San Juan and Animas rivers Diversion Study

Final Report

submitted to:

United States Bureau of Reclamation and the
San Juan River Basin Recovery Implementation Program

prepared by:

Dale Lyons, Michael A. Farrington, Steven P. Platania, and Dave Gori

31 August 2016
Revised 12 December 2016

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EXECUTIVE SUMMARY

This study was conducted by American Southwest Ichthyological Researchers, L.L.C. (ASIR) and The Nature Conservancy (TNC) under a contract with the U.S. Bureau of Reclamation (USBR), in support of the San Juan River Basin Recovery Implementation Program (SJRBRIP, or the "Recovery Program"). The study was undertaken to compile relevant information for the Recovery Program's use in identifying municipal, agricultural, and industrial diversions along the San Juan and Animas rivers that may warrant further investigation of native fish entrainment potential and to address Colorado Pikeminnow and Razorback Sucker stocking sites in respect to diversion structure locations. The latter charge was made during project meetings that followed award of the contract. The study area for this work is the San Juan River from Navajo Reservoir downstream to Lake Powell and the Animas River from Durango, Colorado, downstream to its confluence with the San Juan River.

In consultation with Recovery Program stakeholders (state and federal agencies, agricultural entities, municipalities, and industrial entities), the initial task of the study was to identify pertinent agricultural, municipal, and industrial diversion structures in the study area and compile associated contact information. After this information had been acquired, field visits were conducted at nine of 14 San Juan River diversion sites and at 18 of 24 Animas River diversion sites. This project did not involve fish sampling as that was beyond the scope of work.

Through field visits, review of aerial photographs, and follow-up communications with diversion operators, relevant physical information for each diversion site were obtained and compiled in a database. Physical information for diversion sites not visited were obtained from diversion operators, aerial photographs, online resources, and written reports. Physical information collected for each diversion structure in the study included: location of the diversion, layout and construction of the headgate structure, length and width of any diversion inlet channel upstream of the headgate, type and dimension of headgate(s) and spillway(s), dimensions of fish screens or passages, and dimensions of head-grade control structures in the main river channel adjacent to the diversion. In addition to the physical information database, a photo book containing ground-level photographs of each diversion structure, and a map book containing aerial photographs of each diversion site were prepared.

The 10–year study period defined by the scope of work was 2005–2014. An additional year (2015) of water diversion information was available and is included. Water diversion records from 2005–2015 were obtained from state agencies, diversion operators, and other stakeholders. In addition, 2005–2015 U.S. Geological Survey (USGS) stream gage discharge records within the study area were also acquired. Estimates of monthly and annual diversion were calculated (as a percent of total river discharge at each diversion site) using diversion data and streamflow discharge (the latter obtained from the nearest USGS gage). Monthly and annual estimates were summarized in multiple tables for this report.

Fish density data from the 2005–2014 SJRBRIP fish monitoring programs (adult and subadult, small-bodied, and larval) showed increasing densities from up to downstream for both Colorado Pikeminnow and Razorback Sucker in the San Juan River. Six diversion structures were downstream of Colorado Pikeminnow stocking sites while eight diversion structures on the San Juan River were in the calculated post-stocking movement distance for Razorback Sucker.

During the period of record examined (2005–2014) for this study, neither Colorado Pikeminnow nor Razorback Sucker were reported in the Animas River. Given the current USFWS stocking locations, six diversion structures on the Animas River were within the calculated post-stocking movement distance for Razorback Sucker. Two diversion structures are downstream of Colorado Pikeminnow stocking locations on the Animas River.

INTRODUCTION

The San Juan River is a major tributary to the Upper Colorado River Basin and drains the arid Four Corners region of the southwestern United States. Two species of federally endangered fishes, Colorado Pikeminnow *Ptychocheilus lucius* and Razorback Sucker *Xyrauchen texanus,* persist in the San Juan River Basin albeit at low densities. Both species are endemic to and were historically widespread throughout the Colorado River Basin. Historical accounts from the late 1800s convey reports of Colorado Pikeminnow and Razorback Sucker ascending the Animas River during spring as far upstream as Durango, Colorado (Jordan 1891), a distance of approximately 60 river miles from the confluence of the Animas and San Juan Rivers. Surveys in the late 1980s (1987–1989, Platania 1990) and 1990s (Holden 2000) revealed the extremely low densities of both species in the San Juan River. Since 1994 the Razorback Sucker population in the San Juan River has been annually augmented with hatchery-reared individuals. Annual augmentation of Colorado Pikeminnow began in 1996. In addition, both species are stocked in the Animas River at Berg Park (river mile [RM] 4.0) with the intention of expanding their range upstream (Furr 2014).

The San Juan River Basin Recovery Implementation Program (SJRBRIP) was established in 1992 after the “rediscovery and documentation of successful spawning by Colorado Pikeminnow and the continued presence of Razorback Sucker in the San Juan River” (SJRBRIP 2015). The Recovery Program was created with the dual goals of protecting populations of Colorado Pikeminnow and Razorback Sucker in the San Juan River Basin in accordance with recovery goals of the Endangered Species Act and proceeding with water development within the basin. As such, management actions by the SJRBRIP must balance conservation and habitat requirements of Colorado Pikeminnow and Razorback Sucker with water development in the basin.

The human population in the Desert Southwest, including the San Juan River Basin, is one of the fastest growing in the United States and is heavily reliant on groundwater and surface water (Konieczki and Heilman 2004). A result of this growth is that groundwater and surface water, which are subject to federal and state laws and interstate compacts (Colorado River Compact), tend to be fully allocated (Konieczki and Heilman 2004). Water in the San Juan River Basin is apportioned among sovereign nations, various municipalities, agricultural, industry, and state users (San Juan Water Commission 2003). Delivery of water to meet water allocations of San Juan River Basin water-right holders generally requires diversion structures and the associated delivery infrastructure. The San Juan and Animas rivers contain numerous water diversion structures of varying types and sizes (SJRBRIP 2012; Lyons 2015; this report) and can result in an annual net depletion of up to 854,376 acre-feet (SJRBRIP 2012).

Diversion structures are indispensable for water use in the San Juan River Basin. Unfortunately, water diversion can constitute population sinks for fishes (Roberts and Rahel 2008) and result in total mortality (USBR 2006). Entrainment of fishes was recognized as a potential impediment to recovery (Holden 2000; SJRBRIP 2015) of Colorado Pikeminnow and Razorback Sucker (USFWS 2002a, 2002b) because water withdrawn at diversion sites can unintentionally entrain and isolate fishes in canals where expected survival is low (USFWS 2002a, 2002b). Subadult and adult fishes captured in irrigation canals are subjected to unnatural conditions: relative homogenous habitat, limited food, and drying at the end of irrigation season. Fish present in an irrigation canal following cessation of water diversion from the river are presumed stranded and lost to the population (Renfro et al. 2006). In an attempt to mediate this issue, recovery goals of Colorado Pikeminnow and Razorback Sucker include identifying “problematic” diversion sites and installation of devices or implementation of “other measures” as needed to prevent entrainment of subadult and adult fishes (Management Action A–4 in USFWS 2002a, 2002b). Entrainment of any life stage of Colorado Pikeminnow and Razorback Sucker is a recognized impediment to the recovery of endangered fishes in the San Juan River Basin (SJRBRIP 2015).

Few studies in the San Juan River Basin have examined the risk of fish entrainment at diversions. Renfro et al. (2006) investigated the entrainment risk posed by the Hogback Diversion Canal, Farmers Mutual Canal, Jewett Valley Canal, and Fruitland Irrigation Canal on fishes. At the time of that study, those diversion structures were unscreened and did not provide either behavioral or physical barriers to fish entrainment. A total of 11,399 fish were collected during four sampling efforts in the Hogback Diversion Canal in 2004–2005. The majority of fish collected were specimens of short-lived, small-bodied species (n = 11,087), but 312 large-bodied fish were collected including 17 juvenile/subadult Colorado Pikeminnow (151–315 mm TL). Although Razorback Sucker were not collected in Hogback Diversion Canal during the 2004–2005 study, its migratory nature and the collection of Bluehead Sucker *Catostomus discobolus* (n = 56) and Flannelmouth Sucker *Catostomus latipinnis* (n = 234) indicated the potential for Razorback Sucker entrainment in the canal.

Only 684 fish were collected in the limited (compared to Hogback Diversion Canal) sampling (2005) performed in the Farmers Mutual, Jewett Valley, and Fruitland Irrigation canals. Of these, nine large-bodied individuals (all Flannelmouth Sucker from Jewett Valley Canal) were taken. Endangered fishes were not collected in either the Farmers Mutual or Jewett Canals. Small Colorado Pikeminnow taken in the Fruitland Irrigation Canal were suspected to be from a stocking of Colorado Pikeminnow just prior to sampling. Based on the results of Renfro et al. (2006), the SJRBRIP approved funding for physical modification of the Hogback Diversion Canal. Among the modifications made to the Hogback Diversion Canal was the construction of a weir-wall designed to reduce entrainment of adult fish. At the time of this report (2016), modifications of Fruitland Irrigation Canal that would minimize entrainment of adult Colorado Pikeminnow and Razorback Sucker were being prepared.

Highly mobile fishes (i.e., Colorado Pikeminnow and Razorback Sucker) may be more susceptible to entrainment at diversion structures than fish of low vagility because migrations increase the probability of contact with multiple diversion sites. Colorado Pikeminnow and Razorback Sucker undertake seasonal spawning migrations (Modde and Irving 1998; Irving and Modde 2000; Durst and Franssen 2014). Not only will migrating subadult and adult fish encounter diversion structures as they move throughout the San Juan River Basin but so will drifting larval fishes. Larvae of Colorado Pikeminnow and Razorback Sucker may be entrained at diversion sites during their obligate drifting stage. The number of drifting larval fish that can be entrained at a diversion is a function of the volume of water diverted and the concentration of fishes in proximity to the diversion (USBR 2006).

There is a dearth of vital information regarding interactions between fish and diversion structures in the Animas River. In 2001, U.S. Bureau of Reclamation (USBR) initiated a multi-year study to investigate the impact of existing diversion structures in the Animas River on upstream movement of native fishes and entrainment of small-bodied and young-of-year (YOY) native fishes. Diversion structures in the Animas River were found to be barriers to upstream movement of smaller native fishes; however, fish greater than 400 mm TL were able to bypass the structures (Francis 2007; SWCA Environmental Consultants 2007). The risk of entrainment created by diversion structures was not addressed by these reports “due to the apparent impracticality and expense of fish screens to prevent native sucker YOY entrainment (Francis 2007).” Francis (2007) identified Farmers Ditch Diversion as having great potential to entrain native YOY fishes.

The aforementioned threats to the recovery of endangered fishes posed by entrainment at diversion structures in the San Juan and Animas rivers are addressed in the SJRBRIP Long-Range Plan. Nested under Element 2 (specific goals, actions, and tasks) of the 2015 SJRBRIP Long-Range Plan is Goal 2.4 (Minimize fish entrainment at diversion structures in the San Juan Basin), and within that goal are Action 2.4.1 (specific to the San Juan River) and Action 2.4.2 (specific to San Juan River tributaries). Within those two Actions reside Tasks 2.4.1.1–2.4.1.4 and 2.4.2.1–2.4.2.4, respectfully. The verbiage from Long-Range Plan Goal 2.4 follows:

Action 2.4.1 ***Identify diversions that could potentially entrain endangered fish in the San Juan River and remediate where necessary.***
Diversions and canals on the San Juan and Animas rivers will be evaluated for potential entrainment of fish. This may lead to design and construction of fish screens or deflection weirs to address significant entrainment issues. An assessment of potential entrainment structures in the San Juan and Animas rivers will be conducted in 2015.

Task 2.4.1.1 **Design, construct, and maintain a fish deflection weir at the Hogback Diversion.**
An assessment of fish entrainment done at Hogback Diversion Canal in 2004-2005 (Renfro, Platania, Dudley 2006) found Colorado pikeminnow were being entrained in the canal. A fish deflection weir was designed and constructed for the Hogback Diversion. Construction was completed in FY2013.

Task 2.4.1.2 **Investigate the need for and construct, if appropriate, fish screen or deflection weir at the Arizona Public Service Company (APS) Weir.**

Task 2.4.1.3 **Investigate the need for and construct, if appropriate, a fish screen or deflection weir at the Fruitland Canal**.
An assessment of fish entrainment was done at Fruitland Canal in 2005 (Renfro, Platania, Dudley 2006) and found 19 Colorado pikeminnow entrained. They concluded fish are not generally being entrained in small canals but recommended stocking after cessation of annual diversion activities or stock downstream of diversion heads to minimize entrainment.

Task 2.4.1.4 **Investigate the need for and construct, if appropriate, a fish screen or deflection weir at the Jewett Valley Ditch.**
An assessment of fish entrainment was done at Jewett Valley Ditch in 2005 (Renfro, Platania, Dudley 2006). They concluded fishes are not generally being entrained in small canals but recommended stocking after cessation of annual diversion activities or stock downstream of diversion heads to minimize entrainment.

Task 2.4.1.5 **Investigate the need for and construct, if appropriate, a fish screen or deflection weir at the San Juan Generating Station.**

Action 2.4.2 ***Identify diversions that could potentially entrain endangered fishes in San Juan River tributaries and remediate where necessary.***

Task 2.4.2.1 **Investigate the need for and construct, if appropriate, a fish screen or deflection weir at Animas Pump Station #2.**
Francis (2007) identified Farmers Ditch Diversion on the Animas (RM 21.9) as having great potential to cause significant loss to YOY fish through entrainment. An assessment of potential entrainment structures in the San Juan and Animas rivers will be conducted in 2015.

Task 2.4.2.2 **Investigate the need for and construct, if appropriate, a fish screen or deflection weir at the Farmer's Ditch Diversion.**
Francis (2007) identified Farmers Ditch Diversion on the Animas (RM 21.9) as having great potential to cause significant loss to YOY fish through entrainment. An assessment of potential entrainment structures in the San Juan and Animas rivers will be conducted in 2015.

Task 2.4.2.3 **Investigate the need for and construct, if appropriate, fish screens or deflection weirs at diversion structures in the Animas River.**
Francis (2007) investigated entrainment of native suckers in diversion canals in the Animas River. Although a specific study to estimate entrainment losses was not conducted, he concluded that results of YOY sampling indicate there is enough native YOY sucker recruitment in the reaches above Animas Pump Station #2 and Farmer Ditch Diversion that entrainment in canals and pump stations on the Animas River could occur. An assessment of potential entrainment structures in the San Juan and Animas rivers will be conducted in 2015.

This project seeks to identify surface water diversion structures in the San Juan and Animas rivers and provide information on water withdrawal amounts, withdrawal locations, ownership, and physical descriptions of each diversion. This information was deemed necessary so the SJRBRIP could make evidence-based decisions about the need to assess entrainment risk and potentially investigate actions that could remediate the risk of entrainment to endangered fishes at diversion structures. While the charge related to the remediation portion of this Long-Range Plan charge (Actions 2.4.1 and 2.4.2) is not germane to the current project, it is hoped this San Juan and Animas rivers diversion study is a sufficient response to the primary charge of Actions 2.4.1 and 2.4.2. Likewise, reference to the current project in the discussion text of Action 2.4.1, Task 2.4.2.1, Task 2.4.2.2, and Task 2.4.2.3 (above) suggests this document could meet a portion of those charges.

HISTORY OF MODIFICATION OF THE SAN JUAN AND ANIMAS RIVERS DIVERSION STUDY

Background

In the San Juan River Basin Recovery Implementation Program, scopes of work do not usually undergo major modifications after the contract has been awarded. In the case of the San Juan and Animas rivers Diversion Study, however, the original scope of work (as well as title of the project) was modified by the SJRBRIP following award of the contract. These modifications resulted in subsequent confusion, expressed during review of the draft final report, regarding the specific changes that occurred, the reason for changes in the scope of work, how the changes evolved, the process by which they occurred, and the manifestation of changes on the final report. As the draft version of the final report did not contain a clear narrative delineating the history and reasons that selected objectives were modified or removed after award of the contract, the confusion persisted.

This new section (**HISTORY OF MODIFICATION OF THE SAN JUAN AND ANIMAS RIVERS DIVERSION STUDY**) of the San Juan and Animas rivers Diversion Study final report is in response to those important concerns. This section was added to the final report to answer the aforementioned questions by chronicling key dates, participants (workgroups) involved in the modifications, and decisions that resulted in a change of the original scope of work and original title of the project. It is our hope that inclusion of this new section in the final report provides answers to the many questions proffered during review of the draft version of this document.

Inclusion of this section also allows for better continuity within the final report as numerous caveats regarding these changes are removed from the remainder of the report. From the next chapter (**STUDY GOALS AND OBJECTIVES**) forward in the report, all changes related to the scope and goals of the project have been incorporated. The presence of, or reasons for, the modifications are referenced and discussed only in this chapter and incorporated hereafter. An abbreviated chronology and detailed table of the changes to the San Juan and Animas rivers Diversion Study follows.

Change of Project Title

Soon after the original San Juan and Animas rivers Diversion Study contract was awarded, several Recovery Program members expressed reservations regarding specific project objectives as well as the overall scope of the work. Issues were also raised regarding the contracting process (i.e., contracting through GSA). The matter pertaining to contracting was addressed directly by USBR and as that was an administrative matter not related to the specifics of the project, it is not addressed herein.

The first major clarification undertaken for this study was in reference to the title of the project, as it seemed contradictory with the stated project goal. This confusion was due, in part, to “Fish Entrainment Services” being the published project solicitation title. While the project title/name varied slightly in the text of the contract (i.e., Fish Entrainment Services, Fish Entrainment for the San Juan River Basin Recovery Implementation Program, San Juan River Basin Recovery Implementation Program Fish Entrainment Project), the goal of the project was clearly stated:

> “*Qualitatively and quantitatively assess the entrainment hazards in the San Juan and Animas rivers from Mexican Hat, Utah upstream to the Highway 64 crossing of the San Juan River, approximately 10 miles east of Bloomfield in the San Juan River and to Durango in the Animas River*.” (page 6; U.S. Bureau of Reclamation. 2015.)

It appears that the project name “Entrainment Study” used during the initial phases of this study (summer 2015) resulted from abridging the phrase “Risk of Entrainment” (from “assessing risk of entrainment” or “assess entrainment hazards”). Additional confusion about the goal of the project occurred when truncated project titles such as “Entrainment Study” and “Diversion Study” were used interchangeably. “Entrainment Study” and “Diversion Study” (s*ensu stricto)* are very different studies requiring markedly different protocols to complete (see clarification in next subsection).

While the project name caused some confusion regarding the goal of the work, review of SJRBRIP-Biology Committee (BC) meeting minutes and documents associated with the development of this work, as well as the project goal presented above, consistently represented this effort as an assessment of entrainment risks to Colorado Pikeminnow and Razorback Sucker in the San Juan and Animas rivers. On 3 November 2015, USBR resolved the matter by directing the contractors to retitle the study and subsequently refer to the project as the "San Juan and Animas rivers Diversion Study."

Differences between an Entrainment Study and Diversion Study

Independent of the change of the project title, there remained confusion, based on report content, about whether the project (or portions within) constituted an "Entrainment Study" or a "Diversion Study." The point of contention seemed to appear when diversion information in the report was used to imply the potential for fish entrainment. Even though there are distinct differences between the terms "diversion" and "entrainment" the two are intrinsically linked. Diversion does not have to result in entrainment, but an entrainment event will have been caused by diversion (in reference to this study). While the modified scope of work for this study (see next subsection) removed project goals related to quantification of entrainment risk, those risks remained with the diversion of water and continued to be study goals. It was not practical to talk about diversion without discussing entrainment of fish. Therefore, the general Recovery Program goals related to understanding and addressing entrainment risks are included in this report to provide context and explain how this study fits the Recovery Programs' larger objectives. Their inclusion does not make this work an "Entrainment Study." An example of an "Entrainment Study" undertaken by the SJRBRIP follows.

