good discussion on several of these topics over the course of the year. You may also want to combine some of the lessons so that students do a project that incorporates elements of multiple topics from the curriculum. For example, you could have students write about their river's geography while also talking about its watershed and ways to keep pollution out of it.

Unit 1: Understanding a Watershed

- 1. River Geography
- 2. Watershed Model
- 3. Infiltration and Runoff
- 4. Forests and Wetlands

Unit 2: Water in Our Society

- 5. Commercial Uses of Our Rivers
- 6. Drinking Water
- 7. Groundwater
- 8. Wastewater

Unit 3: River Ecosystems

9. Field Trip (with pre and post activities)

Unit 1: Understanding a Watershed

Project 1: River Geography

Student Assignment

- Write a friendly letter to your partners or create another type of project, explaining:
- a) what a watershed is
- b) the name of your river this is also the name of your watershed!
- c) the journey of your river from its headwaters to the ocean
- d) what the river is like in your area big/small, clear/muddy, fast/slow?
- e) how much precipitation your area receives each year, and what season gets the most precipitation

Informational Texts

- Follow the Water from Brook to Ocean, by Arthur Dorros or Paddle-to-the-Sea, by Holling C. Holling
- KRQE news. "Moisture Makes One-Third of New Mexico Drought-Free" <u>http://krqe.com/2015/05/26/moisture-makes-one-third-of-new-mexico-drought-free/</u>

<u>Classroom Activity</u> – Flexible! Just do as much as you want, and feel free to substitute other activities.

- 1. Read the book, *Follow the Water from Brook to Ocean*, by Arthur Dorros (about the Colorado River) OR *Paddle-to-the-Sea*, by Holling C. Holling (most U.S. School or public libraries have one or the other, or they can be purchased online). Explain how water flows from smaller bodies of water into a larger body.
- 2. Show the *All About Watersheds* poster (see link below.) Introduce the concept of a **watershed** as the land area that drains into a body of water, and explain that this is where **surface water** comes from.
- 3. Show students the *U.S. Watersheds Map* (see link below), pointing out your watershed and your partners' watershed. Talk about the significance of the *Continental Divide* (see link below) in North America, and show them where it is in New Mexico. Ask students "Is every place in the world part of a watershed?" Even if there are no hills or mountains, and there is no visible surface water, every place IS in a watershed because precipitation that falls on that land area eventually drains somewhere.
- 4. Have students identify your river or stream on a large classroom map, and show them where your school is located in relation to your river (north, south, east, west). Figure out where your river or stream starts (headwaters), what tributaries flow into it, and what ocean it flows into at its delta (many students may not know that the Gulf of Mexico is part of the Atlantic Ocean).
- 5. Point out what towns (if any) are upstream from you and discuss how they could affect your water (quantity and quality) either positively or negatively. Discuss what towns are downstream (if any) and how your town could affect their water, either positively or negatively. Trace your river's path to the ocean, recording each body of water it passes through.
- 6. Locate your school and your partners' school on the *Precipitation Map* (see link below). How many inches of precipitation does your area receive? Compare with your partner's ecosystem. You may want to read the Albuquerque Journal article (see link above) about the drought in New Mexico.
- 7. Discuss seasons, timing of your area's precipitation, the altitude of your area and how these affect weather. Explain how **precipitation** and **snowpack** affect the river.
- 8. Show students the *Major Cities and Rivers Map* (see link below), and ask them why they think so many big cities are located near major bodies of water.
- 9. *Optional:* If you have time, students (or groups of students) could research major flora and fauna in different regions along the length of your river or tributaries and create a picture postcard from that place. Or, they could write a story about a journey down the river.
- 10. Optional: New Mexico classes -- for more information about the Rio Grande watershed in New Mexico, show students the Everything is Connected in a Watershed poster (in teacher packet), then visit the All About Watersheds website (see link below) to explore the interactive version.

11. *Optional:* Learn about the Great Pacific Garbage Patch and ocean gyres, using the PBS lesson plan and video (see link below). You may also want to show photos taken by Chris Jordan on Midway Atoll demonstrating the effects of wildlife consuming plastic.

<u>Materials</u>

- U.S. Watersheds map: <u>http://maps.howstuffworks.com/united-states-watersheds-map.htm</u>
- Basic information about the Continental Divide: <u>http://education.nationalgeographic.com/encyclopedia/continental-divide/</u>
- Precipitation Map: <u>http://www.wrcc.dri.edu/pcpn/us_precip.gif</u>
- Major Cities and Rivers Map: <u>http://cgee.hamline.edu/rivers/Resources/watershedmaps/quiz3.htm</u>
- *Everything is Connected in a Watershed* poster and *All About Watersheds* website link: <u>http://allaboutwatersheds.org/poster/poster_view</u>
- *Optional:* Great Pacific Garbage Patch lesson plan <u>http://www.pbs.org/kqed/oceanadventures/video/gyre</u> and Laysan Albatross photos <u>http://ocean.si.edu/slideshow/laysan-albatrosses%E2%80%99-plastic-problem</u> (Caution these photos are pretty graphic, so be sure to preview before sharing with students.)

<u>Vocabulary</u>

- Watershed: The land area from which snowmelt and rain drain into a river, lake or other body of water. Also known as a drainage basin or catchment.
- Surface water: Water collected on the ground or in a waterbody such as a stream, river, lake, wetland or ocean.
- **Continental Divide:** A drainage divide on a continent (in the U.S., the Rocky Mountains) such that the drainage basin on one side of the divide feeds into one ocean or sea, and the basin on the other side either feeds into a different ocean or sea.
- Headwaters: The source of a river (where it starts).
- Tributary: A creek, stream, or river which feeds a larger stream or river or a lake.
- **Delta:** The mouth of a river (so named because it is triangle-shaped like the Greek capital letter Delta).
- **Desert:** A region that receives less than 10" of precipitation per year.
- **Precipitation:** All the water that falls from the sky, in solid or liquid form, such as rain, snow or hail.
- Snowpack: The amount of snow that accumulates annually in a mountainous area.
- **Floodplain:** Land that may be submerged by flood waters, or a plain built up by materials deposited by a river.
Project 2: Watershed Model

For NM classes, this is presented by a guest speaker. For partner classes, we encourage you to see if you can find someone from a local agency who has a watershed model, such as the Enviroscape.

Student Assignment

Write a *persuasive* paragraph, or create another type of project, about why it is important to keep stormwater clean and what we should do.

Informational Texts

- Science News for Kids article. "Suffocating Waters" http://www.d123.org/olhms/dedie/documents/suffocatingwaters.pdf
- *CNN* article. "Garbage Man of the River" <u>http://www.cnn.com/2013/04/18/us/cnnheroes-pregracke-rivers-garbage</u>

<u>Classroom Activity</u> – Flexible! Just do as much as you want, and feel free to substitute other activities.

- 1. Watch *The Human Solution to Water Pollution* video (see link below).
- 2. Schedule a guest speaker to bring a model of a **watershed**, OR make your own using the activity on the back of the USGS poster *Watersheds: Where We Live* (the poster can be shown on a smartboard see link below, and a printable copy of the activity is on the RiverXchange Curriculum Page).
- **3.** Discuss how the gutters in our streets lead to **storm drains**, which often lead directly to the nearest body of water. Discuss the difference between **stormwater** and **wastewater** (from household drains and toilets). Find out how your community handles stormwater is it combined with a municipal wastewater (sewage) system?
- 4. Read news articles (see links above) about garbage in rivers and dead zones caused by nutrients in agricultural runoff. Review the *Top Ten Ways to Protect Our Precious Water* handout (in teacher packet), and brainstorm other ways to reduce **nonpoint-source pollution**.
- 5. *Optional:* For a great math-based extension activity, try *Don't Trash Our Rio* (in teacher packet) where students learn how much trash is pulled from Albuquerque's storm drain system yearly, and calculate how many trash bags or classrooms it would fill. Even though it is based on an Albuquerque news article, this activity is applicable to any area that has a storm drain system.
- 6. Optional: Watch The Majestic Plastic Bag video (see link below).
- 7. *Optional: New Mexico classes,* watch *Segment 3* of the Mid Rio Grande Stormwater Quality Team's educational video (link below) to learn about Albuquerque's and Rio Rancho's stormwater system.
- 8. *Optional: Partner classes,* Google "stormwater" in your area and see what information is there. Water districts, the Departments of Health and Environment etc. have many educational resources.

<u>Materials</u>

- The Human Solution to Water Pollution video (to right of screen): <u>http://sscafca.org/teacher-resources/</u>
- Top Ten Ways to Protect Our Precious Water handout (in teacher packet and on wiki Curriculum page)
- Watershed model such as Enviroscape, **OR** USGS poster *Watersheds: Where We Live* (the poster is available at <u>http://water.usgs.gov/outreach/Posters/watersheds/grade.html</u> and a printable copy of the activity is on the RiverXchange Curriculum Page) and supplies:
 - Butcher paper (or newspaper) and plastic wrap
 - Several large baking pans or plastic containers (clear ones can be reused for Project 4: Groundwater)
 - Waterproof marker
 - Spray bottles filled with water
 - Small plastic houses, cows and cars (or little pieces of modeling clay to represent these)
 - Cocoa powder and colored drink powders
- *Optional:* Don't Trash Our Rio activity (in teacher packet)
- Optional: The Majestic Plastic Bag video: <u>https://vimeo.com/14221747</u>

• *Optional:* Watch *Segment 3* (16:05-end) of the Mid Rio Grande Stormwater Quality Team's educational video: <u>http://www.keeptheriogrand.org/keeping-the-rio-grand/</u>

<u>Vocabulary</u>

- Watershed: The land area from which snowmelt and rain drain into a river, lake or other body of water. Also known as a drainage basin or catchment.
- **Point-source pollution:** Water pollution coming from a single point, such as a sewage-outflow pipe or a factory.
- **Nonpoint-source pollution:** Water pollution coming from a wide land area, not from one specific location. Occurs when rainwater, snowmelt, or irrigation runs off plowed fields, city streets, or suburban backyards, picking up soil particles and pollutants, such as nutrients, pesticides, and other chemicals.
- Storm drain: A drain, often under sidewalks, designed to collect excess rain and ground water from impermeable surfaces such as streets, parking lots, sidewalks, and roofs. Also known as a storm sewer.
- **First flush:** The first surface runoff of a rainstorm. This is when we see the highest levels of pollution in water entering the storm drains.
- **Stormwater:** Runoff from a storm which either flows directly into a water body or is channeled into storm drains, which eventually discharge to surface waters.
- Wastewater: All the water that goes down a drain into a municipal sewer system or septic system. Also known as sewage.

Project 3: Infiltration and Runoff

<u>Student Assignment</u>

Where does rainwater go when it falls on your school grounds? Write a *RACE* paragraph, or create another type of project, using evidence from your mini-field trip around the school.

Informational Texts

- USA Today article. "La Niña Brings Flood Risks, Drought to the West" http://usatoday30.usatoday.com/weather/news/2011-05-12-west-floods-drought_n.htm
- *LA Times* article. "3 days after rain, beach water can still make swimmers ill, study says" <u>http://www.latimes.com/science/sciencenow/la-sci-sn-beach-advisories-storm-runoff-20140303-story.html#ax</u> <u>zz2v99eazt7</u>.

<u>Classroom Activity</u> – Flexible! Just do as much as you want, and feel free to substitute other activities.

- 1. Listen to the *Water Cycle Song* (see link below). You may want to print out the lyrics for students (a printable copy is on the RiverXchange Curriculum Page). Review the six major components of the water cycle: **precipitation, runoff, infiltration, evaporation, transpiration,** and **condensation.**
- 2. Discuss how the sun's energy starts the whole process, and how the water cycle relates to weather, recalling the amount and timing of your area's precipitation.
- **3**. Point out that when precipitation hits the ground, it can either run off, sink in (infiltration, also known as percolation) or evaporate back into the air. Explain how all plants move water from the ground to the air through the process of transpiration.
- 4. Read the *USA Today* article (see link above) and discuss how **La Niña** and **El Niño** bring dry weather or wet weather to your area. Discuss what happens in different areas of the school when you have too much rain are there areas that flood?
- 5. Using *Investigating the School Grounds* (a printable copy is on the RiverXchange Curriculum Page) as a guide, take students on a "mini field trip" to investigate where rainwater goes on your school grounds to observe changes in land contours, and the location of downspouts and catchment areas. Discuss where runoff appears to be occurring, what affects infiltration, and the difference between **permeable** and **impermeable** surfaces.
- 6. Discuss how storm drains carry pollution from impermeable surfaces into the nearest body of water, whereas the process of infiltration into permeable surfaces helps filter out pollution. You may want to read the LA Times article (see link above) about pollution from stormwater.
- 7. Discuss how runoff can cause flash floods. In Albuquerque, concrete-lined arroyos are very dangerous because runoff comes from a larger area and the water moves very fast people have drowned. In Rio Rancho, the arroyos in their natural state are generally safe unless rain clouds are visible.
- 8. *Optional:* For a math-based extension, test infiltration on various surfaces, using *Does it Soak Right In?* (a printable copy is on the RiverXchange Curriculum Page) as a guide. Graph the data as a class to build data analysis skills.

<u>Materials</u>

- Investigating the School Grounds activity (a printable copy is on the RiverXchange Curriculum Page)
- Water Cycle Song: <u>http://www.abcwua.org/education/music/water%20cycle%20song.mp3</u>
- *Water Cycle Song* lyrics (a printable copy is on the RiverXchange Curriculum Page)
- *Optional: Does It Soak Right In?* activity (a printable copy is on the RiverXchange Curriculum Page)
 - A soup can for each group, all the same size, with both ends cut off
 - Stopwatches
 - Rulers
 - Measuring cups

Vocabulary

- **Precipitation:** All the water that falls from the sky, in solid or liquid form, such as rain, snow or hail.
- **Runoff:** The rain or snow that does NOT sink into the ground, that runs off the land into a river, lake or other body of water (often carrying dirt and pollution with it).
- Infiltration: The process of water sinking down into the ground to refill the aquifer. Also called percolation.
- **Evaporation:** The process by which water changes from liquid to vapor (water in a puddle, river, lake, ocean, or other body of water evaporates into the air).
- **Transpiration:** The process by which water comes out of the leaves of plants, primarily through openings in the leaves, and goes into the air.
- **Condensation:** The process by which water changes from vapor to liquid (water in clouds condenses to form rain).
- Impermeable surface: A material that water can NOT soak into (or infiltrate); also called an impervious surface.
- Permeable surface: A material that water can soak (or infiltrate) into; also called a pervious surface.
- Flash flood: A rapid flooding (less than six hours) of low-lying areas (such as washes, rivers, dry lakes, basins), caused by heavy rain, snow or sudden ice melt in surrounding areas.
- Arroyo: A Spanish word for a drainage ditch, gully or ravine which was carved by water drainage.

Project 4: Forests and Wetlands

<u>Student Assignment</u>

Write a *persuasive* paragraph, or create another type of project, about why wetlands and forests are important in our watersheds.

Informational Texts

- *ABQ Journal* article. "River Diversions Halted Due to Burn Scar Runoff" <u>http://www.abgjournal.com/45855/abqnewsseeker/river-diversions-halted-due-to-burn-scar-runoff.html</u>
- American Forests. "Forests and Water" <u>https://www.americanforests.org/conservation-programs/forests-and-water/</u>
- Rapid City Journal article. "Federal Government Confirms Wetland Channels Are Keeping Rap id Creek Cleaner" <u>http://rapidcityjournal.com/news/local/federal-government-confirms-wetland-channels-are-keeping-rapid-cree</u> k-cleaner/article b2a2e469-5100-5a66-866d-0733f183b0ee.html

<u>Classroom Activity</u> – Flexible! Just do as much as you want, and feel free to substitute other activities.

- 1. Watch *The Adventures of Junior Raindrop* video (see link below) to learn about how vegetation helps prevent **erosion**.
- 2. Read the *ABQ Journal* article (see link above) about erosion from wildfires polluting the Rio Grande.
- 3. Do the *Wetland Model* activity from the back of the USGS poster *Wetlands: Water, Wildlife, Plants* (the poster can be shown on a smartboard see link below, and a printable copy of the activity is on the RiverXchange Curriculum Page) to examine the effects of a **wetland** in reducing erosion and controlling flooding.
 - To model forests in the watershed, stick cotton balls in the clay and repeat the experiment again to see that the muddy water gets even cleaner as it travels through the "forest."
- 4. Even in desert areas like New Mexico, there are wetlands, and **riparian areas**. Many are constructed (man-made) specifically for cleaning stormwater. Read the *Rapid City Journal* article (see link above) on how constructed wetlands help keep their creek clean. Discuss how these areas also support a diverse community of living things, and how many people used to think wetlands were not important. In fact, they would fill them in with soil and build right on top of them!
- 5. Find books from your library on different kinds of wetlands, and discuss the differences in wildlife and plant communities they support *OR* watch the *NatureWorks* video (see link below).
- 6. *Optional:* Do the *Water Treatment Plants* activity (see link below) to see how celery sticks, like wetland plants, can help filter water by absorbing pollution. This activity is very quick to set up, then just wait one day to see what happens.
- 7. *Optional: New Mexico classes*, watch the section about Sanchez Farm in the Mid Rio Grande Stormwater Quality Team's educational video (link below) to learn how a constructed wetland helps clean stormwater.