The 2004–2005 project conducted by Renfro et al. (2006) provided an assessment of fish entrainment in the Hogback Diversion Canal, Fruitland Irrigation Canal, Jewett Valley Canal, and Farmers Mutual Canal. The main goals of that work were to determine if Colorado Pikeminnow and Razorback Sucker were entrained in study canals, determine the life stages being entrained, and assess the relative magnitude of entrainment. The information obtained from that work was used by the SJRBRIP to make decisions regarding the need for modifications of the Hogback Canal to minimize entrainment of Colorado Pikeminnow and Razorback Sucker.

The Renfro et al. (2006) "Entrainment Study" differs significantly from the current project as the former is original field research and contained detailed information on the ichthyofaunal composition of selected canals based on sampling by the authors of that work. In addition, that report presented original information on longitudinal distribution of fish in the canal as well as their seasonal distribution and abundance. Renfro et al. (2006) has been cited by the Recovery Program as the type f study (i.e. assessment of fish entrainment) to be conducted if fish entrainment data were deemed necessary from other canals.

The study reported herein was presented as one that would ultimately provide an assessment of the risk of entrainment for Colorado Pikeminnow and Razorback Sucker at San Juan River and Animas River canals. Simplified, the three major tasks of the current project were:

1) Compile and synthesize physical data related to diversions;
2) Compile and synthesize river discharge and surface water diversion data related to diversions;
3) Compile and synthesize fish distribution/abundance data from San Juan and Animas rivers studies; and
4) Synthesize and analyze results of tasks 1, 2, and 3 by river, to determine the relative risk of entrainment of Colorado Pikeminnow and Razorback Sucker at diversion sites.

Tasks 1, 2, and 3 required acquisition of data already available (no original research) and the synthesis of those data within each task. Conversely, task 4 involved synthesis of Tasks 1, 2, and 3 followed by analysis wherein risk of Colorado Pikeminnow and Razorback Sucker entrainment would have been

assessed. While aspects of the "simplified tasks" presented above were modified or deleted (see narrative that follows), the above description helps clarify that this document is a "Diversion Study". Comparison of this study's final report to Renfro et al. 2006 reveals the distinct and significant differences, in both scope and content, between the two types of studies and establishes what constitutes an "Entrainment Study."

Modification of Study Objectives

The remainder of this chapter of the final report presents the chronology of actions related to modification of project study objectives (Table 1). As stated earlier, soon after the contract was awarded several Recovery Program members expressed reservations regarding specific project objectives in relation to the overall scope of the work. The contracting agency (USBR) told Recovery Program participants that they (USBR) would work with them (Recovery Program participants) in an effort to address concerns while still providing a product (document cataloging diversion sites in the study area) that would be of use to the Recovery Program. The USBR organized and managed several conference calls with Recovery Program members and stakeholders. The goal of those conference calls was to identify specific items of concern in the study plan and to agree upon means to address those concerns while proceeding with the broadly stated goals of the study (Table 2).

The first formal discussion regarding the Objectives of this study was held between the SJRBRIP-BC and Recovery Program stakeholders during a November 3rd 2015 conference call. Key points of discussion were the discomfort that some stakeholders felt in regards to the objectives that required the contractors to A) identify the locations (physical site) where entrainment of fish may be occurring and B) to rank the risk of entrainment of fish by location (physical structure). Recovery Program stakeholders and the USBR decided, and reaffirmed during a January 4th 2016 conference call with the aforementioned participants, that the study would not identify areas with high risk of entrainment (Objective 1). The original plan for accomplishing Objective 1 was to produce a qualitative assessment of individual diversions. The diversion site would have been divided between two categories: those that were deemed unlikely to pose a risk of entrainment to Colorado Pikeminnow and Razorback Sucker and those that were thought to pose a risk of entrainment. The next step would have been to undertake Objective 6. The risk of entrainment for diversions placed in the latter category would have been a quantitative assessment of the risk of entrainment at the sites in the latter category (using a suite of physical diversion variables and information on endangered fish distributions and movement). The perceived result of that effort would have would have been a numerical prioritization of the risk of entrainment of Colorado Pikeminnow and Razorback Sucker at a subset of diversion site in the study area (Objective 6).

With the aforementioned change in objectives, the study still includes all diversions in the study area, but there is not a qualitative assessment of entrainment risk. Likewise, information on physical parameters of diversion structures and endangered fish distributions and movement data are synthesized and presented without prioritizing entrainment risk. The SJRBRIP-BC, Recovery Program representatives, stakeholders, and USBR directed final changes to the scope of work (Table 2).

Finally, it should also be noted that, as contractors, we assisted in facilitation of project discussions but not in decisions regarding changes in the scope of work. While we appreciate concerns expressed during the review process (in reference to the impacts of the changes, deviation from the original scope of work, and on the final product) it is important to differentiate items that are the responsibility of the contractors from those outside of their realm. Our (contractors) responsibility was to conduct the work defined by USBR. Clearly, modification of the original scope of work, resultant changes in data presentation and analysis, and reporting limitations of changes are not the responsibility of the contractors but instead were the purview of the Recovery Program.

Table 1. Chronology of events related to project modifications.

Date	Event
3 February 2014	The San Juan River Basin Recovery Implementation Program Office distributes a document titled “BC history on SJRRIP fish passages”. The document outlines efforts by the Biology Committee in reference to diversion structures, fish passage, and entrainment.
5 August 2014	San Juan River Basin Recovery Implementation Program-Biology Committee conference call (meeting minutes): A proposed study and associated RFP (developed by USBR’s Mark McKinstry and the SJRBRIP-BC) to identify sites where entrainment could occur, is being reviewed by the Recovery Program Office and Weston Furr. The proposed study will also identify factors like diversion structure, flow, and timing (season) that could increase the probability of entrainment. After the project has been completed, the Recovery Program can investigate the magnitude of entrainment that is occurring at any identified site through another (separate) study.
27 March 2015	Advertisement of the original solicitation of “Fish Entrainment for San Juan River Basin Recovery Implementation Program - Solicitation Number R15PS00493 (RFQ identification number in GSA is RFQ970146).”
26 June 2015	Notification of contract award (to ASIR) of Fish Entrainment for San Juan River Basin Recovery Implementation Program-R15PS00493).
8 July 2015	San Juan River Basin Recovery Implementation Program Biology Committee Conference Call (multi-agenda) - the Fish Entrainment contract procurement and award is discussed. As per a previous email that Mark McKinstry sent to the SJRBRIP-BC, McKinstry requests discussions between the contractor and BC on factors that should be included in the evaluation process[1]. [1] As per 2.6 METHODS; Technical Approach; Task 4: *“Attend a preliminary one-day meeting with members of the SJRIP and other interested parties to identify potential locations of diversions and finalize methods for data collection, including metrics to rank potential risks of entrainment sites.”*
14 July 2015	Doodle Poll was distributed for a "SJRBRIP-BC workgroup meeting to discuss Fish Entrainment Services." Meeting set for 5 August 2015.
3 August 2015	SJRBRIP Coordination Committee conference call (meeting minutes finalized 5 October 2015) – McKinstry reported on the awarding of the entrainment contract and of the planned 5 August 2015 BC workgroup meeting with the contractor to discuss specific metrics to include in the entrainment evaluation.

Table 1. continued.

Date	Event
5 August 2015	In fulfillment of Task 4, a meeting between the contractor and SJRIBRP-BC workgroup was held at USFWS Ecological Services Field Office (Albuquerque) with call-in capabilities for those who could not attend. Recommendations made by the workgroup to (and followed by) the contractors were: ▪ Given time and money constraints, the project needs to take a "broad brush" approach. ▪ The estimates of diversion as a percent of total river flow can be developed using discharge data from the nearest USGS gage as an approximation of discharge at each diversion site. ▪ The number one risk factor for entrainment is going to be the amount of water taken by each diversion (measured as both cfs and % of river flow diverted). ▪ Diversion structures that may pose the highest risk of entrainment will likely need to be re-visited. ▪ SJRBRIP-established fish monitoring projects (larval, small-bodied, and adult) will serve as the primary data source for San Juan River fisheries data. Animas River data will be requested from the Southern Ute Indian Tribe and the State of Colorado. ▪ Additional measurements made during the site visitations should include location of the thalweg, river width, and distance to and width of diversion works. Source (conference call minutes, direction from USBR contracting officer)
10 August 2015	Meeting minutes from 5 August 2015 distributed: *"The objective of this meeting is to solicit comments on the measurements that we (ASIR) proposed to take and measurements not mentioned in the proposal but that we should consider, and then discuss how to combine these measurements/variables into an entrainment risk.*"
21 September 2015	SJRBRIP Coordination Committee Meeting, Durango. On September 21, 2015, the Coordination Committee (CC) unanimously voted to approve the FY 2016 Annual Workplan, exclusive of … and #33 *Fish Entrainment Study on the San Juan and Animas Rivers* (RFP). SOW #33 will be considered after Reclamation provides a summary of the sequence of events that transpired during solicitation and funding of the San Juan and Animas Rivers Fish Entrainment Study. Reclamation will also provide budget information for this project, to the extent possible, for inclusion in the 2016 annual workplan scope of work (from 2 October 2015 SJRBRIP Coordination Committee draft conference call summary).
1 October 2015	An electronic copy of the original ASIR budget (Volume II of proposal) for "Fish Entrainment for San Juan River Basin Recovery Implementation Program-(Solicitation Number R15PS00493" was provided to USBR by ASIR with permission to distribute as needed to the SJRBRIP (Volume II of proposal).
2 October 2015	SJRBRIP Coordination Committee Conference call (see draft meeting minutes). The full 2016 annual workplan (including entrainment assessment; SOW #33) was approved. Discussion ensued between USBR and SJRBRIP CC regarding concern on how the San Juan and Animas rivers entrainment assessment had evolved.

Table 1. continued.

Date	Event
13 October 2015	To address concerns expressed to USBR by the SJRBRIP Coordination Committee (in regards to the Fish Entrainment Project), the USBR distributed a new Doodle Poll to 29 "interested parties" inviting them to participate in a discussion (i.e., conference call) on the project: Fish Entrainment for San Juan River Basin Recovery Implementation Program. The USBR text included with the Doodle Poll invitation stated: *"The main goal of the conference will be to:* *1) Describe the history and development of the project,* *2) Explain the methods and approach to the project, and* *3) Allow participants to provide feedback on concerns or issues that are important to recognize as the project moves forward."* Documents included with the email were: *1) "Entrainment Admin History..." a brief document of facts and discussions that have occurred within the BC about entrainment* *2) "Entrainment SOW for the..." the SOW that was approved by the CC at the August 2014 meeting that was later advertised and awarded to ASIR as a contract.* *3) "R15PS00493 Volume I" and "R15PS00493 Volume II" the technical and budget portions of the awarded contract. Please do not transmit the budget document outside of this email list.* *4) "USBR Entrainment Study..." A document prepared after the award of the contract that was developed during discussions* [5 August 2015] *with interested parties on the SJRBRIP-BC.*
16 October 2015	The date and time for the conference call on the entrainment contract was set as 3 November 2015. The meeting was coordinated and overseen by USBR. The contractor (ASIR) and subcontractor (TNC) were participants but were not involved in determining the direction of the project.
2 November 2015	Text from the San Juan River Basin Recovery Implementation Program's Long-Range Plan (Page 24) deemed justification for the Fish Entrainment Study is distributed prior to the 3 November 2015 meeting. **Action 2.4.2** Identify diversions that could potentially entrain endangered fish in San Juan River tributaries and remediate where necessary. **Task 2.4.2.1** Investigate the need for and construct, if appropriate, a fish screen or deflection weir at diversion structures in the Animas River. Francis (2007) investigated entrainment of native suckers in diversion canals in the Animas River. Although a specific study to estimate entrainment losses was not conducted, he concluded YOY suckers may be entrained in canals and pump stations.

Table 1. continued.

Date	Event
3 November 2015	Interested Parties conference call regarding the Fish Entrainment Study. Key discussion points: • It was noted that entrainment and diversion have been used interchangeably. This study is about diversion; entrainment risk would require further assessment. The project will be labeled as a diversion study. • The contractors will not produce a prioritized list ranking of entrainment risk for diversion structures as outlined in Objective 6 of the scope of work. • The group of reviewers will be expanded, specifically to include those with hydrologic expertise. • Because this study will address diversion (not entrainment), contractors will not identify or rank locations of entrainment risk as outlined in Objective 1 of the scope of work. • The fulfillment of Objectives 1 and 6 in the scope of work was deemed the purview of the San Juan River Basin Recovery Implementation Program. • An updated working list of risk factors (for inclusion in the report) was presented: i. Diversion amount expressed as a percent of total river flow. ii. Total number of days/year and seasonality of diversion. iii. Diversion structural features that may prevent free movement of native fish (e.g. earthen push-up dam across river channel). iv. Presence or absence of a fish screen. v. Location of diversion relative to stocking location(s) (e.g. # of stocking locations upstream of diversion, or distance to stocking location); and vi. Location of diversion relative to fish density and abundance up and downstream. Key action items from the conference call: • Tom Pitts and Mark McKinstry will work together to form a workgroup of hydrologic reviewers for this project. • The previously identified workgroup (Aug 5 group) will further discuss and develop risk criteria. • The review process for the report will include a technical review (from the above groups) of the results prior to the report being distributed to the larger group. • Fisheries data (Animas River) requests will be made of the Southern Ute Tribe and State of Colorado. • Presentation of the report at the annual SJRBRIP meeting (May 2016) will be reserved for the CC portion of the meeting (only) as opposed to the combined, public/BC/and CC portion of the meeting. Source (conference call minutes, direction from USBR contracting officer)
2 December 2015	SJRBRIP-BC Meeting (Durango, CO) – A brief update on the Diversion Study was presented to the Biology Committee synthesizing results of the 5 August 2015 and 3 November 2015 conference calls.
4 January 2016	The diversion project workgroup discussed the risk factors, providing input and ideas on how to summarize the information. It was decided that fish passage should not be included as a risk factor. It was reiterated that the objective was not to provide a numerical or qualitative ranking of “entrainment risk” but rather to present (in tabular form) data for the variables discussed at the two previous meetings (5 August, 3 November 2015) thereby allowing others to make their own assessment of potential entrainment risk. It was suggested, and agreed upon, that the SJRBRIP PIT tag database be used to determine the up and downstream distance to use in calculating fish densities around diversions.

Table 1. continued.

Date	Event
15 January 2016	Final version of the notes from the 4 January 2016 meeting distributed.
1 February 2016	Dale Lyons (TNC) distributes (to the workgroup) spreadsheets containing raw data and tabular summaries of agricultural, industrial, and municipal diversions on the San Juan and Animas rivers (for the technical review of results).
1 March 2016	Michael Farrington distributes (to the workgroup) a draft "risk assessment table" and raw data and tabular summaries on fish in the Animas and San Juan Rivers. Included with the tables is the methodology used to populate the tables (for the technical review of results).
7 March 2016	Summary table of physical data is distributed to the workgroup (for a technical review of results).
18 March 2016	Deadline for receipt of technical review comments of the 1 February and 1 March 2016 information distributed to workgroup.
25 March 2016	Deadline for receipt of technical review comments on the summary table of physical data (distributed 7 March 2016)
21 June 2016	Draft final report distributed with instructions to submit comments directly to the Recovery Program Office.
2 August 2016	Final set of comments on the draft final report is received by the Recovery Program Office and forwarded to contractor.
17 August 2016	Conference call between USBR and ASIR to discuss the draft final report comments that were received, contract deliverables, and finalizing of the report. USBR contracting requests ASIR to prepare written individual responses to substantive reviewer comments (i.e., does not provide detailed comments on grammar, punctuation, spelling, sentence structure, etc.).
31 August 2016	Final report submitted to contracting office (USBR-Salt Lake City, UT)
	Shading indicates conference call or meeting specifically to work on this project.

Table 2. Original and modified study objectives.

#	ORIGINAL STUDY OBJECTIVES[1]
1	Identify locations in the San Juan and Animas rivers where entrainment and/or impingement could be a potential threat to the Colorado Pikeminnow and Razorback Sucker
2	Document withdrawal amounts (CFS and acre-feet) for each diversion and relate these to proportion of river flows
3	Document withdrawal locations using a GIS and legal descriptions
4	Identify ownership of diversion facilities
5	Document diversion locations with digital images and descriptions of diversions (aspect to river, height, width, gate structure, width of canal, etc.)
6	Prioritize risk of entrainment at each site using metrics based on proportion of flow, amount of screening currently present, proximity to stocking locations, quality of habitat upstream of diversion, and other metrics as identified by the SJRIP biology committee during the initial contract meeting
7	Produce a draft and final report that summarizes and details 1–6 above
#	**MODIFIED STUDY OBJECTIVES**
1	~~Identify locations in the San Juan and Animas rivers where entrainment and/or impingement could be a potential threat to the Colorado Pikeminnow and Razorback Sucker~~
	Study objective 1 was completely eliminated.
6	~~Prioritize risk of entrainment at each site using~~ Synthesize information on diversion strictures including proportion of flow diverted, amount of screening currently present, proximity to stocking locations, quality of habitat upstream of diversion, and other metrics as identified by the SJRIP biology committee and the "interested parties" workgroup. ~~during the initial contract meeting~~
	Study objective 6 was modified. While the physical information related to the diversion would still be compiled and presented, there would not be an evaluation (prioritization) of the risk of entrainment by diversion site. The other modification was recognition of the larger workgroup (besides SJRIP biology committee members) who helped develop the metrics used.

STUDY GOALS AND OBJECTIVES

The final study objectives (Table 3) required compilation of a wealth of physical, hydrologic, and fish information from the study area. The relevant information obtained to meet the study objectives includes a complete listing of diversion sites and their physical features, available diversion records and estimates of diversion as a percent of total river flow for each diversion, and native fish movement distances from stocking locations relative to the diversions. We obtained quantitative information on fish distribution and abundances from SJRBRIP monitoring data and other studies in the San Juan River Basin. The Recovery Program indicated that they would use the information in this report to review San Juan and Animas rivers diversion structures that might warrant further investigation of native fish entrainment potential and to assess stocking locations, with respect to the location of diversion structures, of Colorado Pikeminnow and Razorback Sucker. This project did not generate data on fish in diversion canals.

Table 3. Final study objectives.

#	STUDY OBJECTIVES
1	Document withdrawal amounts (CFS and acre-feet) for each diversion and relate these to proportion of river flows
2	Document withdrawal locations using a GIS and legal descriptions
3	Identify ownership of diversion facilities
4	Document diversion locations with digital images and descriptions of diversions (aspect to river, height, width, gate structure, width of canal, etc.)
5	Synthesize information on diversion strictures including proportion of flow diverted, amount of screening currently present, proximity to stocking locations, quality of habitat upstream of diversion, and other metrics as identified by the SJRIP biology committee and the “interested parties” workgroup.
6	Produce a draft and final report that summarizes and details 1–5 above

STUDY AREA

The San Juan River is a major tributary of the Colorado River and drains 38,300 mi^2 in Colorado, New Mexico, Utah, and Arizona. The majority of water in the San Juan River Basin is derived from high elevation snowmelt in the San Juan Mountains in Colorado. Navajo Dam in New Mexico regulates San Juan River discharge. Constructed in 1963, Navajo Dam captures discharge from the Los Pinos, Navajo, Piedra, and San Juan rivers. Perennial tributaries of the San Juan River not bounded by Navajo Reservoir include the Animas, La Plata, and Mancos rivers and McElmo Creek, Utah (Figure 1). The study area is the San Juan River from Navajo Reservoir downstream to Lake Powell and the Animas River from Durango, Colorado, downstream to its confluence with the San Juan River.

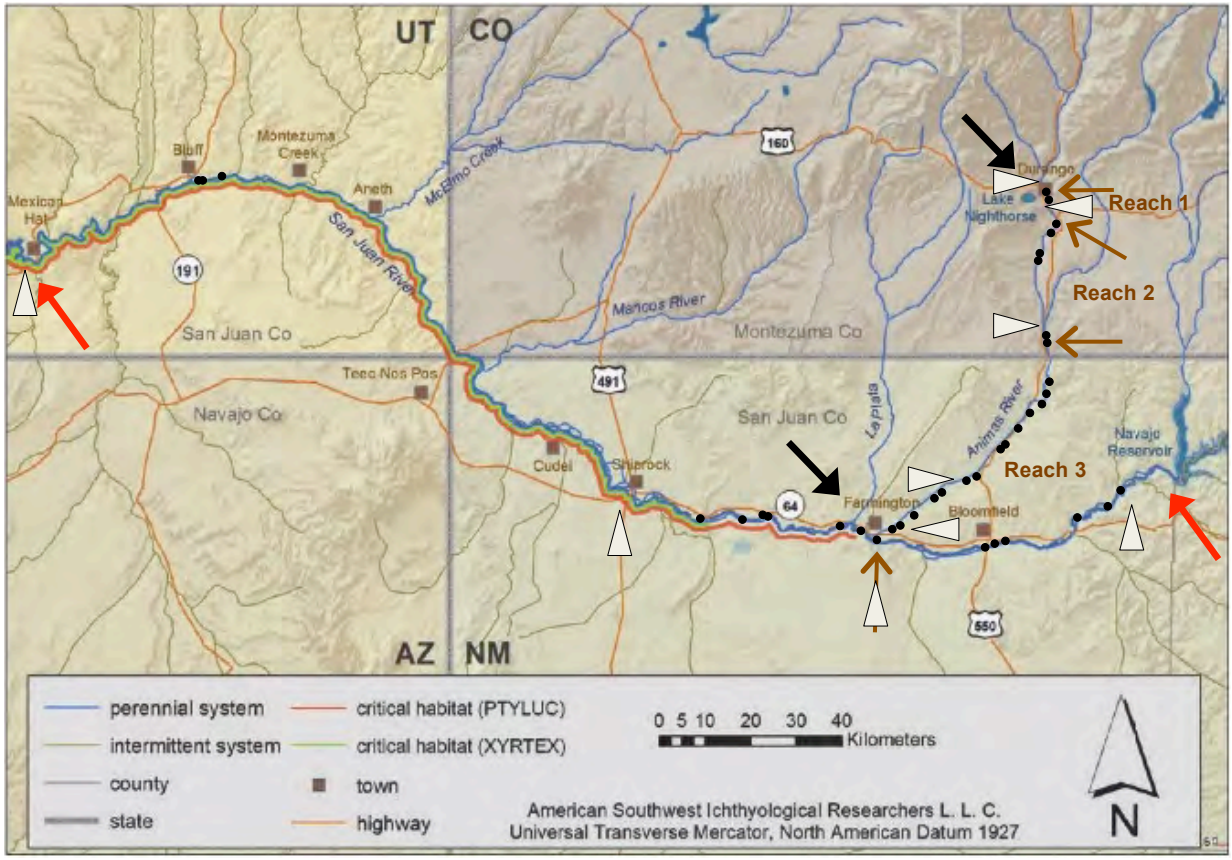

Figure 1. Map illustrating the portions (between the arrows) of the San Juan River (red arrows) and Animas River (black arrows) included in this study. Black dots indicate diversion sites reported herein. Brown arrows indicate Animas River reach segments. Triangles point to locations of USGS flow gages recording data used in this report.

In the San Juan River Basin numerous diversions extract water from the mainstem for agricultural and urban use. The Navajo Indian Irrigation Project (NIIP), San Juan-Chama Diversion, and Navajo-Gallup Water Supply Project allocate major depletions from the San Juan Basin at Navajo Reservoir. Downstream of Navajo Reservoir, smaller water diversion projects shunt water and act as potential portals for entrainment. Agricultural diversions include the Hammond Irrigation Project, supplying water for agricultural use from Blanco to Farmington, NM. The Arizona Public Service Company (APS) weir, located downstream of the Animas River confluence, extracts water and creates an instream barrier limiting fish movement throughout most of the year (Stamp et al. 2005). The Fruitland Irrigation Canal, Farmers Mutual Canal, and Jewett Valley Canal supply water for agricultural use between Farmington and the Navajo Nation. The Hogback Diversion supplies water for crop development within the Navajo Nation between Shiprock and Cudei, NM. The Hogback Diversion is equipped with a weir-wall designed to minimize entrainment of subadult and adult fishes. Similarly, the PNM Weir, supplying water to the San Juan Generating Station, is equipped with a fish ladder. Downstream of these diversions small point diversions extract water from the San Juan River flowing through the Navajo Nation and in Bluff, UT.

There are numerous diversions on the Animas River in NM and CO. The largest and second most-upstream Animas River diversion structure in the study area is the USBR's Animas-La Plata Project, completed in 2008. Downstream of that structure, there are 24 smaller diversion structures on the Animas River between Durango and its confluence with the San Juan River.

U.S. Geological Survey Stream Gages

The are five U.S. Geological Survey (USGS) stream gages operated on the Animas River portion of the study area that record mean daily discharge for this study's period of interest (2005–2015); river mile (RM) is the upstream distance to the gage from the confluence with the San Juan River:

- USGS 09361500 Animas River at Durango, CO RM 61.5
- USGS 09362520 Animas River below Durango Pump Plant near Durango RM 59.7
- USGS 09363500 Animas River near Cedar Hill, NM RM 39.8
- USGS 09364010 Animas River below Aztec, NM RM 15.5
- USGS 09364500 Animas River at Farmington, NM RM 1.4

On the San Juan River portion of the study area there are four USGS stream gages that record mean daily average for this study's period of interest (2005–2015); RM is the upstream distance to the gage from Lake Powell.

- USGS 09379500 San Juan River near Bluff, UT RM 52.1
- USGS 09368000 San Juan River at Shiprock, NM RM 148.0
- USGS 09365000 San Juan River at Farmington, NM RM 180.0
- USGS 09355500 San Juan River near Archuleta, NM RM 218.6

METHODS

The study period for both diversion site and fish data was 2005–2014, however, the delay in award of the contract allowed for inclusion of 2015 flow data. We used multiple sources to identify relevant diversion sites in the study area including:

- State Water Administration Agency Sources:
  - Colorado Division of Water Resources (CDWR), Decision Support System (http://cdss.state.co.us/ONLINETOOLS/Pages/StructuresDiversions.aspx)
  - New Mexico Office of the State Engineer (NMOSE), Real Time Water Information System, District 5 San Juan Basin (http://meas.ose.state.nm.us/district5.jsp)
- San Juan Agricultural Water Users Association (http://www.sjagwater.org/)
- 2013 City of Farmington list of agricultural ditches in San Juan County, NM (http://www.fmtn.org/DocumentCenter/View/3886)
- 1987 New Mexico Acequia Commission, Surface Water Irrigation Organizations in New Mexico (http://www.nmacequiacommission.state.nm.us/Publications/ose-acequia-rpt1987.pdf)

In speaking with operators of agricultural, municipal, and industrial diversions, The Nature Conservancy (TNC) learned of municipal and industrial diversions not referenced in the above sources, and also identified several agricultural ditches no longer in use or that share operations with other ditches. Generally, diversions sites in this study actively divert water from either the San Juan or Animas rivers on an annual basis. The exception is the inclusion of the City of Bloomfield's Second Source diversion, which only operated during summer 2012. Performance issues with this diversion resulted in plans by the City to relocate or improve the diversion facility and reliably utilize San Juan River surface water rights.

Methods Used for Collection, Synthesis, and Analysis of Physical Diversion Data

Contact information for diversion site operators was obtained from TNC's 2015 study of agricultural water use in the San Juan Basin, NM (Lyons 2015) and researching the relevant diversions for this study. Numerous diversion operators were contacted by TNC before and during the week of August 17th, 2016 when 24 San Juan River and Animas River diversion sites were visited and physical data and photographs acquired. As noted in the summary table of physical data, some diversions were not visited because the diversion operators did not return voice messages, declined to participate, or were otherwise unable to meet the field crew. For diversions where the operators did not return calls/messages or declined to participate, to the extent possible, physical data were obtained from aerial photographs. For the remaining diversions not visited but with operators willing to participate, physical data, photographs, engineering drawings, and maps were obtained from the diversion operators.

Physical data collected in the field were compiled in field notes and data forms. Digital photographs for the diversions visited were organized according to river, river mile, and diversion name. Aerial photographs, field photographs, and field notes were consulted while developing narrative descriptions for each diversion, which focused on physical features relevant to the study.

Physical information collected for diversion structures/diversion sites included in the study are:

- Name(s) of diversion operators and contact information
  phone number, email, mailing address
- Type of diversion
  agricultural, municipal, industrial
- Notes regarding diversion location and site access
- Physical location of the diversion and relevant channel features
- Physical data for any head-grade control structure in the river channel
  length, condition/maintenance, and type of material
- Physical data for any diversion channel upstream of headgate
  diversion channel intake width, river width, distance from headgate
- Physical data for headgate structure
  type of structure, material, and number, type, and size of gates, river width at headgate

- Physical data for any spillways
  location and number, type and size of gates
- Physical data for any trash racks and screens
  width, height, grate/mesh opening size, condition
- Physical data for any pipe diversions
  pipe diameter
- Notes regarding planned changes/modifications to diversions
- Photographs of the diversions
- Aerial photographs of each diversion
  identifying relevant physical aspects and diversion location in the study area

Diversion structure information is presented by river (San Juan River first) from downstream to upstream. For the San Juan River, river mile values represent the distance upstream from Lake Powell. On the Animas River, river mile values represent the distance upstream from its confluence with the San Juan River. Physical data acquired for each diversion, including coordinates, contact information, and physical data, were compiled in a Microsoft Excel spreadsheet and table. Modifications to the original Diversion Physical Data Table received from diversion operators have been incorporated into the final version of this table (Appendix A). Ground level photographs (Appendix B) and aerial photographs (Appendix C) of each diversion site are appended.

Description of Flow Data for Diversion Sites

Diversion discharge records, as available, were obtained from 2005–2015 (calendar year). In many instances, discharge data were only available for the most recent years. Data sources were:

- Daily average diversion records from 2005–2015 for most of the Colorado agricultural diversions included in the study were obtained from the Colorado Division of Water Resources' online database (Colorado's Decision Support System; http://cdss.state.co.us/Pages/CDSSHome.aspx). The agency does not specifically qualify the data as provisional and subject to change, though the agency's website does list the Terms of Use, which includes a Liability Disclaimer.
- Daily average diversion records from 2011 to 2015 for most of the New Mexico agricultural diversions included in the study were obtained from the New Mexico Office of the State Engineer (NMOSE) online database (http://meas.ose.state.nm.us/district5.jsp). Older diversion records (2005–2010) for these diversions were then obtained from NMOSE staff. For many Animas River diversions in New Mexico, flow data were not available for the 2011 calendar year. On their website, the NMOSE qualifies the available data as "provisional and subject to revision".
- Daily average diversion records from 2005–2015 for agricultural diversions operated by the Navajo Nation were obtained from Keller-Bliesner Engineering (via Brian Westfall).
- Daily average diversion records from 2009–2015 for the USBR Animas-La Plata Project/Lake Nighthorse Diversion were obtained from USBR staff in Durango.
- Diversion records for municipal diversions were obtained from the municipalities (2012–2015 monthly total diversions for the City of Durango's Santa Rita diversion on the Animas River; 2005–2015 daily average cubic feet per second [cfs] at the Animas Pump Station for the City of Farmington's Animas Pump Station No. 2 on the Animas River).
- Diversion records for industrial diversions were obtained from diversion operators (2014–2015 monthly totals for Williams Field Service Kutz Plant; 2013–2015 calendar year totals for PNM San Juan Generating Station; and 2014–2015 monthly totals for the APS Four Corners Units 4 & 5).

Mean daily discharge records from 2005–2015 for the USGS gages on the San Juan and Animas rivers in CO and NM in the study area were downloaded from USGS websites. Flow information from each diversion and associated USGS gage was summarized and organized by river mile, and includes diversion and gage name, approximate river mile distance from diversion to nearest USGS gage, USGS gage name and number, the form of diversion/discharge data available/collected, field visit date, and whether information was collected via phone or email.

Methods Used for Synthesis and Analysis of Flow Data by Diversion

Estimates of diversion as a percent of total river flow at each diversion site were calculated using available diversion data and streamflow discharge from the nearest USGS gage as an approximation of the river flow rate at the diversion site. Estimates generated were not restricted to the presumed spawning periods of endangered fishes. Vogel (2013) employed this same approach for estimating diversion as a percent of river flow while investigating fish entrainment at Sacramento River diversions.

A limitation associate with this methodology is that it does not account for surface/groundwater gains or losses in the intervening reach of river between a given diversion site and the nearest USGS gage. Moreover, the limited availability of diversion data for some diversions necessitated use of abbreviated periods to calculate diversion as a percent of total river flow. Despite these limitations, the study's estimates of diversion as a percent of total river flow, field data collected at diversion sites, and fisheries data would be useful for the Recovery Program to achieve tasks and actions in the Long-Range Plan.

Diversion structure flow records and USGS discharge records were compiled in a Microsoft Excel spreadsheet, which was programed with formulas to generate estimates of the diversion rate for each diversion as a percent of total river flow. Estimates of diversion rates as a percent of total river flow were calculated on a daily, monthly, and annual basis (calendar year) for diversion sites from which daily average diversion data was obtained. For diversion sites from which only monthly total and/or annual total diversion data were available, the estimates of diversion rates as a percent of total river flow were calculated on a monthly and/or calendar years.

The USGS river discharge records for San Juan and Animas rivers gages used did not require editing (i.e. remove negative values or suspected errors). Similarly, data editing was not required for the Colorado Division of Water Resources (CDWR) diversion records or for diversion data obtained from several municipal and industrial diversion operators.

In contrast, NMOSE diversion records (qualified as "provisional and subject to revision") and diversion records from Keller-Bliesner Engineering ("yet-unprocessed") required some removing of both negative values and suspected errors. Errors were characterized by repeated identical values over long periods and short-term spikes in flow rate many orders of magnitude higher than preceding or following flow rate. No effort was made to apply data shifts, extrapolate or interpolate data over data gaps, or otherwise correct suspected errors as this was beyond the scope of our contract.

When daily mean diversion data could be calculated for both the nearest USGS gage and the diversion site, diversion as a percent of total river flow on a daily basis was calculated as:

daily mean diversion rate (cfs)/daily mean river discharge (cfs) x 100 =
daily mean diversion as a percent of total river flow that day

The resulting daily values (%) were then averaged for specific months and years and calculated, for that diversion, as a percent of total river flow on a monthly and annual basis.

Generally, diversion data for municipal and industrial diversions obtained from the diversion operators was in monthly or annual total volumes diverted (gallons and acre-feet). To estimate percent of total river flow for municipal and industrial diversions, a constant flow rate was assumed and volumes were converted to mean monthly and/or mean annual cfs. Daily mean river discharge from the nearest USGS gage was converted to daily mean discharge (cfs) per month and year. When municipal and industrial diversion data were only available as monthly total volume diverted, diversion as a percent of total river flow on a daily basis was calculated as:

monthly mean diversion rate (cfs)/monthly mean river discharge (cfs) x 100 =
diversion as a percent of total river flow/month

Likewise, when municipal and industrial diversion data were only available as annual (calendar year) total volume diverted, diversion as a percent of total river flow on a daily basis was calculated as:

annual diversion rate (cfs)/annual mean river discharge (cfs) x 100 = diversion as a percent of total river flow for that year

Based on the direction of the Stakeholders and BC workgroup at the January 4, 2016, meeting, on February 1, 2016, TNC distributed via email to the BC workgroup members the Microsoft Excel file containing summaries of the agricultural, industrial, and municipal diversion data including:

Daily mean and other diversion data (monthly and annual total volumes diverted) obtained during this study are included in a digital spreadsheet (Microsoft Excel files) that accompanies this report. In addition, the digital summaries of agricultural, industrial, and municipal diversion data contain:

- River Mile Distances for San Juan River USGS Gages and Diversions
- Estimated Average Annual % of San Juan River Flow Diverted
- Estimated Average Monthly % of San Juan River Flow Diverted

- River Mile Distances for Animas River USGS Gages and Diversions
- Estimated Average Annual % of Animas River Flow Diverted
- Estimated Average Monthly % of Animas River Flow Diverted

Methodology for Synthesis of Fish Composition

Fish were not sampled at any of the diversion sites for this study. Instead, Colorado Pikeminnow and Razorback Sucker capture information from the San Juan River during 2005–2014 was pooled and analyzed. This constitutes the principal dataset for this portion of the project. Unlike the Animas River, where there are very few fish records (in general) and none of Colorado Pikeminnow and Razorback Sucker, 1000s of these endangered fish were collected in the San Juan River from 2005–2014. This extensive database on Colorado Pikeminnow and Razorback Sucker was deemed sufficient to address the objectives of the project, in reference to the San Juan River. Colorado Pikeminnow and Razorback Sucker collection information was obtained from the two of the three SJRBRIP fish monitoring projects; subadult/adult monitoring and small-bodied monitoring. The large number of larval Razorback Sucker (ca. 8,000) and larval Colorado Pikeminnow (ca. 400) taken during the larval fish monitoring project (2005–2014) were not incorporated into this project. Its focus, in reference to entrainment, is to address retention of older life stages (subadult and adult) in the rivers. “Ancillary” specimens of Colorado Pikeminnow and Razorback Sucker (i.e., not larval fish; juvenile or subadult fish) taken during the larval fish monitoring were included in the study. Given the extensive dataset on endangered species, distribution and abundance information for the other (more abundant) native species (Bluehead Sucker and Flannelmouth Sucker) was not needed.

San Juan River electrofishing results (subadult and adult monitoring) are reported as fish/hr. The majority of Colorado Pikeminnow (subadults/adults) were captured during electrofishing efforts while capture of age-1 fish occurred during small-bodied and larval fish monitoring. These latter collections (small-bodied and larval fish sampling) are reported as the number of fish collected/100 m^2 of habitat sampled. Endangered fish monitoring data for both species are available from San Juan River between RM 2.9 and RM 195.0.

The Animas River was divided into three “reaches” based on fish data from Colorado Parks and Wildlife (CPW; formerly Colorado Division of Wildlife, CDOW) and the Southern Ute Indian Tribe (SUIT). Reach 3 was the Animas River from RM 0.0 (confluence with the San Juan River) upstream to RM 37.1 (the New Mexico/Colorado state line). Reach 3 fish data were provided by SUIT and included species composition, relative abundance, and catch-per-unit-effort (CPUE). Reach 2 was the Animas River between RM 37.1 and RM 56.4. This section of river corresponds to SUIT reaches 1–4 in Valdez (2008). Data for fish species in Reach 2 were provided by SUIT and reported as relative abundance and catch-

per-unit-effort (CPUE). For both Reach 2 and 3, the CPUE metric is the number of fish collected/hr of electrofishing. Neither Colorado Pikeminnow nor Razorback Sucker were collected in the Animas River between 2005 and 2014. Therefore, information gleamed from surrogate species (Bluehead Sucker and Flannelmouth Sucker) were used to infer potential effects of diversion structures on Colorado Pikeminnow and Razorback Sucker in the Animas River. Reach 1 was defined as the Animas River between RM 57.4 and RM 62.2. This section of the Animas River (Reach 1) had been defined by CDOW as “Animas 1” and “Animas 2” (Valdez, 2008). Data on fish composition, relative abundance, and distribution from Reach 1 were obtained from CPW. Also included in that dataset were relative abundance (percent of total) and population densities (fish/mi).