<u>Materials</u>

- The Adventures of Junior Raindrop video: <u>http://www.archive.org/details/Adventur1948</u>
- USGS poster *Wetlands: Water, Wildlife, Plants.* The poster is available at <u>http://water.usgs.gov/outreach/Posters/wetlands/middle.html</u>, and a printable copy of the activity is on the RiverXchange Curriculum Page.
- Supplies:
 - Small rectangular plastic storage containers, or baking pans or paint trays
 - Modeling clay
 - Small pieces of carpet
 - Cotton balls

- *NatureWorks* video <u>http://video.nhptv.org/video/1491178229</u>
- *Optional: Water Treatment Plants* activity (a printable copy is on the RiverXchange Curriculum Page)
 - Celery sticks
 - Cups of colored water
- *Optional: Keeping the Rio Grand* <u>http://www.keeptheriogrand.org/keeping-the-rio-grand/</u>, the Mid Rio Grande Stormwater Quality Team's educational video (the part about the constructed wetland is from 13:12 16:01)

Vocabulary

- **Erosion:** The process in which a material (such as a river bank) is worn away by water or air, often due to the presence of abrasive particles in the stream.
- Wetland: An area such as a marsh or swamp that is covered with shallow water or where the soil is naturally soaked with water.
- **Riparian area:** The area around the banks of a natural body of fresh water, where the vegetation and landscape is directly influenced by that water.

Unit 2: Water in Our Society

Project 5: Commercial Uses of Our Waterways

For NM classes, this is presented by a guest speaker from the county's Cooperative Extension. For partner classes, we encourage you to see if you can find someone from a local agency or business who can present on this topic.

Student Assignments

- Write an *informational* paragraph or a *friendly letter* to your partners, or create another type of project, explaining:
- a) How was the river (or other waterway) important when people first settled in your community?
- b) How has your waterway been used by people for commerce (to make money) in your community's history?
- c) Do some people still rely on the waterway for their jobs, such as farming, fishing, shipping, or recreation?
- d) What technologies have people developed to solve water problems in your area (like drilling wells, building dams, locks, and fish ladders, different kinds of irrigation, or technologies to conserve water or prevent pollution?)

Informational Texts

- ABQ Journal article. "Deal Allows Farmers to Sell Irrigation Water"
 <u>http://www.abqjournal.com/221194/news/deal-allows-farmers-to-sell-irrigation-water.html</u>
- *National Geographic* article. "Parched: A New Dust Bowl Forms in the Heartland" <u>http://news.nationalgeographic.com/news/2014/05/140516-dust-bowl-drought-oklahoma-panhandle-food/</u>

<u>Classroom Activity</u> – Flexible! Just do as much as you want, and feel free to substitute other activities.

- Research the major commercial use(s) of your river/waterway (such as agricultural irrigation, shipping/transportation, electricity, fisheries and/or recreation) and invite a guest speaker to present, or find an activity that relates. In New Mexico, the <u>only major</u> commercial use of the Rio Grande is agriculture – 80% of the water goes to irrigation!
- 2. Discuss how these commercial uses influenced the location/history of your community, and how these users can also help a community conserve water and keep water clean (such as conserving water when irrigating, controlling **erosion**, keeping boat engines in good repair).
- 3. Discuss how people have developed technological solutions to solve water problems. For example, many ancient settlements in the West were abandoned because of lack of water, but irrigation technology has made it easier to survive. Dams have made it easier to control the flow of rivers, reservoirs store water, and fish ladders are built so that dams don't prevent their migration. High-efficiency toilets and other appliances help conserve water.
- 4. In NM, discuss the **acequia** system which was put in place by the Pueblo people and early Spanish settlers. Watch one of the YouTube videos if possible (see links below) or read the *Albuquerque Journal* article about water rights (see link above).
- 5. Show students the USGS poster *Navigation: Traveling the Water Highways* (the poster can be shown on a smartboard see link below, and a printable copy of the activity is on the RiverXchange Curriculum Page). Discuss how some communities use their river for transportation, while New Mexico rivers are used mainly for agricultural irrigation. New Mexico students may not be familiar with **dams**, **locks** and boats traveling on the river. If your river is used for transportation, you may want to do the *River Profile* activity on the back of the poster.
- 6. *Optional: Water Ripples games* (see link below). Review ways our society uses water, particularly in agriculture.
- 7. *Optional: Water Rights.* Using the *Pass the Jug* activity guide (see link below), act out the two different methods of assigning water rights to all the water users. Discuss the difference between the Riparian Rights and Prior Appropriation doctrines. Research the history of water rights in your community and compare the

differences in water rights issues with your partners' area. Prior Appropriation is used in the western states, which receive far less precipitation. Revisit the *Precipitation Map* and discuss why this makes a difference. Read about farmers being allowed to sell their water rights to allow more water for the ecosystem.

<u>Materials</u>

- USGS poster *Navigation: Traveling the Water Highways.* The poster is available at http://water.usgs.gov/outreach/Posters/navigation/grade.html, and a printable copy of the activity is on the RiverXchange Curriculum Page.
- *Optional: Water Ripples games.* http://aces.nmsu.edu/ces/watertaskforce/water%20ripples%20gameshow%20quiz/index.html
- Optional: Water Rights
 - Prior Appropriation Game <u>http://www.troutintheclassroom.org/sites/www.troutintheclassroom.org/files/documents/PriorAppropriationGame.doc</u>
 - Precipitation Map: <u>http://www.wrcc.dri.edu/pcpn/us_precip.gif</u>
 - Ancient Irrigation video: <u>http://www.youtube.com/watch?v=RUv2Tz1ayTc</u>
 - Ditch Cleaning at Arroyo Hondo video: <u>http://www.youtube.com/watch?v=YyqxdbsEObU</u>

<u>Vocabulary</u>

- Irrigation: Watering crops. When natural precipitation is not enough for crops, farmers use flood irrigation (common in New Mexico), drip irrigation and/or overhead sprinklers.
- Acequia: An irrigation ditch used to distribute water from rivers to farms. Most are simple ditches with dirt banks, but they can be lined with concrete. An important form of irrigation in the development of agriculture in the American Southwest.
- **Erosion:** The process in which a material (such as a river bank) is worn away by water or air, often due to the presence of abrasive particles in the stream.
- **Dam:** A barrier built across a river to hold water back; sometimes used to generate electricity.
- Lock: A chamber with gates that close off for raising and lowering boats on a river or canal.

Project 6: Drinking Water

For NM classes, this is presented by a guest speaker from the water utility. For partner classes, we encourage you to see if your local utility can send someone to present.

Student Assignments

Write a *persuasive* paragraph (or create another type of project) explaining why it is important to conserve water, and what we should do.

Informational Texts

- Santa Fe drinking water article (a printable copy is on the RiverXchange Curriculum Page)
- Albuquerque drinking water article (a printable copy is on the RiverXchange Curriculum Page)
- *LA Times* article. "Americans use twice as much water as they think they do, study says" <u>http://www.latimes.com/science/sciencenow/la-americans-underestimate-personal-water-usage-study-says-20</u> <u>140227-story.html#axzz2v99eazt7</u>
- *A Long Walk to Water*, by Linda Sue Park (2010: Clarion Books, 128 pages)
- "How Does Water Use in the United States Compare to That in Africa?" <u>https://www.awf.org/blog/how-does-water-use-united-states-compare-africa</u>

<u>Classroom Activity</u> – Flexible! Just do as much as you want, and feel free to substitute other activities.

- Discuss the *Indoor Water Use* graph (see link below), emphasizing that all of these activities use clean drinking water. Explain that in homes and other buildings there is <u>one set of pipes</u> that bring clean drinking water into the home and a different set of pipes that takes the dirty water away. Be sure to mention that in many parts of the country (like in NM) people use almost as much for watering plants outdoors as all their indoor water use combined. Discuss how **xeriscape** and watering during the coolest part of the day can help.
- 2. Schedule a guest speaker to present on where your drinking water comes from, how it is treated to make it safe for drinking, and/or ways to conserve water. OR research where your drinking water comes from, and do *The Value of Water* activity from the back of the USGS poster *Water: The Resource That Gets Used & Used & Used For Everything* (the poster can be shown on a smartboard see link below, and a printable copy of the activity is on the RiverXchange Curriculum Page). Students will examine their water use by using play money to record their daily usage, then brainstorm how to conserve. For a math-based extension activity, you can graph the data as a class to build data analysis skills.
- **3**. Discuss how flooding or drought can affect your community's drinking water. Look for articles in your local paper, or read one of the suggested articles (see links above).
- 4. *Optional: Water Footprint.* Calculate your impact using an online tool (see link below).
- 5. *Optional: Water Use in Other Countries.* To learn more about water use in other countries, read the article about water use in Africa (see link above), invite a guest speaker from Water for People (see link below) and/or watch the *Water for Life* video, and/or read the book *A Long Walk to Water*, by Linda Sue Park. Compare average indoor water use in the U.S. to that in other nations.
- 6. *Optional: The Water-Energy Connection.* Show students the *Power Couple* video and/or water-energy posters to learn about the connection between electricity and water use, then do the activity (see links below.).