Common and scientific names of fishes used in this report follow the American Fisheries Society names of fishes (Page et al., 2013). Scientific name is used at the first mention of an individual species, thereafter only the common name is used.

RESULTS

Identification of Diversions

The following diversion structures, organized by river and increasing river mile, on the San Juan and Animas rivers were included in the study (Figure 2). The detailed compilation of information related to the individual diversions and their physical structures are presented in Appendix A and an electronic spreadsheet. There are 51 fields (Table 4) for each diversion populating Appendix A and the associated spreadsheet. Fifteen San Juan River (Table 5) and 24 Animas River (Tables 6, 7, and 8) diversion structures are reported herein. The brief narrative, for each diversion, that follows includes information on diversion operator, when river diversion normally occurs, and physical features of the diversion structure relevant to the study.

Table 4. Information acquired for individual diversion structures.

INFORMATION FIELDS POPULATING THE DIVERSION STRUCTURE SPREADSHEET		
Diversion Name	ContactA_Email	Diversion Channel Notes
River Name	ContactB_Name	First Spillway Location
River Mile	ContactB_Title	Spillway Type
State	ContactB_Phone	Spillway Width
County	ContactB_AltPhone	Head Gate Type
Visit Date	ContactB_Email	Head Gate Count
Visit Time	Location Description	Open at time of field visit
Visit Note	Access Route	Head Gate Width Each
Diversion/Discharge/Available/Collected	Head/Grade Control Type	Head Gate Normal Operating Position
Entity	Head/Grade Control Condition	Screen Type
Type of Entity	Head/Grade Control Maintenance	Screen Condition
Type of Diversion	Head/Grade Control Notes	Screen Height
Entity Address	River Width at Diversion Channel Intake	Screen Width
ContactA_Name	River Width Notes	Screen Mesh Opening
ContactA_Title	Diversion Channel Intake Width	Inlet Pipe at Headgate
ContactA_Phone	Diversion Channel Intake Width Notes	Maximum Diversion Rate cfs
ContactA_AltPhone	Intake Distance from Headgate	Normal Diversion Rate cfs

Table 5. Diversion sites from the San Juan River reported upon in this document.

DIVERSIONS WITHIN SAN JUAN RIVER (RM 80.7 –217.8)		
DIVERSION NAME	**RM**	**STATE**
Utah Pipe Diversion 3	80.7	Utah
Utah Pipe Diversion 2	81.0	Utah
Utah Pipe Diversion 1	82.3	Utah
Hogback Canal *	158.7	New Mexico
APS Four Corners Units 4 & 5 *	163.7	New Mexico
Jewett Valley Ditch	166.3	New Mexico
San Juan Generating Station *	166.7	New Mexico
Fruitland Irrigation Canal/Shiprock Irrigation	178.4	New Mexico
Farmers Mutual Ditch (San Juan River)*	179.6	New Mexico
Williams Field Services Kutz Plant Diversion*	195.6	New Mexico
Western Refinery Diversion	196.3	New Mexico
City of Bloomfield Second Source Diversion	197.9	New Mexico
Hammond Conservancy District Diversion*	209.3	New Mexico
Turley-Manzanares Ditch	214.4	New Mexico
Bloomfield Irrigation District	217.8	New Mexico
* = Reported upon but diversion site was not visited		

RM 80.7 ***Utah Pipe Diversion 3***

This agricultural diversion is owned by Bill Davis; diversion records were unavailable.

Relevant Physical Features: There is not a head-grade control structure in the river channel adjacent to this diversion. According to the operator, a milk crate secured over the end of the pipe to prevent debris from entering requires frequent replacement.

RM 81 ***Utah Pipe Diversion 2***

Melvin and Bill Gaines operate this UT agricultural pipe diversion. Diversion records were not available for this structure.

Relevant Physical Features: There is not a head-grade control structure. It is unknown whether there is a debris screen over the pipe inlet.

RM 82.3 ***Utah Pipe Diversion 1***

This UT agricultural pipe diversion is operated by Roger Atcity but diversion records were not available for this structure.

Relevant Physical Features: There is not a head-grade control structure in the river channel adjacent to the diversion. It is unknown if there is a debris screen over the pipe.

RM 158.7 ***Hogback Canal – not visited***

As per direction from Mark McKinstry, USBR, information for this diversion was not collected as part of the study. An aerial photograph of the recent improvements at this diversion, including the fish weir, is included in the map book of this report.

RM 163.7 *APS Four Corners Units 4 & 5 – not visited*

This industrial diversion is operated by the Arizona Public Service Company, in NM, to supply water to Four Corners Units 4 & 5. Water was diverted every month of 2014.

Relevant Physical Features: There is a concrete head-grade control structure extending across the river adjacent to the pump-house intake. As evidenced by the photographs supplied by APS, there was a small hydraulic drop over the head-grade control structure. The pump-house intake has metal fish/debris screens (ca. 2.5 cm by 7.5 cm mesh) along its interface with the river channel. This diversion was discussed by Stamp et al. (2005) in their evaluation of the need for fish passage at this and the Fruitland Irrigation Diversion.

RM 166.3 *Jewett Valley Ditch*

The Jewett Valley Ditch is an agricultural diversion operated by Jewett Valley Ditch Association, NM, and diverts water from April through October or November.

Relevant Physical Features: There is a head-grade control structure on the Jewett Valley Ditch that stretches across the river channel adjacent to the diversion channel inlet. It is comprised of large boulders and native bed material and requires maintenance about every five years. The gradient of the river at the head-grade control structure is relatively gentle. The older concrete headgate structure located along the river channel needs improvement and has rudimentary slide-gates that operators position using metal pins. A newer (operational) headgate/spillway is about 37 m downstream of old headgate.

RM 166.7 *PNM San Juan Generating Station – not visited*

This PNM San Juan Generating Station is an industrial diversion operated by the Public Service Company of New Mexico and supplies process water to the San Juan Generating Station. We do not know the months that diversion typically occurs.

Relevant Physical Features: While there is a substantial concrete head-grade control structure that extends across the river channel adjacent to the intake structure, another feature of this diversion is a fish passage on the opposite side of the river from the headgate. The intake structure directs flow to a stilling basin, from which water is pumped to the San Juan Generating Station. There is a trash rack across the intake structure, and a rotating mesh fish screen at the pump-house, with openings approximately 10.6 cm x 15.2 cm.

RM 178.4 *Fruitland Irrigation Canal* (Shiprock Irrigation)

The Fruitland Irrigation Canal is an agricultural diversion operated by Shiprock Irrigation of the Navajo Nation. Over the last several years, diversion at the Fruitland Irrigation Canal has occurred during every month.

Relevant Physical Features: Directly adjacent to the existing concrete headgate structure, is a head-grade control structure that extends across the river channel. The head-grade control structure is comprised of large boulders placed in the river channel. In this reach of the San Juan River, the native bed material is largely silt and sand, necessitating frequent maintenance of the head-grade control structure. Approximately 800 m downstream of the headgate structure in the canal is a radial gate-controlled spillway that, during our August 2015 field visit, was returning all diverted water to the river. At the time of the field visit, the diversion structure at the river had been partially decommissioned and the headgates were removed.

The Navajo Nation is redesigning the diversion. The design process includes consultation with federal and tribal agencies, and that the diversion improvements will likely include some form of fish passage and entrainment mitigation. The preferred design alternative includes a 2-step grouted-boulder head-grade control structure (similar to the Willett Ditch), but with a steel sheet pile cutoff wall. Upstream fish passage will be provided by an open boulder field incorporated into the structure. Downstream boat passage is provided in combination with a trash chute to the river right and just upstream of the canal headworks. The proposed fish entrainment control is to be provided by a long-crested weir-wall about two miles downstream in the Fruitland Irrigation Canal with a

return channel to the river, similar to the one at Hogback Irrigation Canal but smaller and less complex (Personal communication with Ron Bliesner P.E. of Keller-Bliesner Engineering, April 20, 2016). Stamp et al. (2005) evaluated the need for fish passage at this and the Arizona Public Service Company Four Corners Units 4 & 5 diversions.

RM 179.6 *Farmers Mutual Ditch (San Juan River) – not visited*

This is one of two agricultural diversions operated by the Farmers Mutual Ditch Company; one on the Animas River and one on the San Juan River. This diversion was not visited and the operators indicated this San Juan River diversion is not the primary source of water for the Farmers Mutual Ditch. The NMOSE does not have diversion data for Fatmers Mutural Ditch, nor is the diversion indicated on its website.

Relevant Physical Features: Based on the aerial photograph, a substantial head-grade control structure extends across the entire river channel adjacent to the headgate structure. Again, based on the aerial photograph, the head-grade control structure appears to be comprised of large boulders. It is unknown if there is a fish screen in front of the headgate.

RM 195.6 *Williams Field Services Kutz Plant Diversion – not visited*

This industrial diversion is operated by the Williams Field Service/Williams Energy/ Williams Companies, Inc. (NM) for process water at the Kutz Plant. Diversion records for 2015 (January through August) recorded diversion from January through August.

Relevant Physical Features: Aerial photographs show the diversion is along one of two primary channels with the majority of the flow being in the non-diversion channel. There does not appear to be a head-grade control structure adjacent to the headgate structure. Engineering drawings or pictures of the diversion site were unavailable and it is unknown if there is a fish screen at the diversion structure.

RM 196.3 *Western Refinery Diversion*

The Western Refinery Corporation operates this industrial diversion in NM. Diversion records were not available for the diversion. It was previously used on a regular basis to divert process water for the refinery, but since the refinery is no longer in service, diversions no longer regularly occur.

Relevant Physical Features: The diversion channel inlet is approximately 110 m upstream of the concrete headgate, with undiverted water returned to the river about 75 m downstream. There does not appear to be a constructed head-grade control structure in the river channel adjacent to the diversion channel inlet. Across the headgate structure, there are metal fish screens with approximately 10 cm x 10 cm mesh openings.

RM 197.9 *City of Bloomfield Second Source Diversion*

This NM municipal diversion is operated by the City of Bloomfield. Based on communication with Teresa Brevik, the diversion was only operated for a few months following completion in 2012.

Relevant Physical Features: Due to performance issues, the City plans to relocate or improve the diversion facility to reliably utilize its surface water rights on the San Juan River. At the current diversion, there does not appear to be a constructed head-grade control structure. The diversion structure has a slide-gate that controls inflow to the short diversion channel, and second slide-gate that controls flow through a pipe to a settling pond. Water from the settling pond is supposed to be pumped to the City's reservoir for municipal use.

RM 209.3 *Hammond Conservancy District Diversion – not visited*

The Hammond Conservancy District operates this NM agricultural diversion. Diversion for this system typically occurs from April to October.

Relevant Physical Features: Directly adjacent to the concrete headgate structure is a head-grade control reaching across the entire river channel (ca. 120 m). It appears that the

grade head control structure has eroded the bank opposite the diversion so that the head diversion control structure may have needed lengthening. This resulted in a relatively broad river at the diversion with surface flow evident over the head-grade control structure in the aerial photograph. As the Conservancy District declined to participate in the study, it is not known whether there are fish passage structures or fish screens.

RM 214.4 *Turley-Manzanares Ditch*

This agricultural diversion is operated by the Turley-Manzanares Ditch Association diverting water every month.

Relevant Physical Features: A head-grade control structure extends approximately 100 m upstream from the concrete headgate and across most of the river channel. A 30 m portion of the head-grade control structure, closest to the headgate, is poured concrete, while the remainder of the head-grade control structure is partially vegetated and .a mix of boulders, cobbles, and native bed material. According to the operator, the head-grade control structure requires spring maintenance about every other year. The hydraulic drop, at the head-grade control structure, is approximately 1 m. During the field visit, surface flow was observed at multiple locations over the head-grade control structure. A large pool, formed by the head-grade control structure, exists just upstream of the headgate, At the time of the field visit, water velocity in the ditch appeared relatively slow potentially allowing fish to escape to the main channel. A metal screen in front of the diversion headgate is intended to prevent debris from entering the ditch. The metal screen is comprised of 5 mm vertical and horizontal wire with 10 cm x 10 cm openings.

RM 217.8 *Bloomfield Irrigation District*

This NM municipal agricultural diversion is operated by the Bloomfield Irrigation District (BID). In addition to supplying irrigation water, the BID supplies water to the City of Bloomfield for municipal use. Diversion typically occurs every month.

Relevant Physical Features: In the main river channel, adjacent to the diversion channel inlet, is a head-grade control structure. It is maintained annually, in part, to prevent over-diversion during spring peak releases from Navajo Reservoir. The diversion inlet channel is approximately 450 m long, and terminates at the concrete headgate/spillway structure. The headgates have been removed, and flow into the ditch is controlled by altering head using the spillway gates. Separating the 450 m long diversion channel from the river is a broad, elongate, and mostly vegetated island. At the time of the field visit, along the diversion channel, a substantial volume of water was returning to the river at several locations. Also noted was the large volume of water returned to the river through the spillway (at the concrete headgate/spillway structure).

Table 6. Diversion sites from Animas River Reach 3 reported upon in this document.

ANIMAS RIVER REACH 3 (RM 0.0 – 37.1)		
DIVERSION NAME	**RM**	**STATE**
Farmers Mutual Ditch (Animas River)	0.4	New Mexico
Willet Ditch	3.5	New Mexico
North Farmington Ditch	4.6	New Mexico
Farmington-Echo-Allen Ditch	6.1	New Mexico
City of Farmington Animas Pump Station No. 2 *	9.5	New Mexico
Ranchmans Ditch	10.8	New Mexico
Halford-Independent Ditch	15.3	New Mexico
Kello-Blancett Ditch	16.8	New Mexico
Eledge Mill Ditch	19.8	New Mexico
Farmers Irrigation Ditch	21.4	New Mexico
Lower Animas Ditch	21.8	New Mexico
Sargent Ditch *	24.6	New Mexico
Aztec Ditch *	27.4	New Mexico
Stacey Ditch	29.6	New Mexico
Graves-Atterberry (Inca) Ditch *	31.7	New Mexico
Cedar Ditch	33.8	New Mexico
* = Reported upon but diversion site was not visited		

RM 0.4 *Farmers Mutual Ditch* (Animas River)

This is one of two agricultural diversion structures operated by the Farmers Mutual Ditch Company in NM: one on the Animas River and another on the San Juan River. The ditch operators indicated that this diversion is the primary source of water delivery to Farmers Mutual Ditch. Diversion typically occurred from March through October.

Relevant Physical Features: There is a head-grade control stretching across the river channel comprised of native bed material, which does not appear to require maintenance. The head-grade control may be a natural river feature. The head-grade control structure has very gradual hydraulic gradient, allowing water to easily flow past the diversion. The first controlled spillway in the ditch is about 200 m downstream of the headgate structure.

RM 3.5 *Willet Ditch*

The City of Farmington (NM) operates this municipal and agricultural diversion. Water is diverted every month.

Relevant Physical Features: At this site, there is a 93 m long concrete and boulder head-grade control structure that extends from the headgate upstream and across most of the river channel. In addition, ca. 40 m downstream, there is a secondary concrete and large boulder head-grade control structure constructed across the river channel. This secondary structure has a hydraulic drop of about 1 m.

RM 4.6 ***North Farmington Ditch***

This agricultural diversion is operated by the North Farmington Ditch Association, NM. Water diversion occurs every month.

Relevant Physical Features: Adjacent to the diversion inlet channel, a head-grade control structure stretches across the main channel. The grade/head control structure is comprised of native cobbles and bed material, which typically requires maintenance one-two times per year. The hydraulic drop from the top of the head-grade control structure to the downstream bed material is approximately 1 m. The headgate/spillway structure is located approximately 200 m downstream of the diversion channel inlet. Approximately 20 m upstream of the headgate/spillway structure is an uncontrolled secondary head-grade control structure, again, comprised of large native cobbles and bed material. The hydraulic drop from the top of this structure to the downstream bed material is approximately 1 m. At the time of the field visit, surface water flow was not observed overtopping the secondary head-grade control structure, though water did seep through the structure to the wetted return channel downstream.

RM 6.1 ***Farmington-Echo-Allen Ditch***

This agricultural diversion is operated by the Farmington Echo Ditch Company, NM. Based on the available diversion records, diversion typically occurs from February through November/December.

Relevant Physical Features: To create sufficient head at the diversion channel inlet, a head-grade control structure stretches across the entire river channel, constructed of cobbles/native bed material. It appears that the head-grade control structure requires frequent maintenance. At the time of the field visit, river flow was not observed above the head-grade control structure, though water did seep through the structure to the wetted channel downstream. The diversion channel inlet and head-grade control structure are accessible from a public road. The headgate and spillway structure is located downstream of the diversion inlet (locked gate, private property). At the time of the field visit ditch operators were unable to meet our field crew.

RM 9.5 ***City of Farmington Animas Pump Station No. 2 – not visited***

This municipal diversion is operated by the City of Farmington with water diverted every month.

Relevant Physical Features: A concrete head-grade control structure extends across the river channel adjacent to the headgate structure. The hydraulic drop from the top of the concrete structure to the downstream bed material is about 1 m. The structure has two steps: the upstream concrete step (at the top of the structure to the concrete apron below) and then at the edge of the concrete apron to the downstream bed material. The sluice channel/spillway at the headgate is not a fish passage and serves to control water at the headgate structure. There is a trash rack at the inlet of the diversion pipe. Farmington is planning to modify the concrete head-grade control structure to mitigate safety issues with the structure (the structure causes hydraulic recirculation directly downstream of the structure, which is a significant safety hazard to recreational boaters and anglers). The City is designing a new concrete head-grade control structure that will be similar to the Willet Ditch structure with hydraulic features for boating/kayaking.

RM 10.8 ***Ranchmans Ditch***

The Ranchmans Ditch Association, NM, operates this agricultural diversion withdrawing water from March through November.

Relevant Physical Features: A head-grade control structure constructed of large cobble and bed material is present about 40 m downstream of the headgate structure. The hydraulic drop over the head-grade control structure, from the top of the structure to the elevation of the bed material downstream of the structure, is about 1 m. According to the operator, the head-grade control structure requires annual maintenance with heavy equipment.

RM 15.3 *Halford-Independent Ditch*

This agricultural diversion is operated by the Halford-Independent Ditch Association, NM. Water diversion at the Halford-Independent Ditch typically occurs from April through November.

Relevant Physical Features: It appears that at least some native bed material has been deposited in the main river channel adjacent to the diversion channel inlet to provide adequate head in the diversion channel. The diversion channel is formed by a small, vegetated island. At the headgate structure, large diameter cobble and moderately sized boulders have been deposited across the diversion channel to form a secondary head-grade control structure and to provide adequate head at the radial headgate. During the August 2015 field visit to the site, some flow was observed below the secondary head-grade control structure, but not over the structure. The distance between the diversion channel inlet and the secondary head-grade control structure was about 40 m.

RM 16.8 *Kello-Blancett Ditch*

The Kello-Blancett Ditch Association, NM, operates this agricultural diversion from March or April through November.

Relevant Physical Features: There is a concrete head-grade control structure in the main river channel adjacent to the diversion channel. During the August 2015 field visit, the hydraulic drop at the head-grade control structure was approximately 1 m. The diversion channel leads diverted water away from the main river channel (ca. 250 m), to the headgate structure and uncontrolled spillway. Adjacent to the concrete headgate structure, within the diversion channel, is a secondary concrete head-grade control structure with a hydraulic drop of about 1 m. This secondary structure, and resulting head, has been raised (ca. 30 cm) with wooden boards installed across the top the structure, and secured with vertical reinforcement bar staked in the concrete.

RM 19.8 *Eledge Mill Ditch*

This agricultural diversion is operated by the Eledge Ditch Company, NM and usually diverts water from April through November.

Relevant Physical Features: While the head-grade control structure is not constructed across the main river channel, cobbles and native bed material are piled in front of the diversion structure to protect it and create a short diversion channel. A trash rack of horizontal pipes spaced approximately 30 cm apart covers the headgate.

RM 21.4 *Farmers Irrigation District*

This agricultural diversion is operated by the Farmers Irrigation District Association, NM. Water diversion typically occurs from March through November/December.

Relevant Physical Features: Adjacent to the diversion structure is a substantial concrete head-grade control structure that extends across the entire river channel. The vertical elevation drop from the top of the concrete head-grade control structure to the bed material downstream of the structure is approximately 1.75 m. The head-grade control structure has two vertical steps: the upper step from the top of the structure to the apron, and the second step from the rim of the apron to the downstream bed material. At the time of the field visit, there was a hydraulic drop over both of these steps, more or less continuous across the entire structure. According to Farmers Irrigation District Association, the head-grade control structure does not normally require maintenance. About half of the water diverted into the ditch is used for municipal supply in Farmington, with about 20 cfs normally returning to the river at the end of the ditch.

RM 21.8 *Lower Animas Ditch*

The Lower Animas Ditch Association operates this agricultural diversion. Water diversion typically occurs March through November.

Relevant Physical Features: There is a head-grade control structure across the river channel adjacent to the Lower Animas Ditch headgate structure. The head-grade control

structure is comprised of large boulders and native bed material, and requires maintenance every 1–2 years. The main headgate (radial-gate) is next to the spillway gate (slide-gate).

RM 24.6 *Sargent Ditch – not visited*

Sargent Ditch Association, NM operates this agricultural diversion, which typically diverts water from April through December.

Relevant Physical Features: There is a head-grade control structure across the river channel adjacent to the headgate structure. The aerial photographs of this site also indicate that the head-grade control structure is constructed of large boulders and native bed material.

RM 27.4 *Aztec Ditch – not visited*

This agricultural diversion is operated by the Aztec Ditch Association, NM. Aztec Ditch diversion records show diversion occurs from January through November or December.

Relevant Physical Features: An aerial photograph of the diversion site shows a substantial head-grade control structure across the river channel adjacent to the headgate structure. The head-grade control structure appears to be constructed of large boulders and native bed material. The first spillway location appears to be about 50 m downstream of the headgate.

RM 29.6 *Stacey Ditch*

Stacey Ditch is an agricultural diversion operated by the Stacey Ditch Association, NM. Diversion of water at Stacey Ditch typically occurs from March through November.

Relevant Physical Features: The diversion channel inlet is approximately 700 m upstream of the headgate and spillway structure. There does not appear to be a head-grade control structure in the main river channel at the diversion channel inlet. A vegetated earthen berm separates the main channel from the diversion channel, which is eroded in several locations. In August 2015, some water was returning to the main river channel from gaps in the earthen berm and through the spillway at the headgate structure.

RM 31.7 *Graves-Atterberry (Inca) Ditch – not visited*

The Graves-Atterberry Ditch Association operates this ditch. Diversion typically occurs from April through November.

Relevant Physical Features: Based on the aerial photograph of the site, it appears that a head-grade control structure comprised of boulders and native bed material extends from the headgate across most of the river channel.

RM 33.8 *Cedar Ditch*

This agricultural diversion is operated by the Cedar Ditch Association, NM. Diversion typically occurs April through November.

Relevant Physical Features: The head-grade control structure that stretches across the river channel adjacent to the headgate structure is comprised of concrete pieces, large and medium-sized boulders, and car body panels. To hold this material in-place, ditch operators have driven sections of steel railroad rails vertically through the riverbed, leaving the upper end exposed above the water surface. The head-grade control structure appears to present a significant safety hazard for anglers and recreational boaters and rafters. According to the ditch operators, the head/diversion structure normally requires maintenance following high spring runoff. The diversion headgate structure, which has two old wheel-operated slide-gates and a spillway slide-gate, is in need of improvement. The spillway at the headgate does not appear to be used, though there is an active spillway approximately 400 m downstream along the ditch.

Table 7. Diversion sites from Animas River Reach 2 reported upon in this document.

ANIMAS RIVER REACH 2 (RM 37.1 – 56.4)		
DIVERSION NAME	**RM**	**STATE**
Ralston Ditch *	38.1	Colorado
Twin Rock Ditch	39.7	Colorado
Citizens-Animas Ditch *	48.0	Colorado
Dena (Little Fishes) Ditch	48.9	Colorado
Cason Ditch	53.5	Colorado
East Mesa Ditch	55.1	Colorado
* = Reported upon but diversion site was not visited		

RM 38.1 ***Ralston Ditch – not visited***

This agricultural diversion is operated by the Ralston Ditch Association (CO) and primarily serves NM water users. Diversion typically occurs April through October.

Relevant Physical Features: Based on the aerial photograph, a head-grade control structure comprised of boulders and native bed material extends from the headgate across the river channel.

RM 39.7 ***Twin Rock Ditch***

This agricultural diversion is operated by the Twin Rock Ditch Company, CO, but primarily serves water users in NM. Based on the available diversion records, diversion typically occurs April through November.

Relevant Physical Features: A head-grade control structure comprised of large boulders extends from the headgate across the river channel. There is an angled trash rack across the inlet of the diversion structure on vertical steel slats with about 30 cm spacing.

RM 48.0 ***Citizens-Animas Ditch – not visited***

This agricultural diversion is operated by the Citizens-Animas Ditch Association, CO. Based on the available diversion records, diversion typically occurs every month.

Relevant Physical Features: An 80 m long, partially vegetated (willow and grass), earthen berm is present upstream of the headgate. At the furthest extent of the vegetated berm, a head-grade control comprised of native bed material extends across most of the main river channel.

RM 48.9 ***Dena Ditch/Little Fishes Wildlife Habitat Enhancement Project***

This diversion is operated by Lite Fishes L.L.C., in CO to divert water for recreation and fishing ponds along the Animas River. Diversion records for this system were not available from the operator, but it appears that water levels in the ponds are partially maintained by alluvial groundwater.

Relevant Physical Features: Extending from the headgate to the river channel is 15 m long weir comprised of large diameter boulders and cobbles. The weir does not extend all the way across the river channel.

RM 53.5 ***Cason Ditch***

This agricultural diversion is operated by the Cason Ditch Association in CO, with diversion typically occurring from June through September.

Relevant Physical Features: There is a partially vegetated earthen berm (ca. 225 m long) forming the diversion channel upstream of the headgate structure. At the headgate there is an uncontrolled spillway of small boulders and concrete pieces that allows excess water to return to the river. The headgate inlet lacks a trash rack and fish screen.

RM 55.1 ***East Mesa Ditch***

This agricultural diversion is operated by the East Mesa Ditch Company, CO, with diversion typically occurring from April through October. The ditch operator relayed that, during normal operations, fish are frequently observed swimming into and out of the headgate structure.

Relevant Physical Features: There is a partially vegetated earthen berm (ca.160 m long) that forms the diversion channel upstream of the headgate structure. At the headgate structure, there is an uncontrolled spillway comprised of small boulders and concrete pieces that allow excess water to return to the river. There is a trash rack across the headgate inlet (horizontal pipes with approximately 33 cm spacing) and a log/skim board at the water level to prevent logs/debris from entering the diversion, but no fish screen.

Table 8. Diversion sites from Animas River Reach 1 reported upon in this document.

ANIMAS RIVER REACH 1 (RM 57.4 –62.2)		
DIVERSION NAME	**RM**	**STATE**
Bureau of Reclamation, Lake Nighthorse Diversion	59.8	Colorado
City of Durango, Santa Rita Municipal Diversion	60.2	Colorado

RM 59.8 ***USBR Animas-La Plata Project/Lake Nighthorse Diversion***

The largest diversion structure in the study area is the USBR's Animas-La Plata Project. This project takes water from the Animas River (near Durango, CO) and pumps it to Lake Nighthorse. The Animas-La Plata Operation, Maintenance and Replacement Association operates the Animas-La Plata Project diversion. Intermittent diversion has occurred since 2009; with no diversion in 2012, 2013 and 2016, and minimal diversions in 2014 and 2015. The Animas-La Plata Project does not currently divert water from the Animas River on a daily basis. Instead, water is diverted during spring runoff or other periods of high flow to offset Lake Nighthorse evaporative and seepage losses and maintain reservoir storage level.

Relevant Physical Features: As part of the project construction, native bed material may have been placed across the channel downstream of the diversion intake to provide adequate head for diversions at lower river flows. This head-grade control feature is evident in the aerial photograph. The diversion intake has a trash rack with 50 cm vertical slat openings at the face of the inlet located along the river channel. Diverted water then enters an off-channel stilling basin that has fine mesh fish screens. Diverted water (and fish) not drawn through the fish screens and pumping plant is returned to the river via a gate-controlled return channel.

RM 60.2 ***City of Durango Santa Rita Municipal Diversion***

This municipal diversion is operated by the City of Durango, CO. The diversion is one of the City's sources of municipal water and diverts surface water from the Animas River. Based on the available diversion record, typical diversions coincide with peak municipal demand in June through October.

Relevant Physical Features*:* The City has placed large diameter boulders and bed material in the channel to form a weir that provides adequate head for the diversion. At the time of the field visit (August 2015), the diversion was not operating. Although water was somewhat pooled in front of the diversion intake, some flow was moving through gaps in the boulder weir. The diversion intake structure has an angled trash rack with vertical slats, spaced 8 cm apart.

Longitudinal Synthesis of Diversion Volumes and Percent of River Diverted

Estimates of the percent of river flow diverted at each diversion site were calculated following the procedures described in the methods section of this report. A cautionary note included earlier in this document reminds readers that there are numerous limitations with this methodology foremost of which is disparity (among states and agencies) in the quality and accuracy of water diversion information available for use. In addition, limited diversion data for some sites necessitated use of brief periods to calculate diversion as a percentage of total river flow. Working within these limitations, estimates of diversion as a percent of total river flow were generated for nine San Juan River and 21 Animas River diversions (Figure 2). Those data were calculated, by river, as annual (Tables 9 and 11) percent of river flow diverted at each diversion site (2005–2015) and monthly (Tables 10 and 12) percent of river flow diverted at each diversion site (2005–2015).

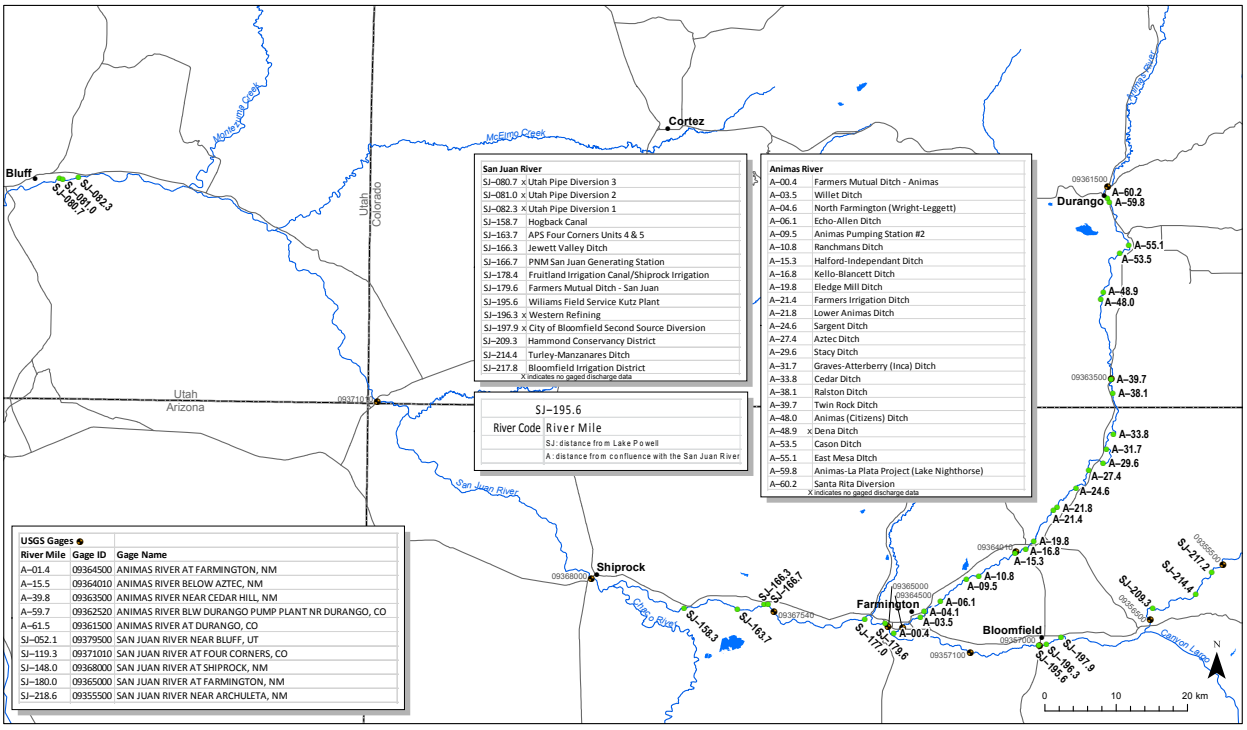

Figure 2. Map illustrating USGS gages, diversion sites, and their locations (RM) reported herein. "X" indicates sites for which volume of water diverted was not calculated.

Table 9. Estimated mean daily percentage of the San Juan River diverted by year (2005–2015), calculated only on days diversion occurred (days of diversion in parenthesis).

	Hogback Canal	APS Four Corners Units 4 & 5 *	Jewett Valley Ditch	PNM San Juan Generating Station *	Fruitland Irrigation Canal	Williams Field-Kutz Plant	Hammond Conservancy District	Turley-Manzanares Ditch	Bloomfield Irrigation District
RM Distance from Lake Powell	158.7	163.7	166.3	166.7	178.4	195.6	209.3	214.4	217.8
Nearest Gage	09368000	09368000	09365000	09365000	09365000	09365000	09355500	09355500	09355500
RM to Gage	10.7	15.7	13.7	13.3	1.6	15.6	9.3	4.2	0.8
Year									
2005	15.48 (98)		1.04 (45)		6.90 (222)		10.19 (147)		18.24 (312)
2006	15.21 (116)		0.09 (173)		8.57 (238)		12.67 (185)		20.50 (347)
2007	13.44 (202)		0.08 (178)		6.55 (211)		7.27 (178)	0.24 (129)	14.02 (333)
2008	5.88 (30)		0.01 (119)		1.98 (45)		8.51 (188)	0.21 (338)	13.03 (359)
2009	22.66 (113)		1.68 (270)		13.85 (69)		11.15 (188)	0.25 (294)	17.76 (360)
2010	17.10 (123)		0.78 (365)		9.84 (128)		12.62 (179)	0.28 (365)	18.42 (365)
2011	16.76 (259)				12.25 (292)				
2012	17.48 (215)		2.38 (254)		11.87 (343)		6.33 (308)		17.28 (348)
2013	18.91 (202)		1.15 (310)	0.03	14.46 (317)		14.33 (226)		26.91 (365)
2014	12.17 (196)	0.03	2.37 (231)	0.03	12.84 (268)		20.14 (189)		32.25 (360)
2015	7.22 (101)	0.02	1.75 (234)	0.03	13.57 (125)		14.65 (214)		29.38 (322)

* Diversion data provided by APS and PNM were monthly and annual total volumes, not daily means, therefore the number of days of diversion is not known.

Table 10. Estimated mean daily percentage of the San Juan River diverted by month (2005–2015), calculated only on days diversion occurred (days of diversion in parenthesis).

	Hogback Canal	APS Four Corners Units 4 & 5 *	Jewett Valley Ditch	PNM San Juan Generating Station *	Fruitland Irrigation Canal	Williams Field-Kutz Plant	Hammond Conservancy District	Turley-Manzanares Ditch	Bloomfield Irrigation District
RM Distance from Lake Powell	158.7	163.7	166.3	166.7	178.4	195.6	209.3	214.4	217.8
Nearest Gage	09368000	09368000	09365000	09365000	09365000	09365000	09355500	09355500	09355500
RM to Gage	10.7	15.7	13.7	13.3	1.6	15.6	9.3	4.2	0.8
2005	(98)		(45)		(222)		(147)		(312)
Jan									8.52 (28)
Feb									16.67 (20)
Mar			3.24 (14)						16.65 (31)
Apr	2.42 (20)		0.05 (26)		1.34 (12)		10.88 (17)		24.52 (29)
May			0.02 (5)		1.26 (31)		2.50 (21)		5.69 (21)
Jun					1.52 (30)		5.07 (30)		10.56 (30)
Jul					6.22 (31)		14.20 (31)		29.11 (31)
Aug	31.08 (12)				10.52 (29)		15.06 (19)		28.70 (31)
Sep	26.75 (30)				13.90 (29)		14.14 (16)		24.19 (30)
Oct	8.04 (29)				6.51 (30)		11.93 (13)		20.37 (28)
Nov	8.66 (7)				11.19 (30)				9.25 (10)
Dec									12.02 (23)
2006	(116)		(173)		(238)		(185)		(347)
Jan									12.06 (30)
Feb									12.72 (28)
Mar									10.57 (31)
Apr					5.73 (23)		19.18 (17)		22.70 (13)
May			0.06 (27)		5.25 (31)		16.69 (31)		33.49 (31)
Jun			0.05 (30)		5.79 (30)		7.87 (30)		17.29 (30)
Jul	21.68 (15)		0.11 (29)		11.85 (28)		9.61 (31)		21.57 (31)
Aug	14.10 (31)		0.12 (23)		8.43 (30)		11.76 (31)		27.40 (31)
Sep	18.64 (29)		0.16 (29)		10.78 (30)		12.99 (30)		29.45 (30)
Oct	8.98 (30)		0.12 (28)		5.41 (27)		14.12 (15)		28.55 (31)
Nov	17.01 (9)		0.15 (7)		11.11 (16)				16.15 (30)
Dec	19.54 (2)				14.74 (23)				14.38 (31)
2007	(202)		(178)		(211)		(178)	(129)	(333)
Jan					(8)				14.04 (30)
Feb									11.11 (6)
Mar									10.06 (31)
Apr	12.15 (27)		0.16 (14)		5.71 (27)		8.89 (19)		18.27 (30)
May	3.26 (31)		0.03 (31)		2.02 (31)		2.81 (31)		6.31 (31)
Jun	6.64 (30)		0.05 (26)		3.87 (30)		6.11 (30)		13.40 (30)
Jul	21.74 (31)		0.09 (30)		8.33 (31)		9.66 (31)		22.11 (31)
Aug	17.74 (31)		0.13 (21)		8.54 (27)		8.91 (22)	0.19 (19)	20.57 (22)
Sep	18.04 (30)		0.14 (30)		8.40 (29)		7.58 (30)	0.19 (29)	16.09 (30)
Oct	14.62 (22)		0.08 (26)		7.07 (21)		8.74 (15)	0.33 (24)	16.00 (31)
Nov					9.08 (7)			0.26 (26)	9.28 (30)
Dec								0.23 (31)	10.58 (31)
2008	(30)		(119)		(45)		(188)	(338)	(359)
Jan								0.19 (31)	6.36 (31)
Feb								0.10 (26)	3.72 (27)
Mar								0.04 (27)	1.75 (31)
Apr			0.02 (15)				2.71 (19)	0.07 (28)	5.28 (30)
May	4.06 (27)		0.01 (3)		2.29 (30)		3.56 (31)	0.09 (31)	7.13 (31)
Jun	2.14 (1)		0.02 (16)		1.38 (15)		4.14 (30)	0.09 (30)	8.12 (30)
Jul			0.05 (17)				14.04 (31)	0.31 (29)	30.84 (31)
Aug	32.28 (2)		0.07 (16)				12.46 (31)	0.31 (31)	27.33 (31)
Sep			0.11 (22)				9.86 (30)	0.29 (30)	20.87 (30)
Oct			0.11 (30)				12.28 (16)	0.39 (24)	22.44 (31)
Nov								0.35 (30)	10.65 (30)
Dec								0.31 (21)	9.98 (26)

Table 10. continued.