<u>Materials</u>

- Indoor Water Use Graph <u>http://www.epa.gov/WaterSense/pubs/indoor.html</u>
- USGS Poster *Water: The Resource That Gets Used & Used & Used For Everything.* The poster is available at <u>http://water.usgs.gov/outreach/Posters/water_use/grade.html</u>, printable copy of the activity is on the RiverXchange Curriculum Page.
- Optional: Water Footprint Calculator
 - <u>http://environment.nationalgeographic.com/environment/freshwater/change-the-course/water-footprint-cal</u> <u>culator/</u>

- Optional: Water Use in Other Countries
 - Find a guest speaker from your local Water for People Committee: <u>http://www.waterforpeople.org/take-action/volunteer</u>
 - OR *Water for Life* video: <u>http://www.archive.org/details/Unworks-MTV-WFL</u>

• Optional: The Water-Energy Connection

- *Power Couple: The Shocking True Story of Water and Electricity* video, with viewers' guide and posters. <u>http://www.abcwua.org/education/Energy_Water_Nexus.html</u>
- Understanding the Energy Demand of Bottled Water. http://www.earthday.org/sites/default/files/3.%20Understanding%20the%20Energy%20Demand%20of% 20Bottled%20Water_5-8%20Lesson%20Plan.pdf

Vocabulary

- Drinking water: Water that has been purified to standards set for human consumption.
- Xeriscape: The use of low water use plants in landscape (not "zeroscape".) Xeros is Greek for "dry."
- **Conserve:** To use something wisely; not wasting.
- La Niña: An irregularly occurring movement of deep cold water to the ocean surface along the western coast of South America that brings less precipitation to the southern U.S. and more to the northern U.S.
- El Niño: An irregularly occurring flow of unusually warm surface water along the western coast of South America that brings more precipitation to the southern U.S. and less to the northern U.S.

Project 7: Groundwater

Student Assignment

How are groundwater and surface water connected? Write a *RACE* paragraph, or create another type of project, using what you learned from the aquifer model.

Informational Texts

- ABQ Journal article. "State: Kirtland Jet Fuel Leak Massive" http://www.abqjournal.com/upfront/042254588838upfront05-04-10.htm
- *ABQ Journal* article. "KAFB Ramps Up Fuel Spill Cleanup" <u>http://www.abqjournal.com/161358/news/kafb-ramps-up-fuel-spill-cleanup.html</u>
- LA Times article. "Groundwater contamination a growing problem in L.A. County wells" <u>http://www.latimes.com/visuals/graphics/la-me-g-drought-wells-20150520-htmlstory.html</u>

<u>Classroom Activity</u> – Flexible! Just do as much as you want, and feel free to substitute other activities.

- 1. Watch *The Story of Groundwater* video (see link below) to learn the difference between **groundwater** and **surface water**.
- 2. Show students the *Major U.S. Aquifers* map (see link below) and locate your **aquifer**.
- 3. Do the activity *Recharge-Discharge* from the back of the USGS poster *Groundwater: The Hidden Resource* (the poster can be shown on a smartboard see link below, and a printable copy of the activity is on the RiverXchange Curriculum Page). Students build a simple aquifer model to learn about the water table, how a well works, and how groundwater and surface water are connected. Discuss how if we pump too much of surface water it can deplete groundwater, and vice versa. Also, if one person pumps too much groundwater from their well, it can affect their neighbors' wells.
- 4. Leaking underground tanks (such as septic tanks or gas tanks beneath gas stations) are a major source of groundwater pollution. This can be demonstrated using small plastic cups with holes poked in the bottom. Sink a cup into the gravel of the model and fill it with colored water to see how pollution spreads through groundwater. Note that contaminated groundwater can pollute surface water and vice versa.
- 5. Read articles from the Albuquerque Journal about a jet fuel leak from Kirtland Air Force Base (see links above) or find articles about similar issues in your area. Discuss what types of pollution can get into groundwater and what can't. Solids such as trash and dog poop on the earth's surface cannot travel down to the aquifer. Dissolved chemicals, heavy metals, and very large amounts of farm animal waste can, however.
- 6. Read the resources about groundwater from the Groundwater Foundation (see links below). Review the *Top Ten Ways to Protect Our Precious Water* handout (in teacher packet). Brainstorm other ways to prevent groundwater pollution.

<u>Materials</u>

- The Story of Groundwater video. <u>https://archive.org/details/Groundwater_Animation</u>
- Major U.S. Aquifers map: <u>http://pubs.usgs.gov/ha/ha730/ch_a/gif/A004_us.gif</u>
- Top Ten Ways to Protect Our Precious Water handout (in teacher packet)
- USGS poster *Groundwater: The Hidden Resource*. The poster is available at <u>http://water.usgs.gov/outreach/Posters/groundwater/grade.html</u> and a printable copy of the activity is on the RiverXchange Curriculum Page.
- Supplies:
 - Several clear baking pans or plastic containers
 - Gravel to fill containers 2/3 full
 - Several pump tops from soft-soap or hand-lotion containers
 - Paper cups with holes punched in the bottom to sprinkle water
 - Colored drink powder

- *The Groundwater Foundation* Uses of groundwater including chart <u>http://www.groundwater.org/get-informed/basics/groundwater.html</u>
- The Groundwater Foundation Contamination http://www.groundwater.org/get-informed/groundwater/contamination.html

<u>Vocabulary</u>

- Aquifer: A wet underground layer of water-bearing rock or materials (gravel, sand, silt or clay) from which groundwater can be extracted using a well.
- **Groundwater:** Water located beneath the earth's surface in cracks between soil particles and fractures in rock formations. A large and usable quantity of groundwater is called an aquifer.
- Surface water: Water collected on the ground or in a waterbody such as a stream, river, lake, wetland or ocean.
- Water table: The top surface of an aquifer (how far you have to dig down to find water).
- Well: A man-made hole with a pipe that goes down to the water table. A pump helps bring the groundwater up.

Project 8: Wastewater

For NM classes, this is presented by a guest speaker from the water utility. For partner classes, we encourage you to see if your local utility can send someone to present.

Student Assignment

Write a *narrative* or *creative* paragraph, or create another type of project, explaining the journey of your community's wastewater.

Informational Texts

- *KOAT* news. "Aging Pipes Mean Higher Water Bills" <u>http://www.koat.com/news/aging-pipes-could-mean-water-bill-hike/34284754</u>
- Combined sewer overflows article, by Anne Jefferson, a geology professor from Kent State. <u>http://all-geo.org/highlyallochthonous/2013/03/combined-sewer-overflows-solving-a-19th-century-problem-in</u> <u>-the-21st-century/</u>

<u>Classroom Activity</u> – Flexible! Just do as much as you want, and feel free to substitute other activities.

- 1. Invite a guest speaker to learn about where your community's **wastewater** goes, *OR* if your community has a municipal sewer system, do the activity *Where Does Your Used Water Go?* on the back of the USGS poster *How Do We Treat Our Wastewater?* (the poster can be shown on a smartboard see link below; printable copy is on the RiverXchange Curriculum Page).
- 2. Read the article about Albuquerque's crumbling sewer infrastructure, and/or the article about combined sewer overflows (see links above), or find news articles about issues in your area. If possible, you may want to watch the YouTube video, *A Drop's Life*, about combined sewer overflows in the Washington, DC water system.
- 3. Show students the *Septic System* poster (the poster can be shown on a smartboard, and a printable copy is on the RiverXchange Curriculum Page) and explain the difference between a **sewer system** and a **septic system** they both treat wastewater essentially the same way, but a septic tank is right by the house and uses a drainfield in rural areas. If desired, watch the *Dirty Jobs* video (see link below). If your community has mostly septic systems, discuss how important it is to have the tanks pumped out regularly to avoid groundwater pollution.
- 4. Discuss what kinds of things NOT to put down the drain or toilet for example, fats, oils, and grease can solidify in pipes and cause a backup. Discuss how treated wastewater is recycled in many communities (such as watering golf courses), and how a community's treated wastewater will be used by downstream communities.
- 5. Review the differences between **stormwater**, **drinking water**, and **wastewater**, emphasizing how different sets of pipes are involved, and that the "quality" of the water being transported is very different.