	Hogback Canal		APS Four Corners Units 4 & 5 *		Jewett Valley Ditch		PNM San Juan Generating Station *		Fruitland Irrigation Canal		Williams Field-Kutz Plant		Hammond Conservancy District		Turley-Manzanares Ditch		Bloomfield Irrigation District	
RM Distance from Lake Powell	158.7		163.7		166.3		166.7		178.4		195.6		209.3		214.4		217.8	
Nearest Gage	09368000		09368000		09365000		09365000		09365000		09365000		09355500		09355500		09355500	
RM to Gage	10.7		15.7		13.7		13.3		1.6		15.6		9.3		4.2		0.8	
2009		(113)				(270)				(69)				(188)		(294)		(360)
Jan															0.29	(13)	9.86	(30)
Feb															0.29	(21)	10.29	(28)
Mar															0.30	(22)	10.57	(31)
Apr					2.72	(29)							12.32	(19)	0.29	(29)	24.84	(30)
May	4.45	(18)			0.89	(31)							11.84	(31)	0.26	(25)	25.60	(31)
Jun	9.60	(30)			1.43	(29)							10.99	(30)	0.21	(25)	22.88	(30)
Jul	21.21	(16)			2.69	(30)							10.52	(31)	0.22	(15)	22.51	(31)
Aug	36.76	(21)			3.01	(31)			15.55	(7)			9.97	(31)	0.25	(29)	20.60	(31)
Sep	39.61	(27)			2.62	(29)			15.11	(27)			12.11	(30)	0.29	(27)	26.39	(30)
Oct					1.89	(31)			12.34	(25)			10.45	(16)	0.25	(31)	21.80	(31)
Nov	11.37	(1)			0.01	(29)			13.04	(10)					0.17	(26)	10.46	(30)
Dec					0.00	(31)									0.21	(31)	5.09	(27)
2010		(123)				(365)				(128)				(179)		(365)		(365)
Jan					0.00	(31)									0.29	(31)	8.40	(31)
Feb					0.00	(28)									0.17	(28)	10.70	(28)
Mar					0.00	(31)									0.28	(31)	9.99	(31)
Apr					1.51	(30)							15.64	(10)	0.30	(30)	21.01	(30)
May	5.57	(2)			1.55	(31)			1.85	(2)			16.29	(31)	0.30	(31)	33.33	(31)
Jun	13.41	(25)			1.43	(30)			8.12	(28)			15.29	(30)	0.30	(30)	31.53	(30)
Jul	22.96	(8)			0.08	(31)			11.07	(30)			8.94	(31)	0.21	(31)	18.10	(31)
Aug	16.47	(28)			1.31	(31)			8.69	(15)			12.08	(31)	0.33	(31)	24.55	(31)
Sep	19.34	(30)			1.70	(30)			9.55	(22)			10.24	(30)	0.23	(30)	20.22	(30)
Oct	18.43	(27)			1.05	(31)			11.24	(22)			11.20	(16)	0.29	(31)	20.98	(31)
Nov	15.13	(2)			0.00	(30)			12.00	(8)					0.34	(30)	11.32	(30)
Dec	3.63	(1)			0.00	(31)			13.19	(1)					0.31	(31)	10.54	(31)
2011		(259)								(292)								
Jan	20.21	(12)							14.85	(26)								
Feb	14.18	(13)							13.74	(10)								
Mar	19.10	(24)							14.58	(25)								
Apr	18.32	(27)							12.00	(28)								
May	16.66	(29)							10.98	(26)								
Jun	5.23	(30)							1.98	(17)								
Jul	11.80	(31)							8.47	(16)								
Aug	25.19	(30)							13.75	(31)								
Sep	23.10	(30)							12.23	(26)								
Oct	16.32	(31)							10.98	(28)								
Nov	0.24	(2)							15.14	(30)								
Dec									13.53	(29)								
2012		(215)				(254)				(343)				(308)				(348)
Jan	20.11	(1)			0.00	(5)			14.10	(31)			0.00	(22)			11.32	(22)
Feb									14.99	(28)			0.00	(28)			10.36	(28)
Mar	10.98	(3)							10.79	(26)			0.00	(28)			11.98	(28)
Apr	8.38	(28)			1.97	(13)			5.75	(29)			9.11	(30)			24.50	(30)
May	6.38	(31)			1.65	(30)			4.44	(31)			11.45	(31)			22.12	(31)
Jun	22.95	(30)			1.38	(24)			12.42	(30)			12.52	(27)			24.36	(27)
Jul	16.25	(31)			2.24	(31)			8.42	(30)			9.14	(31)			19.59	(31)
Aug	24.31	(31)			4.16	(31)			12.67	(31)			9.37	(31)			18.67	(31)
Sep	20.11	(30)			3.81	(30)			10.06	(30)			8.16	(30)			16.88	(30)
Oct	23.56	(24)			5.18	(31)			11.70	(26)			5.28	(31)			18.16	(31)
Nov					0.75	(30)			19.44	(20)			0.00	(19)			13.84	(30)
Dec	26.30	(6)			0.00	(29)			19.93	(31)							13.45	(29)

Table 10. continued,

	Hogback Canal		APS Four Corners Units 4 & 5 *		Jewett Valley Ditch		PNM San Juan Generating Station *		Fruitland Irrigation Canal		Williams Field-Kutz Plant		Hammond Conservancy District		Turley-Manzanares Ditch		Bloomfield Irrigation District	
RM Distance from Lake Powell	158.7		163.7		166.3		166.7		178.4		195.6		209.3		214.4		217.8	
Nearest Gage	09368000		09368000		09365000		09365000		09365000		09365000		09355500		09355500		09355500	
RM to Gage	10.7		15.7		13.7		13.3		1.6		15.6		9.3		4.2		0.8	
2013		(202)				(310)				(317)				(226)				(365)
Jan	18.32	(5)			0.00	(31)			20.83	(31)							13.28	(31)
Feb	27.12	(3)			0.00	(28)			20.40	(26)							12.68	(28)
Mar					0.00	(31)			22.73	(12)							13.38	(31)
Apr	20.79	(16)			0.22	(30)			10.20	(21)			10.53	(16)			15.71	(30)
May	13.02	(31)			0.68	(31)			7.17	(31)			26.43	(31)			53.72	(31)
Jun	24.30	(30)			0.02	(22)			13.34	(30)			19.66	(30)			40.67	(30)
Jul	24.03	(31)			1.50	(31)			11.19	(30)			10.26	(31)			23.42	(31)
Aug	18.66	(30)			3.97	(31)			12.09	(29)			11.66	(31)			26.67	(31)
Sep	12.12	(24)			2.12	(30)			8.77	(23)			18.19	(30)			40.04	(30)
Oct	18.70	(29)			2.70	(31)			12.14	(31)			14.07	(31)			43.88	(31)
Nov	14.24	(3)			0.75	(14)			17.55	(26)			0.00	(26)			18.61	(30)
Dec									21.39	(27)							19.74	(31)
2014		(196)				(231)				(268)				(189)				(360)
Jan			0.03						23.49	(29)							18.92	(26)
Feb			0.04						21.66	(24)							18.59	(28)
Mar			0.04						21.49	(10)							18.12	(31)
Apr	11.00	(25)	0.04		2.60	(23)			8.98	(28)			24.70	(17)			40.42	(30)
May	10.88	(20)	0.02		2.26	(31)			7.28	(23)			29.08	(31)			59.63	(31)
Jun	6.20	(30)	0.02		1.76	(30)			5.37	(28)			23.96	(30)			49.68	(30)
Jul	14.90	(30)	0.04		2.82	(31)			9.88	(26)			19.27	(31)			39.11	(31)
Aug	15.26	(30)	0.07		3.29	(31)			8.86	(22)			12.88	(31)			30.68	(31)
Sep	15.90	(29)	0.03		3.51	(30)			9.89	(25)			15.19	(30)			32.58	(30)
Oct	11.08	(25)	0.04		3.01	(22)			9.47	(25)			16.53	(19)			40.72	(31)
Nov	9.23	(7)	0.03		0.20	(19)			17.26	(15)							17.72	(30)
Dec			0.03		0.00	(14)			20.18	(13)							17.67	(31)
2015		(101)				(234)				(125)				(214)				(322)
Jan			0.03		0.00	(29)			21.64	(19)							17.20	(31)
Feb			0.02		0.00	(24)			18.92	(20)							17.61	(28)
Mar			0.01		0.00	(27)			14.68	(23)							16.93	(31)
Apr	17.56	(11)	0.05		4.99	(30)			11.30	(26)			17.70	(12)			34.19	(30)
May	6.91	(31)	0.03		2.70	(31)			7.06	(15)			22.32	(31)			44.19	(31)
Jun	2.54	(30)	0.01		0.90	(30)			0.54	(3)			21.06	(30)			45.09	(30)
Jul	8.70	(27)	0.02		2.40	(30)			8.14	(14)			19.11	(31)			43.24	(31)
Aug	5.60	(2)	0.03		2.26	(31)			9.00	(3)			12.21	(31)			29.56	(31)
Sep			0.02		3.24	(2)			13.55	(2)			13.62	(30)			30.16	(30)
Oct													7.09	(31)			26.14	(31)
Nov													17.70	(18)			10.59	(18)
Dec																		

* Diversion data provided by APS and PNM were monthly and annual total volumes, not daily means, therefore the number of days of diversion is not known.

Table 11. Estimated mean daily percentage of the Animas River diverted by year (2005–2015), calculated only on days diversion occurred (days of diversion in parenthesis).

	Farmers Mutual Ditch	Willet Ditch	North Farmington Ditch	Farmington-Echo-Allen Ditch	Farmington Animas Pump Stn No. 2	Ranchmans Ditch	Halford-Independent Ditch	Kello-Blancett Ditch
RM Distance to San Juan confluence	0.4	3.5	4.6	6.1	9.5	10.8	15.3	16.8
Nearest Gage	09364500	09364500	09364500	09364500	09364010	09364010	09364010	09364010
RM to Gage	1.0	2.1	3.2	3.2	6.0	4.7	0.2	1.3
Year								
2005	0.54 (217)	0.29 (334)	0.85 (204)	4.74 (264)	1.44 (365)	0.60 (190)	10.53 (224)	1.57 (212)
2006	0.64 (237)	0.36 (348)	1.14 (235)	6.37 (266)	1.11 (365)	1.02 (249)	4.84 (227)	1.77 (208)
2007	0.57 (204)	0.29 (327)	0.95 (255)	4.55 (258)	1.15 (365)	0.87 (268)	4.74 (227)	1.50 (217)
2008	0.66 (285)	0.22 (355)	1.24 (225)	4.95 (273)	1.27 (366)	0.99 (217)	5.55 (212)	1.76 (256)
2009	1.21 (215)	0.23 (336)	3.10 (305)	14.66 (281)	1.63 (365)	2.68 (214)	11.28 (198)	5.59 (219)
2010	0.99 (228)	0.25 (363)	2.04 (314)	11.74 (248)	1.58 (365)	2.04 (265)	9.51 (255)	4.38 (193)
2011					2.42 (365)			
2012	42.93 (182)		4.44 (229)	32.02 (164)	2.40 (366)	5.57 (223)	13.26 (261)	8.92 (244)
2013	35.17 (252)		1.25 (350)	17.91 (237)	3.96 (365)	3.13 (280)	5.60 (319)	5.68 (224)
2014	17.07 (227)		0.57 (365)	6.63 (264)	1.95 (365)	1.78 (305)	3.35 (243)	2.71 (205)
2015	16.04 (245)		0.90 (322)	7.92 (232)	2.12 (322)	0.84 (213)	4.01 (240)	2.17 (246)

	Eledge Ditch	Farmers Irrigation District	Lower Animas Ditch	Sargent Ditch	Aztec Ditch	Stacey Ditch	Graves-Atterberry (Inca) Ditch	Cedar Ditch
RM Distance to San Juan confluence	19.8	21.4	21.8	24.6	27.4	29.6	31.7	33.8
Nearest Gage	09364010	09364010	09364010	09364010	09364010	09363500	09363500	09355500
RM to Gage	4.3	5.9	6.3	9.1	11.9	10.2	8.1	6.0
Year								
2005	2.22 (221)	0.22 (232)	0.22 (216)	0.62 (162)	4.41 (253)		0.11 (131)	0.14 (176)
2006	3.08 (207)	0.29 (294)	0.19 (264)	0.80 (173)	5.47 (270)	0.99 (221)	0.09 (209)	0.11 (166)
2007	3.60 (195)	8.19 (259)	0.20 (244)	0.91 (132)	5.55 (193)	0.58 (249)	0.08 (191)	0.12 (174)
2008	4.18 (200)	8.40 (250)	0.24 (257)	0.84 (170)	5.15 (264)		0.11 (198)	0.13 (191)
2009	7.26 (271)	20.75 (269)	0.53 (256)	1.83 (180)	13.68 (244)	6.34 (8)	0.16 (213)	0.19 (188)
2010	5.30 (308)	10.2 (225)	0.47 (216)	1.67 (159)	11.15 (261)	3.75 (76)	0.15 (175)	0.16 (176)
2011				0.00 (1)	2.91 (1)	0.00 (1)	0.00 (1)	0.00 (1)
2012	16.76 (187)	19.75 (285)	16.86 (344)	2.46 (321)	17.62 (335)	5.33 (318)	3.73 (322)	2.46 (147)
2013	9.64 (230)	13.64 (344)	15.50 (318)	2.36 (257)	12.83 (347)	4.20 (266)	4.14 (279)	0.71 (255)
2014	3.97 (217)	6.84 (283)	6.85 (259)	1.02 (264)	6.93 (303)	1.78 (329)	2.00 (339)	1.24 (259)
2015	4.59 (219)	9.52 (231)	7.11 (254)	1.07 (246)	9.34 (214)	3.25 (239)	2.97 (240)	1.26 (240)

	Ralston Ditch	Twin Rock Ditch	Citizens-Animas Ditch	Cason Ditch	East Mesa Ditch	USBR ALP Nighthorse Diversion	Durango Santa Rita Diversion
RM Distance to San Juan confluence	38.1	39.7	48.0	53.5	55.1	59.8	60.2
Nearest Gage	09363500	09363500	09363500	09362520	09362520	09361500	09361500
RM to Gage	1.7	0.1	8.2	6.2	4.6	1.7	1.3
Year							
2005	4.00 (170)	1.01 (198)	3.91 (283)				
2006	3.70 (178)	1.02 (258)	3.37 (310)				
2007	2.89 (183)	1.07 (325)	3.01 (308)				
2008	2.60 (200)	1.39 (284)	3.65 (326)	0.19 (139)	3.09 (177)		
2009	3.90 (217)	2.52 (215)	6.29 (238)	0.31 (95)	4.48 (183)	3.29 (94)	
2010	2.63 (189)	2.15 (206)	5.54 (276)	0.21 (95)	4.05 (171)	11.18 (288)	
2011	0.00 (1)	2.10 (205)	4.66 (273)	0.11 (137)	2.84 (177)	23.32 (188)	
2012	3.12 (326)	3.46 (210)	6.04 (360)	0.27 (186)	4.98 (187)		0.08 (n/a)
2013	2.51 (286)	2.25 (207)	5.39 (335)	0.14 (166)	3.58 (179)		0.08 (n/a)
2014	1.54 (361)	1.89 (165)	4.65 (221)	0.17 (147)	3.03 (160)	0.90 (61)	0.03 (n/a)
2015	2.78 (296)					0.35 (36)	0.01 (n/a)

Table 12. Estimated mean daily percentage of the Animas River diverted by month (2005–2015), calculated only on days diversion occurred (days of diversion in parenthesis).

	Farmers Mutual Ditch		Willet Ditch		North Farmington Ditch		Farmington-Echo-Allen Ditch		Farmington Animas Pump Stn 2		Ranchmans Ditch		Halford-Independent Ditch		Kello-Blancett Ditch		Eledge Ditch	
RM Distance from Lake Powell	0.4		3.5		4.6		6.1		9.5		10.8		15.3		16.8		19.8	
Nearest Gage	09364500		09364500		09364500		09364500		09364010		09364010		09364010		09364010		09364010	
RM to Gage	1.0		2.1		3.2		3.2		6.0		4.7		0.2		1.3		4.3	
2005		(217)		(334)		(204)		(264)		(365)		(190)		(224)		(212)		(221)
Jan			0.45	(28)			1.68	(20)	2.40	(31)								
Feb			0.38	(19)	0.23	(5)	0.35	(9)	1.90	(28)								
Mar	0.37	(7)	0.27	(31)	0.66	(22)	0.59	(14)	1.56	(31)	0.39	(18)	3.22	(15)				
Apr	0.19	(24)	0.11	(28)	0.30	(26)	1.15	(26)	1.38	(30)	0.39	(26)	2.57	(28)	0.36	(15)	0.91	(27)
May	0.08	(20)	0.04	(18)	0.23	(17)	0.93	(18)	0.33	(31)	0.19	(17)	1.93	(18)	0.31	(21)	0.55	(18)
Jun	0.11	(30)	0.09	(30)	0.26	(30)	1.53	(30)	0.06	(30)	0.25	(30)	2.44	(30)	0.51	(30)	1.08	(30)
Jul	0.30	(21)	0.18	(31)	0.49	(27)	3.99	(31)	0.00	(31)	0.79	(31)	6.73	(31)	1.45	(31)	2.10	(31)
Aug	0.82	(31)	0.31	(31)	1.24	(31)	9.01	(31)	0.67	(31)	0.89	(30)	12.36	(31)	2.50	(31)	4.73	(31)
Sep	1.37	(30)	0.46	(30)	2.60	(30)	19.5	(30)	3.08	(30)	1.19	(26)	31.51	(30)	4.81	(30)	5.80	(30)
Oct	0.49	(28)	0.34	(28)	0.65	(13)	3.41	(28)	2.26	(31)	0.38	(12)	12.71	(28)	0.89	(28)	1.13	(28)
Nov	0.71	(26)	0.33	(29)			1.09	(27)	3.73	(30)			18.27	(13)	0.56	(26)	0.25	(26)
Dec			0.48	(31)	0.22	(3)			0.00	(31)								
2006		(237)		(348)		(235)		(266)		(365)		(249)		(227)		(208)		(207)
Jan	0.00	(1)	0.44	(30)			1.84	(2)	4.09	(31)								
Feb			0.61	(28)	2.54	(1)			0.03	(28)								
Mar	0.76	(3)	0.46	(31)	1.68	(31)	6.52	(17)	0.00	(31)			3.03	(18)			0.50	(7)
Apr	0.50	(29)	0.30	(30)	0.93	(28)	5.60	(30)	0.00	(30)	0.85	(24)	4.13	(30)	0.99	(21)	1.71	(30)
May	0.17	(31)	0.14	(31)	0.19	(11)	2.28	(31)	0.62	(31)	0.53	(31)	2.18	(31)	0.88	(31)	1.24	(31)
Jun	0.37	(30)	0.25	(30)	0.94	(29)	5.82	(30)	2.27	(30)	0.97	(30)	3.77	(30)	1.65	(30)	2.50	(30)
Jul	0.87	(31)	0.40	(31)	1.87	(31)	13.32	(31)	4.05	(31)	1.66	(31)	10.22	(31)	3.40	(31)	6.02	(31)
Aug	0.62	(31)	0.36	(31)	1.49	(31)	10.35	(31)	2.05	(31)	1.86	(31)	6.46	(31)	2.59	(31)	4.45	(31)
Sep	0.69	(30)	0.38	(30)	1.31	(30)	10.92	(30)	0.00	(30)	1.69	(30)	6.95	(26)	2.36	(30)	4.00	(30)
Oct	0.31	(27)	0.21	(31)	0.46	(28)	2.30	(31)	0.00	(31)	0.26	(30)	1.40	(30)	0.46	(31)	1.40	(17)
Nov	1.74	(23)	0.35	(29)	0.23	(8)	1.16	(29)	0.00	(30)	0.63	(29)			0.02	(3)		
Dec	3.41	(1)	0.53	(16)	0.11	(7)	0.03	(4)	0.00	(31)	0.11	(13)						
2007		(204)		(327)		(255)		(258)		(365)		(268)		(227)		(217)		(195)
Jan			0.47	(22)	0.47	(14)			0.02	(31)					0.01	(7)		
Feb			0.44	(9)	0.44	(7)			1.75	(28)	0.06	(8)						
Mar	0.40	(2)	0.29	(31)	0.29	(31)	1.11	(15)	3.42	(31)	0.71	(27)	4.49	(5)			1.21	(3)
Apr	1.14	(7)	0.21	(30)	0.21	(30)	3.80	(26)	0.59	(30)	0.75	(28)	3.99	(30)	1.05	(18)	2.98	(30)
May	0.12	(28)	0.10	(31)	0.10	(24)	1.54	(31)	0.00	(31)	0.23	(28)	2.60	(31)	0.72	(31)	1.13	(29)
Jun	0.15	(30)	0.13	(30)	0.13	(30)	2.03	(30)	0.31	(30)	0.51	(30)	2.45	(30)	0.77	(30)	1.38	(30)
Jul	0.55	(31)	0.37	(31)	0.37	(31)	7.09	(31)	1.66	(31)	0.91	(31)	5.34	(31)	1.86	(31)	3.62	(31)
Aug	0.67	(21)	0.39	(21)	0.39	(20)	9.86	(21)	1.55	(31)	1.03	(20)	7.12	(21)	2.87	(21)	5.22	(23)
Sep	0.97	(30)	0.39	(30)	0.39	(29)	10.32	(30)	3.77	(30)	1.88	(29)	9.04	(30)	3.42	(30)	8.19	(30)
Oct	0.58	(30)	0.26	(31)	0.26	(30)	3.99	(31)	0.79	(31)	1.14	(29)	5.40	(31)	1.02	(31)	3.02	(19)
Nov	0.85	(25)	0.33	(30)	0.33	(6)	2.76	(30)	0.00	(30)	1.15	(27)	2.69	(5)	0.54	(18)		
Dec			0.29	(31)	0.29	(3)	0.56	(13)	0.00	(31)	0.30	(11)	1.00	(13)				
2008		(285)		(355)		(225)		(273)		(366)	(217)			(212)		(256)		(200)
Jan			0.32	(29)	0.14	(2)			1.28	(31)			0.21	(1)	0.06	(12)		
Feb	0.00	(12)	0.31	(27)					1.45	(29)					0.35	(13)		
Mar	0.13	(6)	0.17	(31)	0.04	(3)	0.92	(18)	2.16	(31)	0.13	(1)						
Apr	0.25	(30)	0.22	(30)	0.33	(10)	1.86	(30)	0.08	(30)	0.34	(29)	3.06	(26)	0.64	(26)	1.26	(28)
May	0.12	(31)	0.11	(31)	0.23	(25)	1.65	(31)	0.64	(31)	0.37	(31)	1.79	(31)	0.67	(31)	1.16	(31)
Jun	0.10	(30)	0.06	(30)	0.22	(30)	1.43	(30)	0.43	(30)	0.45	(30)	1.13	(30)	0.45	(30)	0.83	(30)
Jul	0.25	(31)	0.15	(29)	0.63	(31)	3.61	(28)	0.98	(31)	0.98	(31)	3.33	(28)	1.29	(29)	2.30	(31)
Aug	0.98	(31)	0.30	(31)	2.50	(31)	9.56	(31)	2.42	(31)	2.12	(14)	8.31	(31)	4.03	(31)	7.34	(31)
Sep	1.15	(30)	0.27	(30)	2.88	(30)	15.52	(30)	2.91	(30)	1.60	(30)	10.68	(30)	4.21	(30)	9.89	(30)
Oct	1.11	(31)	0.34	(31)	1.93	(31)	8.91	(31)	2.86	(31)	2.23	(31)	9.85	(31)	2.66	(31)	7.65	(19)
Nov	1.35	(30)	0.21	(30)	0.69	(26)	1.51	(30)	0.00	(30)	0.11	(20)	7.70	(4)	0.98	(23)		
Dec	1.09	(23)	0.19	(26)	0.13	(6)	0.06	(14)	0.00	(31)								

Table 12. continued.

	Farmers Mutual Ditch		Willet Ditch		North Farmington Ditch		Farmington-Echo-Allen Ditch		Farmington Animas Pump Stn 2		Ranchmans Ditch		Halford-Independent Ditch		Kello-Blancett Ditch		Eledge Ditch	
RM Distance from Lake Powell	0.4		3.5		4.6		6.1		9.5		10.8		15.3		16.8		19.8	
Nearest Gage	09364500		09364500		09364500		09364500		09364010		09364010		09364010		09364010		09364010	
RM to Gage	1.0		2.1		3.2		3.2		6.0		4.7		0.2		1.3		4.3	
2009		(215)		(336)		(305)		(281)		(365)		(214)		(198)		(219)		(271)
Jan	0.12	(3)	0.16	(30)	0.80	(5)			0.00	(31)					0.07	(1)		
Feb			0.26	(28)	0.21	(8)	2.25	(13)	1.92	(28)								
Mar	0.51	(4)	0.20	(31)	0.31	(23)	1.83	(31)	4.15	(31)							1.22	(4)
Apr	0.59	(30)	0.18	(30)	0.75	(26)	4.96	(30)	2.90	(30)	1.10	(29)	3.04	(25)	0.97	(15)	3.26	(30)
May	0.11	(31)	0.06	(31)	0.25	(31)	1.25	(31)	0.20	(31)	0.27	(31)	1.21	(31)	0.53	(31)	0.84	(31)
Jun	0.24	(21)	0.14	(30)	0.67	(30)	3.82	(30)	0.55	(30)	1.03	(30)	3.65	(30)	1.42	(30)	2.74	(30)
Jul	1.27	(31)	0.19	(16)	3.70	(30)	21.05	(31)	4.49	(31)	2.93	(31)	10.10	(30)	5.20	(31)	7.68	(31)
Aug	2.62	(31)	0.36	(20)	8.20	(31)	42.27	(31)	3.65	(31)	5.63	(31)	19.84	(31)	13.22	(30)	21.41	(31)
Sep	2.27	(30)	0.37	(28)	9.65	(30)	43.35	(30)	1.65	(30)	4.73	(29)	25.68	(29)	9.65	(29)	20.93	(30)
Oct	1.39	(31)	0.36	(31)	5.03	(31)	14.27	(31)	0.00	(31)	3.32	(30)	15.81	(22)	8.75	(31)	9.46	(23)
Nov	0.29	(3)	0.36	(30)	1.76	(30)	1.06	(23)	0.00	(30)	0.20	(3)			2.73	(15)	0.20	(30)
Dec			0.20	(31)	0.69	(30)			0.00	(31)					0.01	(6)	0.11	(31)
2010		(228)		(363)		(314)		(248)		(365)		(265)		(255)		(193)		(308)
Jan			0.18	(31)	0.58	(31)			0.00	(31)					0.50	(12)	0.05	(10)
Feb			0.12	(28)	0.68	(28)			0.49	(28)					0.06	(1)	0.09	(27)
Mar	0.88	(13)	0.21	(31)	0.67	(31)	1.98	(2)	3.84	(31)			0.06	(2)			0.12	(25)
Apr	0.64	(30)	0.23	(30)	1.04	(30)	3.73	(30)	1.88	(30)	0.54	(20)	4.06	(30)	0.91	(14)	2.13	(21)
May	0.25	(31)	0.14	(29)	0.73	(31)	3.33	(31)	0.78	(31)	0.43	(31)	2.39	(31)	1.69	(12)	2.06	(31)
Jun	0.41	(30)	0.18	(30)	1.24	(30)	6.96	(30)	1.01	(30)	0.68	(30)	4.48	(30)	3.00	(16)	3.45	(30)
Jul	1.67	(31)	0.34	(31)	7.07	(29)	26.53	(31)	7.29	(31)	2.85	(31)	21.30	(31)	9.76	(31)	17.60	(31)
Aug	0.82	(31)	0.35	(31)	2.21	(27)	8.16	(31)	2.61	(31)	1.48	(31)	7.41	(31)	2.36	(31)	7.18	(31)
Sep	1.53	(30)	0.42	(30)	3.93	(28)	22.86	(30)	0.86	(30)	5.67	(30)	19.08	(30)	7.20	(30)	15.03	(30)
Oct	1.65	(31)	0.43	(31)	3.43	(31)	21.22	(31)	0.00	(31)	3.92	(31)	14.83	(31)	4.16	(31)	5.91	(31)
Nov	0.24	(1)	0.24	(30)	0.54	(18)	2.49	(26)	0.00	(30)	1.63	(30)	5.33	(30)	2.59	(15)	0.30	(19)
Dec			0.16	(31)			0.03	(6)	0.00	(31)	0.70	(31)	1.49	(9)			0.23	(22)
2011										(365)								
Jan									1.38	(31)								
Feb									1.03	(28)								
Mar									3.60	(31)								
Apr									5.27	(30)								
May									3.08	(31)								
Jun									0.05	(30)								
Jul									0.00	(31)								
Aug									3.63	(31)								
Sep									7.45	(30)								
Oct									3.48	(31)								
Nov									0.00	(30)								
Dec									0.06	(31)								
2012		(182)				(229)		(164)		(366)		(223)		(261)		(244)		(187)
Jan									0.00	(31)								
Feb									0.00	(29)								
Mar									2.21	(31)								
Apr	11.41	(13)			0.51	(5)			0.20	(30)	0.65	(26)	2.38	(26)	1.21	(26)	2.92	(12)
May	8.36	(30)			0.73	(30)	3.55	(8)	0.99	(31)	0.57	(30)	2.21	(30)	1.46	(30)	2.23	(30)
Jun	39.16	(26)			4.14	(24)	20.04	(24)	4.39	(30)	2.33	(24)	7.27	(24)	6.02	(24)	7.78	(24)
Jul	51.01	(31)			5.44	(31)	23.51	(30)	9.45	(31)	3.52	(31)	8.92	(31)	7.23	(31)	11.88	(31)
Aug	46.97	(31)			6.28	(31)	35.88	(31)	4.11	(31)	7.21	(31)	16.39	(31)	14.26	(31)	19.92	(31)
Sep	145.55	(17)			9.19	(25)	62.59	(29)	2.75	(30)	14.55	(30)	22.52	(30)	22.69	(30)	38.70	(28)
Oct	59.00	(15)			8.91	(31)	33.84	(31)	1.42	(31)	9.48	(31)	54.30	(31)	17.09	(31)	25.86	(30)
Nov	0.00	(19)			0.99	(23)	5.48	(11)	1.39	(30)	4.49	(20)	0.46	(30)	2.49	(30)	0.17	(1)
Dec					0.00	(29)			1.66	(31)			0.00	(28)	0.49	(11)		

Table 12. continued.

	Farmers Mutual Ditch		Willet Ditch		North Farmington Ditch		Farmington-Echo-Allen Ditch		Farmington Animas Pump Stn 2		Ranchmans Ditch		Halford-Independent Ditch		Kello-Blancett Ditch		Eledge Ditch	
RM Distance from Lake Powell	0.4		3.5		4.6		6.1		9.5		10.8		15.3		16.8		19.8	
Nearest Gage	09364500		09364500		09364500		09364500		09364010		09364010		09364010		09364010		09364010	
RM to Gage	1.0		2.1		3.2		3.2		6.0		4.7		0.2		1.3		4.3	
2013		(252)				(350)		(237)		(365)		(280)		(319)		(224)		(230)
Jan					0.00	(31)			2.39	(31)			0.00	(31)				
Feb					0.00	(28)			6.02	(28)			0.00	(28)				
Mar	19.62	(24)			0.01	(30)	2.83	(5)	7.31	(31)	4.20	(5)	0.00	(31)	0.60	(5)		
Apr	69.15	(30)			2.60	(30)	22.66	(30)	9.58	(30)	4.80	(30)	9.49	(30)	4.13	(30)	12.43	(28)
May	9.78	(31)			0.86	(31)	3.23	(31)	0.00	(31)	0.93	(31)	2.14	(31)	1.36	(31)	2.12	(31)
Jun	12.46	(30)			3.66	(16)	17.19	(30)	0.00	(30)	3.60	(30)	5.10	(27)	6.38	(30)	9.08	(30)
Jul	112.81	(31)			4.58	(31)	69.72	(31)	12.96	(31)	10.6	(31)	28.31	(29)	20.87	(31)	33.35	(31)
Aug	35.42	(31)			1.88	(31)	15.19	(31)	5.06	(31)	1.93	(31)	8.49	(31)	4.04	(31)	8.20	(31)
Sep	20.69	(30)			0.97	(30)	7.93	(21)	3.51	(30)	1.30	(30)	5.23	(30)	2.91	(30)	5.09	(30)
Oct	13.72	(31)			0.83	(31)	3.69	(31)	0.74	(31)	1.16	(31)	1.85	(31)	1.50	(31)	2.78	(31)
Nov	0.00	(14)			0.54	(30)	0.88	(24)	0.00	(30)	1.49	(30)	0.00	(20)	1.16	(5)	0.21	(18)
Dec					0.11	(31)	0.22	(3)	0.01	(31)	2.14	(31)						
2014		(227)				(365)		(264)		(365)		(305)		(243)		(205)		(217)
Jan					0.15	(31)			0.00	(31)	2.98	(31)						
Feb					0.07	(28)	0.31	(6)	3.45	(28)	2.36	(28)						
Mar	11.35	(7)			0.03	(31)	3.01	(19)	5.24	(31)	1.88	(31)	0.00	(5)				
Apr	17.76	(30)			0.33	(30)	5.71	(30)	3.26	(30)	1.32	(30)	1.67	(30)	1.40	(16)	3.72	(30)
May	7.25	(31)			0.57	(31)	3.16	(31)	1.66	(31)	0.62	(31)	1.89	(31)	1.44	(31)	2.18	(31)
Jun	5.38	(30)			0.28	(30)	2.45	(30)	0.78	(30)	0.44	(30)	1.27	(30)	1.03	(30)	1.42	(30)
Jul	21.42	(31)			1.05	(31)	9.53	(31)	0.82	(31)	1.56	(31)	4.85	(31)	3.56	(31)	5.40	(31)
Aug	31.90	(31)			1.11	(31)	15.81	(31)	1.51	(31)	2.63	(31)	8.72	(29)	4.95	(31)	6.55	(29)
Sep	31.71	(30)			1.50	(30)	14.93	(29)	1.73	(30)	2.77	(30)	6.76	(30)	5.66	(30)	7.26	(30)
Oct	8.75	(31)			0.61	(31)	2.84	(31)	0.30	(31)	1.22	(27)	1.94	(31)	0.68	(31)	2.03	(31)
Nov	0.01	(6)			1.12	(30)	1.62	(26)	3.03	(30)	1.73	(5)	0.05	(26)	0.77	(5)	0.21	(5)
Dec					0.05	(31)			1.83	(31)								
2015		(245)				(322)		(232)		(322)		(213)		(240)		(246)		(219)
Jan					0.04	(31)			4.43	(31)								
Feb					0.06	(28)			3.35	(28)								
Mar	0.00	(13)			0.15	(31)	1.25	(13)	4.19	(31)			0.00	(14)	0.14	(14)		
Apr	20.46	(30)			1.43	(30)	9.88	(30)	1.75	(30)	0.78	(11)	5.65	(30)	1.75	(30)	6.48	(25)
May	6.68	(31)			0.41	(31)	3.46	(31)	0.71	(31)	0.30	(31)	1.93	(31)	1.35	(31)	2.13	(31)
Jun	1.90	(30)			0.06	(30)	0.90	(30)	0.32	(30)	0.21	(30)	0.63	(30)	0.34	(30)	0.53	(30)
Jul	8.93	(31)			0.64	(31)	3.57	(31)	1.16	(31)	0.63	(31)	2.17	(31)	1.51	(31)	1.97	(31)
Aug	23.51	(31)			2.43	(31)	19.00	(24)	2.68	(31)	2.68	(31)	7.75	(31)	4.99	(31)	9.98	(29)
Sep	37.05	(30)			2.63	(30)	17.07	(30)	3.93	(30)	0.70	(30)	9.92	(30)	4.69	(30)	8.85	(30)
Oct	25.50	(31)			1.61	(31)	9.72	(31)	0.00	(31)	0.70	(31)	3.46	(31)	2.34	(31)	4.57	(31)
Nov	8.03	(18)			0.11	(18)	0.93	(12)	0.00	(18)		(18)	0.20	(12)	0.74	(18)	0.39	(12)
Dec																		

Table 12. continued.