<u>Materials</u>

- USGS poster *How Do We Treat Our Wastewater*? The poster is available at http://water.usgs.gov/outreach/Posters/wastewater/grade.html, and a printable copy of the activity is on the RiverXchange Curriculum Page.
- Supplies:
 - 14 feet of yarn, string or rope
 - Shredded paper or packing peanuts and a cardboard box
- *Septic System* poster (on the RiverXchange Curriculum Page).
- Combined Sewer Overflow video: *A Drop's Life*. Applies to certain cities only, mostly in the eastern US, find out if your city has this type of system. <u>https://www.youtube.com/watch?v=5Ug1hravb9Q</u>
- *Dirty Jobs: Septic Tank Technician* video (Caution this video has one bad word at 1:16) <u>http://home.howstuffworks.com/home-improvement/plumbing/sewer2.htm</u>

Vocabulary

- **Wastewater:** All the water that goes down a drain into a municipal sewer system or septic system. Also known as sewage.
- Sewer system: A system of underground pipes used to transport human waste. In some communities, the sewer system is combined with the storm system (known as a combined sewer).
- **Septic system:** A small-scale sewage treatment system common in areas with no connection to a municipal wastewater system. A septic tank is a key component of a septic system.
- **Stormwater:** Runoff from a storm which either flows directly into a water body or is channeled into storm drains, which eventually discharge to surface waters.
- Drinking water: Water that has been purified to standards set for human consumption.

Unit 3: River Ecosystem Field Trip

Project 9: Field Trip

Student Assignment

Write a *narrative* paragraph or a *friendly letter* to your partners, or create another type of project, about your field trip:

- a) If you tested the water, explain why we collect water quality data and what it means.
- b) If you planted trees or did another service learning project, explain how your project will help the river ecosystem.

Informational Texts

- *A Waterproof Case* (in teacher packet)
- The Water Down Under booklet (in teacher packet)
- Local ecosystem articles (These are for NM teachers in other areas should search local newspapers for articles about their own ecosystem).
 - *ABQ Journal* article. "Battle with Beavers" <u>http://www.abqjournal.com/45685/north/battle-with-beavers.html</u>
 - Santa Fe New Mexican article. "Crews complete restoration project at Buckman recreation area" <u>http://www.santafenewmexican.com/news/local_news/crews-complete-restoration-project-at-buckman-recreation-area/article_284dd705-05e8-59bb-8585-f00934e93516.html</u>
 - The Washington Times article. "NM water release aims to help silvery minnow" <u>http://www.washingtontimes.com/news/2014/may/6/water-release-aims-to-help-silvery-minnow/?page</u> <u>=all</u>

Pre-Field Trip Activities

- 1. Define an **ecosystem** (the physical environment together with all the species that live there). Discuss how living things depend on the nonliving things, such as water, air, soil/rocks, and the sun.
- 2. Read *The Water Down Under* booklet to learn more about macroinvertebrates and water quality. Discuss the role of **aquatic macroinvertebrates** in the **food web** and what they can tell us about the health of our ecosystem. Many animals depend on them for food. Some aquatic macroinvertebrates are sensitive to pollution, so one way scientists can tell how healthy a river ecosystem is by looking at which types of macroinvertebrates are living in the water. Many spend only part of their lives in the water, so if the water is polluted, it has far-reaching effects on the ecosystem. Discuss **producers, consumers** and **decomposers**, and where aquatic macroinvertebrates fit (some are consumers, some are decomposers).
- 3. Talk about the field trip and location, and what students can expect.
- 4. *Optional: Frogline News*. Watch a newscast by frogs (see link below) to revisit how pollution gets into surface water. Discuss the significance of frogs (i.e., the frog is a biological **indicator species** because it is very sensitive to water pollution). Remind students of the watershed model and how they can prevent nonpoint-source pollution.
- 5. Optional: Acid Rain. Watch the video How Acid Rain Works (see link below).

<u>Field Trip</u>

- 1. For New Mexico Classes: Field trips may include a service learning project, such as tree planting or an agricultural activity. Otherwise, they will incorporate hands-on lessons about **riparian areas**, wetlands, macroinvertebrates and water quality, and students will use a field journal. On the field trip, students will gather data about pH, temperature, turbidity and dissolved oxygen.
- 2. For Partner Classes: We strongly encourage you to take any water-related field trip available in your area, and we can help if you have trouble finding one.

Post-Field Trip Activity

- 1. Review how land use affects water quality and what the water quality data tells us about the ecosystem.
 - Increased river temperature can be caused by many things including low river flow, large areas of impermeable surfaces, lack of vegetation, and stormwater that is warm from flowing over roads.
 - High temperature and/or fertilizers (including pet waste) can cause algae bloom, which reduces dissolved oxygen.
 - Erosion or algae bloom can cause turbidity, leading to higher temperature.
 - Acid rain, mine drainage or algae bloom can cause low pH (normally pH is determined by the types of • rocks or trees present in the watershed).
- 2. Read news articles about issues in your local ecosystem. A few articles for NM are provided (see links above).
- 3. Optional: River Food Web. Make a food web for your local ecosystem, identifying producers, consumers and decomposers, native species and invasive species, as well as local endangered species. Discuss how wildlife are "water users" too. Like humans, wildlife needs clean water to live, so as a community we must consider their needs when making choices about water. NM Classes: use Bosque plant and animal cards to do The Web activity (a printable copy is on the RiverXchange Curriculum Page), discussing how all living things depend on each other. For Partner Classes: The Web activity can be applied to any ecosystem and is a fun way to get kids thinking "on their feet".

Materials

Pre-Field Trip Activities:

- Frogline News video: <u>http://www.dailymotion.com/video/x2qhkrw</u>
- Optional: Acid Rain. How Acid Rain Works video, http://science.howstuffworks.com/nature/climate-weather/atmospheric/acid-rain.htm

Field Trip:

- *Macroinvertebrate Data Sheets* (if desired, printable copies are on the RiverXchange Curriculum Page). **Post-Field Trip Activities:**
- World Water Monitoring Challenge website http://worldwatermonitoringchallenge.com/ •
- *Optional: The Web* food web activity (a printable copy is on the RiverXchange Curriculum Page).

Vocabulary

- **Ecosystem:** All the living and nonliving things that interact in a particular place. •
- **Bosque:** A Spanish word for woodlands, it refers to the riparian areas of stream and river banks in the • southwestern US.
- **pH:** A measure of the acidity or alkalinity of water (or a solution) on a scale that ranges from 0 (extremely • acidic) to 14 (extremely alkaline). Pure water has a pH of 7 (neutral).
- Turbidity: A measure of water clarity based on the amount of particles suspended in it. •
- Dissolved oxygen: The concentration of oxygen dissolved in water, expressed in milligrams per liter or as a • percent saturation.
- **Riparian area:** The area around the banks of a natural body of fresh water, where the vegetation and landscape is directly influenced by that water.
- Aquatic macroinvertebrates: Animals that have no backbone, are visible with the naked eye, and spend all • or part of their life in water. This diverse group includes worms, mollusks, arachnids, crustaceans, and insects.
- **Food web:** A representation of the predator-prey relationships between species within an ecosystem.
- Producers: Organisms, generally plants, that make their own food (using only the sun's energy, water, and • inorganic compounds), and are the foundation of the food chain.
- **Consumers:** Organisms that obtain nutrients by eating other organisms (such as plants or other animals).
- **Decomposers:** Organisms (such as bacteria, fungi, other plants and animals) that break down the remains of • dead organisms, releasing the substances that can be used by other members of the ecosystem.
- **Native species:** A species that naturally occurs in a particular ecosystem. •

- **Invasive species:** A plant or animal introduced from a different area that competes with native species that is taking over an area.
- Endangered species: A plant or animal species existing in such small numbers that it is in danger of becoming extinct (dying out completely).

Appendix 2

Extension Questions and Activities

Field Trip:

Extension Activities:

- Write a *narrative* paragraph or a *friendly letter* to your partners, or create another type of project, about your field trip: Explain how your project will help the river ecosystem and what you learned. Describe what was difficult for you on the field trip and what was enjoyable.
- Make a food web for your local ecosystem, identifying producers, consumers and decomposers, native species and invasive species, as well as local endangered species. Discuss how wildlife are "water users" too. Like humans, wildlife needs clean water to live, so as a community we must consider their needs when making choices about water. Use Bosque plant and animal cards to do *The Web* activity (a printable copy is on the RiverXchange Curriculum Page), discussing how all living things depend on each other.
- Learn about The STRAW Project. An ongoing watershed restoration project first inspired by 4th graders in 1992, based in Marin Co. California! Add it to your school's library and show the documentary in class.
 http://www.pointblue.org/our-science-and-services/conservation-science/conservation-training/straw-program or read about the project in this article and discuss:

http://www.marinij.com/article/NO/20150325/NEWS/150329872

- What did you learn about the history of the Rio Grande River and the floodplain we planted in? How does this history impact the future of cottonwoods in the area?
- Identify some common invasive species. Where did they come from and how are they impacting the Bosque?
- What is the process of planting cottonwoods and willows and why do we do it in the wintertime?
- After this field trip, how may you see and understand the Bosque differently?
- What did you most enjoy being down in the Bosque?
- How can you apply what you learned or enjoyed on your field trip in your everyday life?

Stormwater:

Extension Activities: For a math extension activity try the "Does it Soak Right In?" lesson "Don't Trash Our Rio!" is another great extension activity for this presentation. That activity sheet can be found in your RX welcome folder.

You can also review the <u>"Top Ten Ways To Protect Our Precious Water</u>" handout in your teacher packet or within the Project 2 section on the curriculum webpage. Here you can zoom in and explore your watershed and the watershed that family and friends live in, perhaps

Interactive Topographical Watershed Map of Earth

Reflection Questions:

- What is stormwater and where does your community's stormwater go?
- What did you learn about stormwater that was surprising to you?

even your RiverXchange partners who live outside of New Mexico!:

- How does what happens in your yard or your neighbor's yard impact the watershed?
- What have you noticed about stormwater in your own neighborhood? What are things you can do to clean up stormwater?
- How can surface water become polluted?
- What's happens when rain falls on a pervious surface compared to an impervious surface? Give examples of impervious surfaces.
- How are groundwater and surface water connected?
- What are ways you can minimize stormwater pollution?
- What role do forests and wetlands play in a watershed?

Wastewater:

Extension Activities:

Through the ABQ Water Utility Authority's website you can navigate virtually through Albuquerque's wastewater system: <u>http://www.abcwua.org/Education/SWRP_home.html</u> or the overall water system:<u>http://www.abcwua.org/education/el_WSD_2.html</u> Want to add a project-based learning component to this exercise? Use these questions and activities to go along with your tour: http://www.abcwua.org/education/educators_WSDcur2_quest.html

Maybe even create a PSA with your class inspired by all you've learned!

Discuss what kinds of things NOT to put down the drain or toilet – for example, fats, oils, and grease can solidify in pipes and cause a backup. Discuss how treated wastewater is recycled in many communities (such as watering golf courses), and how a community's treated wastewater will be used by downstream communities.

Watch one of these videos in class to review the process of wastewater and what students can do to take care of wastewater:

-<u>https://www.youtube.com/watch?v=Ldz29NqwK78</u> (An animation narrated by a young student) -<u>https://www.youtube.com/watch?v=tuYB8nMFxQA</u> (A video on the water treatment process created by New Jersey American Water)

- What is wastewater and how does it impact your community?
- What is the difference between wastewater, stormwater and drinking water?
- How can you use what you've learned to make a difference at home and at school?
- What is the process of treating wastewater in your community?
- What surprised you about the process of treating wastewater from the presentation?
- Since our wastewater gets cleaned and recycled at the wastewater treatment plant, why is it important to do what we can to keep it clean before it arrives there?

Drinking Water:

Extension Activities:

-Create a filter in class to clean contaminated water and investigate your findings with this lesson. This can be done over the course of a few days in class or you can demonstrate how a filter works with our class in a shorter lesson.: <u>http://seplessons.ucsf.edu/node/1754</u>

-A short article and video comparing the average consumption of water per day per person in Africa compared to in the U.S.

https://www.awf.org/blog/how-does-water-use-united-states-compare-africa

-A great lesson, learning about the issue of water scarcity and importance of conservation. Students log their personal use of and observation of water use over two days. Students can discuss their findings and talk about what would happen if water scarcity were an issue. There is also a TRUE/FALSE game to learn about water and how it impacts the human body and communities. <u>https://thewaterproject.org/resources/WaterLogs_5to8.pdf</u>

- Where does your drinking water come from and what communities rely on it?
- Drinking water is used for much more than bathing, flushing toilets and drinking. What are other ways you and your community use drinking water? Did you learn anything surprising about how we use drinking water, if so - what?
- What percentage of the Earth is covered in water? Out of that amount, how much is accessible fresh water? How much is available as drinking water and why is it important to conserve it?
- One-third of the world's population does not have access to clean drinking water. How would your life be different if you had to walk miles to bring back water to your family?

Agriculture:

Extension Activities: To explore more about the Dust Bowl with your students:

http://www.pbs.org/kenburns/dustbowl/educators/overview/

<u>Out of the Dust- Karen Hesse</u> (This book is in the voice of 14 year old Billie Jo. She narrates her struggle to help her family in the years of the Depression from the Dust Bowl. Takes place in Oklahoma, written as a poem. This book helped me fall in love with reading when I was in 5th grade!)

Extension activity: Interview a grandparent or an adult friend who knows about the Depression through personal experience or through stories told by their parents and relatives. Share with class members.

Soil is Not Trivial lesson plan

- What was the Dust Bowl and how did it impact people?
- What do you think are the major agricultural lessons for us from the Dust Bowl?
- How may we be able to prevent a dust bowl from occurring?
- What is important for farmers to consider when planning how to irrigate their farm and why?
- How does agriculture relate to water and to our daily lives?
- What did you discover in your planting activity about the different types of irrigation?

Appendix 3 Photos









Exhibit 4 B.E.M.P. 2017-2018





BOSQUE SCHOOL



scholarship community integrity BEMP Education Office 4000 Bosque School Road NW Albuquerque, NM 87120 505.898.6388

Bosque Ecosystem Monitoring Program (BEMP) 2017-2018 Stormwater Science Education Overview

The main objective of the *Stormwater Science* outreach education program is to teach students that the health of the Rio Grande is directly correlated to the health of the surrounding watershed. BEMP educators have developed a *Stormwater Science* program that includes a 90-minute classroom activity, a four- to five-hour study trip to the Rio Grande, and an optional water chemistry lab during which students gain an understanding of the complex system. **During the 2017-2018 school-year 2247 students participated in** *Stormwater Science* activities in their classrooms, in the field or both. The classroom program was delivered to **1517 students** in **30 classrooms** at **19 different schools** in **Rio Rancho**, **Albuquerque, and Belen.**

The Stormwater Science program targets middle school and high school students using two main formats: an indoor classroom lesson and an outdoor field experience or "study trip." The principal objective for the classroom portion of the program is to demonstrate how some of our daily (individual) actions impact the health of the Rio Grande. To reach that goal, students construct a model of the Rio Grande Watershed (see Page 6) under different scenarios. The model watershed has five different communities along the river: a cattle ranch, up-anddownstream eco-friendly towns, an urban city, and agricultural fields. Students add different "nunoff cards" to the river downstream of the community where the runoff constituents originate. Some of the runoff is naturally occurring (e.g. turbidity) while other is human caused (e.g. pesticides or oil). The model runs through two different scenarios: (1) a *before-the-storm* and (2) an *after-the-storm*. These two versions of a watershed demonstrate the harmful effects storm water contamination can have on aquatic organisms and downstream communities. At a broader scale, the classroom program encourages students to be reflective about their daily behaviors and to think about ways they can help keep their watershed clean. Students are asked to brainstorm ways they can help improve watershed health before educators lead a discussion on watershed stewardship that aligns with the MRGSQT educational messaging. Further, in order to reach students that identify Spanish as their first language and better capture New Mexico's students diversity, the handout for this activity is available to students in both English and Spanish (classroom handout is included on page 4of this document).

The main goal for the study trip is to build upon the themes of the classroom presentation and to provide a hands-on experience in water quality testing at the river. This section consists in a four to five hour trip to the Rio Grande during which students investigate how stormwater moves through the city and what it carries with it. Further, students get to collect and interpret water quality data to better understand the subject. The program starts with an arroyo survey which examines and categorizes the amount of visible pollutants (e.g. plastics, paper, dog poop, animal

scat, etc.) in the San Antonio arroyo in Albuquerque, which drains to bosque. In the arroyo, students survey for several types of litter and test water quality using a LaMotte water quality monitoring kit (see Page 6). When the students arrive at the bank of the Rio Grande, they do additional water quality testing and search for macro-invertebrates. Students then collectively share their results, compare them to results they gathered in the arroyo, and discuss what the data could mean in terms of river health. This section of the curriculum allows students to have a more hands-on learning experience.

One of the challenges for middle and high school participation in programs like Stormwater Science is that teachers are only able to bring a subset of students into the field, while the rest remain at school with a substitute teacher. In order to reach more middle and high school students and provide another educational opportunity outside of the classroom, BEMP has offered a water chemistry lab during the 2016-2017 and 2017-2018 school-years. As an alternative to the conventional study trip, BEMP hoped the lab would accommodate some of the teachers" restrictions and provide an opportunity for hands on water testing. Very few teachers chose the lab option and generally expressed more interest in the study trip. In the future, BEMP does not plan to offer at water chemistry lab option to teachers except by special request.

During the 2017 fall semester, BEMP developed a new *Watershed Ecology* activity to use at events like our end of year Student Congress. This new activity follows the teaching objectives of *Stormwater Science*, but students collect data in a made up watershed to discover how runoff affects life in the river. Educators piloted the activity at the 2017 Rio Rancho Children's Water Festival and plan to use it at similar events in the future.

Hundreds of students also took part in *Stormwater Science* related field activities at three BEMP events this year. The BEMP Student Congresses (approximately 250 students and 45 teachers and chaperones), where BEMP students had the chance to share their research and experiences in the bosque, including watershed health observations; BEMP"s Otter Day (approximately 200 students and 75 teachers and chaperones), an event for first graders, hosted by high school students to teach about endangered animals in New Mexico (see Page 7); BEMP also co-hosts the annual Sevilleta-Luquillo Virtual Symposium with Luquillo Long Term Ecological Research Site in Puerto Rico, where approximately 50 students chose to present their research in Spanish. This year many of our Albuquerque students chose to present on the topic of watershed health. During June and July BEMP partners with Horizons Albuquerque, students learn about the many different ways in which scientists collect data about the environment, including water chemistry techniques in the Rio Grande and how their results are connected to storm events.

English Classroom Handout – Mid/High School





Spanish Classroom Handout – Mid/High School







Field Journal for outdoor study trips (cont.)



Water Chemistry

10717	Arroyo	River				
Temperature	°F / °⊂	°F/ °C				
Turbidity	JTU	JTV				
Nitrate	ppm	ppm ppm				
Phosphate	ppm					
pН						
Dissolved	þþm	ppm				
oxygen	%	5				
E. coli	Present / Absent	Present / Absent				
Temperature Tur 8-12 °C-good Sou 13-15 °C-fair fire >15 °C-poor 1-3 4-1 >10 pH 1-strong acid-poor 6-weak acid-fair 7-neutral-good 8-weak base-fair 14-strong base-poor	bidity Nitrates rces: erosion, Sources: p soil, fertili 9 JTU-good 1-4 ppm- 100 JTU-fair 5-20 ppm 0 JTU-poor >20 ppm- <u>Dissolved Oxygen</u> 1 ppm or 60-100% -good 4 ppm or 40-60% - fair 8 ppm or 0-40% - poor	Phosphates lants, Sources: plants, zer fertilizer, plastic good 1 ppm-good t-fair 2 ppm-fair poor 4ppm-poor <u>E.coli</u> d Sources: animal waste Eccli will always be present in small amounts. Large amounts are harmful to humans and animal				
Overall river h	ealth: (circle one)					
Good	Fair	Poor				



Middle school students at Cien Aguas International School (top right). In the field middle school students look for evidence of pollution in San Antonio Arroyo (center right) and study water quality through macroinvertebrates (bottom right). 1st grade students complete a puzzle to find the "secret messages" about protecting river habitats at Otter Day (below)





2017-2018 Stormwater S	Science Education	Outreach Numbers
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				# students	# students				#		
Date	Teacher	School	City	in classroom	in Field or	# adults	Grade	Activity	Presen-	Hours	School
8/16/2017	redener	Amy Bielh HS		clussiooni	18	2	9th	Study trip	1	1	нс
0/13/2017		Amy Bielh HS	Albuquerque		24	2	Oth	Study trip	1	1	нс
10/6/2017	Condra Lawcan	Carfield STEM Middle School	Albuquerque		24	2	C+b	Study trip	1	1	TIS NAC
10/0/2017	SUTURA LAWSUT	Bis Banaka Watan Sastival	Albuquerque	140	25	2		Study trip		4	
10/23/2017				149		28	411	Event	0	3	ES
10/24/2017		Rio Rancho Water Festival	Rio Rancho	130		25	4th	Event	6	3	ES
11/1/2017		Amy Bielh HS	Albuquerque		24	2	9th	Study trip	1	1	HS
11/6/2017	Velia Raff	Cien Aguas International School	Albuquerque	60		2	6th	Classroom	2	2	MS
11/17/2017	Sondra Lawson	Garfield STEM Middle School	Albuquerque	85		1	6th + 7th	Classroom	3	3	MS
11/29/2017		Amy Bielh HS	Albuquerque		20	2	9th	Study trip	1	1	HS
12/4/2017	Selena Shepherd	Monte Vista Elementary	Albuquerque	25		1	5th	Classroom	1	1.5	ES
12/4/2017	Lisa Vargas	Monte Vista Elementary	Albuquerque	30		2	5th	Classroom	1	1.5	ES
12/4/2017	J. Romero, B. Delanoy	San Felipe de Neri	Albuquerque	24		1	5th	Classroom	1	1.5	ES
12/7/2017	J. Romero, B. Delanoy	San Felipe de Neri	Albuquerque		24	5	5th	Study trip	1	4	ES
12/8/2017	Selena Shepherd	Monte Vista Elementary	Albuquerque		25	2	5th	Lab	1	1.5	ES
12/8/2017	Lisa Vargas	Monte Vista Elementary	Albuquerque		30	2	5th	Lab	1	1.5	ES
12/8/2017	Larissa	Monte Vista Elementary	Albuquerque	30		2	5th	Classroom	1	1.5	ES
12/6- 14/2017	Kari Daniels	Bosque School	Albuquerque	85		1	8th	Classroom	4	6	MS
1/10/2018	Alicia Ruch-Flynn	Albuquerque Institute of Math and Science	Albuquerque	50		1	7th	Classroom	2	3	MS
1/10/2018	Beverly Miller	Albuquerque Institute of Math and Science	Albuquerque	25		1	7th	Classroom	1	1.5	MS
1/31/2018	Jennifer Moss	Tony Hillerman Middle School	Albuquerque	20		1	7th/8th	Classroom	1	1.5	MS
2/6/2018	Suzy Dunnam	Jefferson Middle School	Albuquerque	75		1	7th	Classroom	5	5	MS
2/6/2018	Kathleen Nubar	The international School at Mesa del Sol	Albuquerque	25		1	8th/9th	Classroom	2	2	MS
2/8/2018	Kathleen Nubar	The international School at Mesa del Sol	Albuquerque		20	2	8th/9th	Study Trip	1	4	MS
2/12/2018	Elizabeth Landsford	Bandelier Elementary	Albuquerque	25		1	3rd	Classroom	1	1	ES
2/12/2018	Susan Fuller	Bandelier Elementary	Albuquerque	25		1	3rd	Classroom	1	1	ES

2/12/2018	Sarah Campbell	Bandelier Elementary	Albuquerque	26		2	3rd	Classroom	1	1	ES
2/12/2018	Lea Lahasa	Bandelier Elementary	Albuquerque	26		2	3rd	Classroom	1	1	ES
2/13/2018	Mary Erwin	Wilson Middle School	Albuquerque	145		1	6th	Classroom	5	5	MS
3/6/2018	Katelin Fischer	Ace Leadership High School	Albuquerque	15		1	10th	Classroom	1	1.5	HS
3/15/2018	Katelin Fischer	Ace Leadership High School	Albuquerque		15	2	10th	Study trip	1	4	HS
4/2/2018	Ashley Webb	Dolores Gonzales Elementary	Albuquerque	25		1	4th	Classroom	1	1	ES
4/2/2018	Carmen Lopez- Gaston	Dolores Gonzales Elementary	Albuquerque	18		1	4th	Classroom	1	1	ES
4/2/2018	Hilda Alvarez	Dolores Gonzales Elementary	Albuquerque	18		1	4th	Classroom	1	1	ES
4/3/2018	David Tichnell	Holy Ghost Catholic School	Albuquerque	26		1	6th	Classroom	1	1	MS
4/5/2018	David Tichnell	Holy Ghost Catholic School	Albuquerque		26	2	6th	Study trip	1	4	MS
4/9/2018	Rona Gomez	Georgia O'Keeffe Elementary	Albuquerque	27		1	5th	Classroom	1	1	ES
4/10/2018	Rona Gomez	Georgia O'Keeffe Elementary	Albuquerque	108		4	5th	Classroom	4	4	ES
4/23/2018	Holly Riviera	Holy Ghost Catholic School	Albuquerque	25		1	5th	Classroom	1	1	ES
5/9/2018	Carol Blackshear	Del Rio Academy	Belen	15		5	4th-6th	Classroom	1	1	MS
5/9/2018	Eric	Del Rio Academy	Belen	15		5	6-8th	Classroom	1	1	MS
5/10/2018	Robert Jones	Harrison Middle School	Albuquerque	165		5	6th	Classroom	5	5	MS
4/11/2018	BEMP	Otter Day	Albuquerque		103	33	Kinder/1 st	Event	6	2.5	ES
4/16/2018	BEMP	Otter Day	Albuquerque		104	41	1st	Event	6	2.5	ES
4/25/2018	BEMP	BEMP Congress	Bernalillo		150	30	7th-12th	Event	38	4	MS + HS
4/27/2018	BEMP	BEMP Congress	Albuquerque		100	15	4th-6th	Event	25	4	MS
5/25/2018	BEMP	LTER Virtual Symposium	Albuquerque		34	12	6th-12th	Event	10	2.5	MS + HS
6/11/2018	BEMP	Horizons Albuquerque	Albuquerque		15	3	8th	Study trip	1	2	MS
6/26/2018	BEMP	Horizons Albuquerque	Albuquerque		15	3	6th	Study trip	1	1	MS
Total #'s				1517	730	259			159	107	

Exhibit 5 Nature Conservancy 2017-2018



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The Nature Conservancy in New Mexico Urban Conservation Educational Programs Final Report to the City of Albuquerque: June 2018

In 2018, The Nature Conservancy engaged some specific communities, including an under-resourced area, with education/awareness programs focused on stormwater pollution emphasizing nature-based solutions. Our education program reached both adults and youth with hands-on, outdoor learning activities about stormwater impacts on the Rio Grande, how Albuquerque residents can reduce stormwater pollution, and the role of infiltration and the use of trees and other vegetation to clean our air and water. We reached approximately 100 adults and 250 children with our water messages and an additional number of people with earned media from articles featured in the Albuquerque Journal and Alibi.

Youth Education Programs:

In April, we conducted two Earth Day events connecting with students from all over Albuquerque. One event at a local Title I school, in the Barelas neighborhood included children from kindergarten through 5th grade. Activities ranged from planting a school garden, making native plant seed balls (seed bombs), soil filter experiment, stormwater bingo and learning about rainwater catchments. Other activities included a hands-on game board called "What Belongs in the River?" which was a fun way to engage younger students in understanding stormwater pollution sources. We also piloted the "Conservation Classroom" by providing curriculum on water conservation to over 100 elementary students.

A second event was hosted at Sandia Lakes for about 150 special-needs students and their families (75 adults). Students were primarily from Albuquerque Sign Language Academy, plus special-education students from various schools throughout Albuquerque Public Schools (APS) system. Participants, both youth and adults, participated in similar hands-on activities and watershed based educational curriculum. Topics included stormwater management, water quality, watershed connections, the importance of forests and mountains as water towers, drinking water sources, impacts of drought, and ecological consequences of river management.





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We have also engaged eight Rocky Mountain Youth Corp members, ages 17-25, in activities to learn about trees and how stormwater could serve as an asset to building a more robust tree canopy in Albuquerque. Crew members assisted with taking an inventory of and assessing the health of trees in city parks and street trees to help us understand where the gaps in tree canopy are, which trees do the best in our urban setting and identifying locations where stormwater could benefit street trees.

Finally, we participated in an afterschool program at NexGen Academy focused on technology, where students learned about stormwater management and produced a device to measure soil moisture. Using an Arduino, a small programable computer chip, the students developed a field unit that could be placed along an arroyo, acequia or small canal to measure soil moisture to inform the appropriate biofiltration plants that area could support. The unit is water tight, to be able to handle natural weather and transmits the data to a google spreadsheet in real time. It also has four sets of sensors to measure soil moisture at various depths. We worked with the students to help them understand rainfall totals, stormwater management including the types of arroyos and other channels that are used to carry stormwater, the concept of biofiltration and how it works, as well as the reasons behind why this type of data is important and how it could be used. The students diligently worked on their prototype and won first place in the State MESA competition and are competing this week in the National finals.





Adult Education Programs:

In March, we hosted a volunteer day to install 2,500 gallons of rainwater storage capacity at Dolores Gonzales Elementary School in Barelas. This installation brought in additional support from General Mills and their employees, who volunteered to install the barrels at the school. It was a great day and they made short work of the installation. We also had a volunteer who created a video of the day, which can be found here: https://vimeo.com/260859979.


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As well, we engaged three neighborhood associations near Tijeras Arroyo through a watershed health forum to discuss stormwater management, sources of pollution and how residents can reduce their contributions. We will continue to work with these neighborhoods to help them address their local issues. Related to this, the Arid LID Coalition has doubled in the number of active members participating in our bi-monthly meetings. The group has targets for stormwater education and outreach as a primary goal for this year and we are in the process of developing a short (1-2 min) video about green stormwater infrastructure and the role it plays in arid environments. We expect the video to be released during the EPA Region 6 Stormwater conference in August. Additionally, we have engaged a small group of residential and commercial developers to understand how we might overcome barriers to the adoption of green stormwater infrastructure techniques.

Tijeras Creek is an important tributary of the Rio Grande and with its recent TMDL limits, it is an area of active restoration. The Conservancy has continued to participate in this Watershed Collaborative, which is addressing all parts of the watershed from high in the Sandias to the River. Projects such as the Cedro Restoration Project at the Cedro Creek headwaters and the Rocky Mountain Youth Corp project, funded by the Rio Grande Water Fund, which is restoring 3-4 miles of Cedro Creek, will improve conditions to reduce erosion, improve water infiltration and potentially reduce the flow of contaminants into the City's jurisdiction.

Finally, we have engaged with two local experts to develop a plant list of trees and shrubs that are suitable for five elevational transects crossing the city. These selected species account for drought tolerance, water requirements, temperature limits, invasiveness, wildlife habitat and other attributes that make them good selections for our arid City.

Marketing and Communications:

During the time of the Conservancy's contract with the city, we disseminated a media advisory about urban conservation outreach activities, which was pitched to regional media outlets (see attached). Two local newspaper outlets, The Albuquerque Journal and the Alibi produced stories about stormwater management and our education efforts. In total, between February and June, 14 stories appeared about urban conservation initiatives reaching 4.68M online and 206,000 via broadcast. These stories have a total publicity value of \$16,000.

Additionally, a volunteer produced a video about the rainwater catchment project, which was disseminated through social media tools and received wide distribution through one of our partners, General Mills (see link on page 2). As well, all media coverage and releases are highlighted on the Conservancy's website and Facebook page. These educational programs were also featured in the Conservancy's spring State Director's Letter, which included a quote from Kevin Daggett, reaching more than 8,000 households in New Mexico and was distributed to 3,000 individuals through our Great Places e-newsletter.

Highlighted stories include: June 14 <u>http://www.koat.com/article/nature-conservancy-trains-kids-how-to-prevent-tree-loss/21351290</u>

June 13 http://www.krqe.com/news/albuquerque-metro/students-take-part-in-annual-tree-trimming/1234185842



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April 19 https://alibi.com/feature/55803/Healthy-Plants-Healthy-Kids.html

April 19 - ABQ Journal Home Style section

http://www.pressreader.com/usa/albuquerque-journal/20180420/282948155827883

April 5

https://www.bizjournals.com/albuquerque/news/2018/04/04/nature-conservancy-opens-albuquerqueoffice.html?anae_ae_set1&sarticle_du&ed2018-04-04&uBTJH4DWHKt2BFfqH0OBRBLQ000b4250&t1522881870&j80857241

Exhibit 6 EarthForce 2017-2018



ТО:	Kathy Verhage, City of Albuquerque
FROM:	Vince Meldrum
DATE:	Wednesday, October 3, 2018
RE:	Earth Force Progress Report/Invoice

Thank you again for your ongoing support of Earth Force. We are happy to report that we are making substantial progress toward the goals outlined in our contract with the City of Albuquerque.

Our contract outlines benchmarks in three areas: Educator Training; Volunteer Engagement/Training; and, World Water Monitoring Day. As of the end of September we have made substantial progress in each category. Please accept the following as an interim report on our progress.

Goal 1: Train 10 Educators

To date we have identified 12 educators who will be working with Earth Force this year. Of that number six received training in September two received training in the Spring of 2017, and four will be working under the umbrella of an experienced educator at Truman Middle School (will not require training). The following is a list of educators working with Earth Force during the 2017/2018:

Isleta Middle School:

* Loretta Ortiz - 6th Grade Teacher

* Christine Nieto - 6th Grade Teacher

* Janelle Armijo - 5th Grade Teacher

* Rebecca Vesely - Principal

Truman Middle School:

** Lynn Schuler - MS Teacher/MESA Leader Michael Pedersen - MS Teacher Jesse Winter - MS Teacher Cilian Perez - MS Teacher Nicholas Kadlec - MS Teacher

Native American Community Academy (NACA):

** Charlene Lucero - 6th and 7th Grade Science Teacher

* Tylar Rodriguez - HS Chemistry and Physics

* Rob Salazar - 7th and 6th Grade Science Teacher

* Trained in September 2017

** Trained Prior to September 2017

Goal 2: Engage 7 Volunteers

Earth Force engages volunteers who support students and educators as they progress through the Earth Force process. So far, this year Earth Force has identified and has begun the process of preparing volunteers from the following organizations:

- Bureau of Indian Affairs (BIA)
- U.S. Fish and Wildlife Service,
- Sandia Pueblo Environment Department
- Isleta Pueblo Environment Department
- Bosque Ecosystem Monitoring Program (BEMP)
- Intel

Goal 3: Prepare for World Water Monitoring Day

As of the end of September we had planned two events to commemorate World Water Monitoring Day. First, we planned to host students from Truman Middle School at the Valle de Oro Urban Refuge on September 20, 2017 (that event has subsequently taken place). Second, we began working with NACA to host students for a water monitoring event at Valle de Oro (we are still finalizing a date for that event).