	Farmers Irrigation District		Lower Animas Ditch		Sargent Ditch		Aztec Ditch		Stacey Ditch		Graves-Atterberry (Inca) Ditch		Cedar Ditch		Ralston Ditch		Twin Rock Ditch	
RM Distance from Lake Powell	21.4		21.8		24.6		27.4		29.6		31.7		33.8		38.1		39.7	
Nearest Gage	09364010		09364010		09364010		09364010		09363500		09363500		09363500		09363500		09363500	
RM to Gage	5.9		6.3		9.1		11.9		10.2		8.1		6.0		1.7		0.1	
2005		(232)		(216)		(162)		(253)				(131)		(176)		(170)		(198)
Jan																		
Feb																		
Mar	0.15	(10)					2.67	(3)									0.00	(1)
Apr	0.07	(27)	0.03	(22)	0.12	(11)	1.40	(29)			0.03	(11)			0.28	(9)	0.37	(5)
May	0.03	(18)	0.03	(18)	0.11	(17)	1.04	(18)			0.04	(1)	0.02	(15)	0.61	(17)	0.30	(31)
Jun	0.05	(30)	0.05	(30)	0.21	(30)	1.60	(30)					0.03	(30)	0.68	(30)	0.31	(30)
Jul	0.14	(31)	0.16	(31)	0.69	(31)	4.12	(28)			0.07	(26)	0.09	(30)	1.77	(31)	0.91	(31)
Aug	0.37	(31)	0.34	(31)	1.54	(31)	9.79	(27)			0.12	(31)	0.23	(31)	5.94	(31)	1.65	(31)
Sep	0.60	(30)	0.55	(30)	0.67	(29)	13.44	(30)			0.19	(30)	0.31	(30)	10.65	(30)	2.11	(30)
Oct	0.19	(28)	0.21	(28)	0.22	(13)	2.36	(28)			0.08	(28)	0.11	(28)	3.98	(22)	0.97	(31)
Nov	0.26	(27)	0.28	(26)			2.26	(29)			0.06	(4)	0.07	(12)			0.83	(8)
Dec							2.75	(31)										
2006		(294)		(264)		(173)		(270)		(221)		(209)		(166)		(178)		(258)
Jan	0.01	(3)					4.05	(30)										
Feb	0.23	(17)	0.04	(5)			5.69	(28)										
Mar	0.44	(20)	0.18	(27)			1.58	(12)									0.00	(2)
Apr	0.53	(30)	0.14	(30)	0.31	(12)	2.78	(21)			0.07	(13)			1.61	(16)	0.66	(11)
May	0.10	(31)	0.08	(31)	0.28	(31)	2.57	(31)	0.40	(28)	0.05	(31)	0.06	(21)	1.32	(31)	0.54	(31)
Jun	0.19	(30)	0.16	(30)	0.63	(30)	4.81	(30)	0.68	(29)	0.08	(30)	0.10	(30)	3.37	(30)	1.01	(30)
Jul	0.46	(31)	0.36	(31)	1.12	(28)	11.78	(31)	1.21	(31)	0.13	(31)	0.18	(29)	8.51	(31)	1.85	(31)
Aug	0.37	(31)	0.28	(31)	1.06	(31)	8.08	(31)	1.07	(31)	0.11	(31)	0.14	(29)	3.01	(31)	1.44	(31)
Sep	0.37	(30)	0.31	(30)	1.27	(30)	8.19	(30)	1.13	(30)	0.12	(30)	0.12	(30)	3.78	(30)	1.64	(30)
Oct	0.12	(31)	0.11	(21)	0.44	(11)	1.32	(26)	0.60	(31)	0.05	(31)	0.04	(27)	2.32	(9)	0.39	(31)
Nov	0.20	(29)	0.11	(28)					1.38	(28)	0.05	(12)					0.59	(30)
Dec	0.05	(11)							2.01	(13)							0.90	(31)
2007		(259)		(244)		(132)		(193)		(249)		(191)		(174)		(183)		(325)
Jan									2.44	(16)							1.04	(31)
Feb									2.31	(9)							0.93	(28)
Mar	0.03	(19)	0.08	(19)					2.24	(12)							0.82	(14)
Apr	6.07	(17)	0.15	(30)	0.40	(3)	2.36	(22)	0.23	(27)	0.06	(6)			1.65	(13)	0.44	(7)
May	2.39	(30)	0.06	(31)	0.26	(31)	1.72	(31)	0.10	(29)	0.03	(31)	0.04	(18)	0.78	(31)	0.37	(31)
Jun	3.09	(30)	0.07	(30)	0.29	(30)	2.32	(30)	0.11	(30)	0.04	(30)	0.04	(30)	1.10	(30)	0.51	(30)
Jul	9.99	(31)	0.22	(31)	0.77	(20)	5.85	(31)	0.32	(31)	0.11	(31)	0.12	(31)	4.74	(31)	1.42	(31)
Aug	13.56	(24)	0.31	(21)	1.40	(16)	9.66	(21)	0.38	(21)	0.12	(21)	0.16	(21)	5.28	(24)	1.78	(31)
Sep	21.35	(30)	0.46	(30)	2.09	(30)	12.91	(30)	0.47	(30)	0.14	(30)	0.17	(30)	4.68	(30)	1.99	(30)
Oct	9.26	(31)	0.20	(29)	0.56	(2)	4.61	(27)	0.36	(31)	0.06	(30)	0.11	(31)	1.48	(24)	1.20	(31)
Nov	8.93	(30)	0.26	(23)					0.23	(13)	0.05	(12)	0.20	(13)			0.91	(30)
Dec	1.37	(17)					0.23	(1)									0.79	(31)
2008		(250)		(257)		(170)		(264)				(198)		(191)		(200)		(284)
Jan							0.61	(8)									1.04	(31)
Feb							0.02	(4)									1.09	(29)
Mar	0.28	(5)	0.06	(11)			0.58	(22)									0.52	(19)
Apr	3.99	(30)	0.09	(30)	0.12	(3)	1.14	(29)			0.04	(14)	0.03	(6)	0.80	(17)	0.48	(16)
May	2.48	(31)	0.06	(31)	0.26	(29)	1.58	(31)			0.03	(31)	0.04	(31)	0.68	(31)	0.47	(31)
Jun	1.78	(30)	0.05	(30)	0.16	(30)	1.21	(30)			0.02	(30)	0.03	(30)	0.48	(30)	0.36	(30)
Jul	5.18	(31)	0.13	(31)	0.47	(31)	4.08	(31)			0.06	(30)	0.06	(31)	2.00	(31)	0.82	(31)
Aug	8.13	(31)	0.45	(31)	1.34	(25)	13.47	(31)			0.15	(31)	0.19	(31)	5.11	(31)	2.61	(31)
Sep	19.77	(30)	0.60	(30)	1.91	(30)	13.13	(30)			0.19	(30)	0.23	(30)	4.46	(30)	3.03	(30)
Oct	18.28	(31)	0.55	(31)	1.14	(22)	9.71	(27)			0.22	(31)	0.23	(31)	3.91	(30)	2.65	(31)
Nov	9.24	(30)	0.12	(30)			1.38	(15)			0.05	(1)	0.15	(1)			2.04	(4)
Dec	0.00	(1)	0.02	(2)			0.58	(6)									0.00	(1)

Table 12. continued.

	Farmers Irrigation District		Lower Animas Ditch		Sargent Ditch		Aztec Ditch		Stacey Ditch		Graves-Atterberry (Inca) Ditch		Cedar Ditch		Ralston Ditch		Twin Rock Ditch	
RM Distance from Lake Powell	21.4		21.8		24.6		27.4		29.6		31.7		33.8		38.1		39.7	
Nearest Gage	09364010		09364010		09364010		09364010		09363500		09363500		09363500		09363500		09363500	
RM to Gage	5.9		6.3		9.1		11.9		10.2		8.1		6.0		1.7		0.1	
2009		(269)		(256)		(180)		(244)		(8)		(213)		(188)		(217)		(215)
Jan																		
Feb			0.01	(12)			4.05	(2)										
Mar	6.79	(26)	0.15	(30)			4.40	(4)										
Apr	7.74	(30)	0.18	(30)	0.25	(7)	2.91	(22)			0.06	(11)			2.68	(26)		
May	1.66	(30)	0.04	(29)	0.20	(31)	1.25	(31)			0.02	(31)	0.03	(27)	0.57	(26)	0.36	(17)
Jun	5.06	(30)	0.14	(26)	0.46	(28)	3.63	(30)			0.04	(30)	0.06	(30)	1.06	(30)	0.87	(30)
Jul	22.01	(31)	0.49	(31)	1.88	(31)	16.48	(31)	4.53	(1)	0.17	(31)	0.16	(31)	4.34	(31)	1.90	(31)
Aug	55.45	(31)	1.30	(31)	3.60	(30)	41.82	(31)	6.60	(7)	0.31	(31)	0.36	(31)	7.23	(31)	4.38	(31)
Sep	46.97	(30)	1.11	(30)	2.97	(29)	29.74	(26)			0.29	(30)	0.28	(29)	4.96	(30)	4.09	(30)
Oct	30.72	(31)	0.93	(31)	2.34	(24)	15.07	(28)			0.23	(31)	0.30	(24)	6.67	(31)	5.16	(31)
Nov	6.89	(30)	0.40	(6)			2.77	(30)			0.06	(18)	0.16	(16)	1.38	(12)	0.54	(30)
Dec							1.68	(9)									1.06	(15)
2010		(225)		(216)		(159)		(261)		(76)		(175)		(176)		(189)		(206)
Jan																		
Feb																		
Mar																	0.00	(1)
Apr	6.17	(25)	0.12	(17)	0.24	(9)	1.85	(18)	1.40	(12)	0.06	(12)			0.89	(13)		
May	4.15	(31)	0.10	(31)	0.32	(23)	2.77	(31)	0.79	(3)	0.05	(31)	0.04	(21)	0.81	(30)	0.34	(28)
Jun	6.87	(30)	0.16	(30)	0.54	(26)	5.75	(29)	2.47	(20)	0.07	(30)	0.08	(30)	1.22	(30)	0.85	(30)
Jul	33.87	(31)	0.87	(31)	2.81	(29)	30.83	(31)	5.60	(30)	0.18	(28)	0.16	(31)	4.30	(28)	2.65	(31)
Aug	13.25	(31)	0.32	(31)	1.56	(17)	11.19	(31)	4.42	(11)	0.15	(24)	0.16	(31)	2.70	(30)	2.18	(25)
Sep	10.09	(30)	0.87	(30)	4.23	(20)	22.25	(30)			0.26	(29)	0.23	(30)	3.34	(30)	4.20	(30)
Oct	1.39	(31)	0.82	(31)	1.63	(30)	14.26	(31)			0.25	(21)	0.22	(31)	4.35	(28)	3.65	(31)
Nov	0.00	(16)	0.21	(15)	0.10	(5)	3.73	(30)					0.05	(2)			1.10	(30)
Dec							3.36	(30)										
2011																		(205)
Jan																		
Feb																		
Mar																	0.00	(2)
Apr																	1.28	(7)
May																	1.43	(31)
Jun																	0.38	(30)
Jul																	1.28	(31)
Aug																	3.05	(31)
Sep																	3.21	(30)
Oct																	3.31	(31)
Nov																	3.02	(11)
Dec																		
2012		(285)		(344)		(321)		(335)		(318)		(322)		(147)		(326)		(210)
Jan			0.52	(22)	0.00	(22)	3.24	(22)	0.00	(22)	0.00	(22)	0.00	(22)	0.00	(22)		
Feb			0.00	(28)	0.00	(28)	3.25	(28)	0.00	(28)	0.00	(28)	0.00	(2)	0.00	(28)	0.00	(2)
Mar	0.33	(22)	0.49	(28)	0.00	(28)	2.02	(28)	0.52	(28)	0.00	(28)			0.00	(28)	0.00	(1)
Apr	3.87	(30)	5.03	(30)	0.60	(30)	3.00	(30)	1.95	(30)	1.75	(30)	0.00	(2)	0.43	(30)	0.45	(9)
May	2.81	(30)	4.62	(30)	0.43	(30)	3.76	(30)	1.80	(30)	2.22	(30)			1.06	(30)	0.99	(31)
Jun	15.82	(22)	20.05	(24)	1.69	(24)	15.81	(24)	5.14	(24)	3.86	(24)			2.61	(24)	1.83	(30)
Jul	23.35	(30)	23.66	(31)	3.13	(31)	25.14	(31)	8.83	(31)	5.59	(31)	4.63	(14)	3.99	(31)	3.56	(31)
Aug	51.11	(31)	38.49	(31)	6.14	(31)	43.22	(22)	9.78	(31)	8.63	(31)	3.45	(31)	5.41	(31)	4.43	(31)
Sep	79.79	(30)	60.42	(30)	8.49	(30)	68.34	(30)	13.87	(30)	12.02	(30)	3.98	(30)	10.35	(30)	5.44	(30)
Oct	11.31	(31)	38.08	(31)	5.65	(31)	34.81	(31)	11.59	(31)	6.11	(31)	2.28	(31)	9.95	(31)	5.46	(31)
Nov	1.39	(30)	2.78	(30)	0.06	(29)	5.09	(30)	3.59	(26)	0.00	(30)	0.00	(15)	0.00	(30)	4.02	(14)
Dec	0.11	(29)	0.00	(29)	0.02	(7)	3.14	(29)	0.00	(7)	0.00	(7)			0.00	(11)		

Table 12. continued.

	Farmers Irrigation District		Lower Animas Ditch		Sargent Ditch		Aztec Ditch		Stacey Ditch		Graves-Atterberry (Inca) Ditch		Cedar Ditch		Ralston Ditch		Twin Rock Ditch	
RM Distance from Lake Powell	21.4		21.8		24.6		27.4		29.6		31.7		33.8		38.1		39.7	
Nearest Gage	09364010		09364010		09364010		09364010		09363500		09363500		09363500		09363500		09363500	
RM to Gage	5.9		6.3		9.1		11.9		10.2		8.1		6.0		1.7		0.1	
2013		(344)		(318)		(257)		(347)		(266)		(279)		(255)		(286)		(207)
Jan	0.00	(31)	0.02	(29)			3.26	(31)										
Feb	0.00	(28)	0.04	(28)			3.28	(28)										
Mar	1.34	(31)	9.83	(31)	0.02	(11)	4.19	(17)	3.10	(11)	0.00	(11)	0.00	(11)	0.00	(11)	0.00	(1)
Apr	20.12	(30)	22.52	(30)	2.71	(30)	20.05	(30)	7.97	(28)	5.37	(30)	0.00	(30)	4.16	(30)	0.00	(3)
May	4.13	(31)	5.19	(31)	0.47	(31)	4.14	(31)	2.08	(26)	2.07	(31)	0.09	(31)	1.62	(31)	0.84	(17)
Jun	19.06	(30)	18.76	(30)	2.08	(30)	14.87	(30)	4.69	(30)	4.75	(30)	0.20	(30)	3.85	(30)	2.21	(30)
Jul	69.96	(31)	74.96	(31)	10.54	(30)	62.26	(31)	8.55	(31)	12.33	(31)	0.39	(31)	6.88	(31)	4.81	(31)
Aug	13.95	(31)	15.23	(31)	2.37	(31)	14.87	(31)	5.19	(31)	5.67	(31)	0.23	(31)	3.68	(31)	3.08	(31)
Sep	10.08	(30)	9.91	(30)	1.77	(30)	9.47	(30)	3.73	(30)	3.99	(30)	0.06	(22)	1.86	(30)	1.85	(30)
Oct	6.89	(31)	4.20	(31)	0.18	(31)	4.86	(31)	3.55	(31)	3.49	(31)	0.02	(31)	1.45	(31)	1.51	(31)
Nov	6.56	(30)	0.00	(16)	0.02	(30)	3.44	(30)	0.85	(19)	0.04	(26)	0.00	(30)	0.01	(30)	1.17	(30)
Dec	3.28	(10)			0.02	(3)	3.07	(27)	0.00	(29)	0.00	(28)	0.00	(8)	0.00	(31)	0.79	(3)
2014		(283)		(259)		(264)		(303)		(329)		(339)		(259)		(361)		(165)
Jan							3.53	(31)	0.00	(31)	0.00	(31)			0.00	(31)		
Feb							3.53	(28)	0.00	(28)	0.00	(28)			0.00	(28)		
Mar	3.10	(21)	5.34	(5)	0.00	(6)	4.23	(31)	0.00	(8)	0.03	(26)	0.00	(6)	0.43	(31)		
Apr	7.29	(30)	4.82	(30)	0.74	(30)	7.60	(30)	2.88	(30)	2.61	(30)	1.44	(30)	2.58	(30)	0.00	(1)
May	5.08	(31)	4.14	(31)	0.64	(31)	4.18	(31)	1.52	(31)	1.69	(31)	0.91	(31)	1.25	(31)	0.96	(26)
Jun	2.91	(30)	3.14	(30)	0.40	(30)	3.16	(25)	1.36	(30)	1.39	(30)	0.77	(30)	0.83	(30)	0.76	(30)
Jul	11.98	(31)	11.38	(31)	1.32	(27)	9.99	(31)	3.33	(31)	3.84	(31)	2.03	(31)	2.38	(31)	2.04	(31)
Aug	16.39	(31)	15.15	(31)	2.80	(31)	15.35	(31)	5.41	(31)	5.67	(31)	2.48	(30)	3.59	(31)	3.00	(31)
Sep	13.34	(30)	14.71	(30)	2.40	(30)	14.57	(30)	4.61	(30)	4.73	(30)	1.60	(30)	3.36	(30)	2.79	(30)
Oct	4.04	(31)	3.51	(31)	0.30	(31)	2.83	(30)	0.05	(31)	1.91	(31)	0.96	(31)	2.49	(31)	1.46	(16)
Nov	0.08	(30)	0.25	(30)	0.26	(30)	3.07	(5)	0.00	(30)	0.31	(30)	0.40	(30)	1.34	(30)		
Dec	0.00	(18)	0.00	(10)	0.27	(18)			0.00	(18)	0.00	(10)	0.00	(10)	0.00	(27)		
2015		(231)		(254)		(246)		(214)		(239)		(240)		(240)		(296)		
Jan															0.00	(5)		
Feb															0.00	(28)		
Mar			0.14	(22)	0.00	(14)	1.17	(8)	0.00	(14)	0.00	(14)	0.00	(14)	0.00	(31)		
Apr	6.82	(29)	7.83	(30)	1.03	(30)	8.36	(30)	2.95	(30)	3.47	(30)	1.11	(30)	1.78	(30)		
May	3.62	(31)	2.73	(31)	0.75	(31)	3.03	(31)	1.71	(31)	1.41	(31)	1.32	(31)	1.62	(31)		
Jun	1.16	(30)	1.15	(30)	0.16	(30)	0.98	(30)	0.59	(30)	0.56	(30)	0.30	(30)	0.41	(30)		
Jul	5.64	(31)	4.99	(31)	0.67	(31)	5.21	(31)	1.75	(31)	2.00	(31)	1.37	(31)	2.14	(31)		
Aug	20.62	(31)	21.8	(31)	2.18	(31)	27.27	(25)	4.67	(29)	4.45	(31)	2.66	(31)	3.90	(31)		
Sep	19.44	(30)	12.32	(30)	2.63	(30)	18.53	(30)	7.50	(30)	6.00	(30)	2.17	(30)	8.62	(30)		
Oct	11.91	(31)	7.98	(31)	1.04	(31)	7.45	(29)	6.46	(31)	4.68	(31)	0.98	(31)	7.13	(31)		
Nov	4.90	(18)	0.00	(18)	0.23	(18)			0.24	(13)	1.97	(12)	0.00	(12)	2.27	(18)		
Dec																		
Nov	9.24	(30)	0.12	(30)			1.38	(15)			0.05	(1)	0.15	(1)			2.04	(4)
Dec	0.00	(1)	0.02	(2)			0.58	(6)									0.00	(1)

Table 12. continued.

	Citizens-Animas Ditch		Cason Ditch		East Mesa Ditch		USBR ALP Nighthorse Diversion		Durango Santa Rita Diversion	
RM Distance to San Juan confluence	48.0		53.5		55.1		59.8		60.2	
Nearest Gage	09363500		09362520		09362520		09361500		09361500	
RM to Gage	8.2		6.2		4.6		1.7		1.3	
2005		(283)								
Jan	1.39	(25)								
Feb	0.00	(1)								
Mar	0.00	(1)								
Apr	0.25	(11)								
May	0.44	(31)								
Jun	0.93	(30)								
Jul	2.29	(31)								
Aug	4.19	(31)								
Sep	8.53	(30)								
Oct	5.56	(31)								
Nov	9.26	(30)								
Dec	3.85	(31)								
2006		(310)								
Jan	3.00	(31)								
Feb	2.93	(28)								
Mar	3.37	(9)								
Apr	0.95	(11)								
May	1.52	(31)								
Jun	2.68	(30)								
Jul	5.24	(31)								
Aug	4.49	(31)								
Sep	4.97	(30)								
Oct	2.41	(17)								
Nov	2.89	(30)								
Dec	4.00	(31)								
2007		(308)								
Jan	2.78	(31)								
Feb	2.13	(6)								
Mar	0.00	(3)								
Apr	1.07	(23)								
May	1.22	(31)								
Jun	1.72	(30)								
Jul	4.06	(31)								
Aug	5.77	(31)								
Sep	4.76	(30)								
Oct	4.18	(31)								
Nov	3.26	(30)								
Dec	1.31	(31)								
2008		(326)		(139)		(177)				
Jan	1.73	(31)								
Feb	2.00	(12)								
Mar	1.36	(13)								
Apr	0.49	(25)	0.00	(4)	0.31	(5)				
May	1.38	(31)	0.00	(4)	0.79	(31)				
Jun	1.15	(30)	0.05	(20)	0.74	(30)				
Jul	2.07	(31)	0.13	(31)	1.88	(31)				
Aug	6.21	(31)	0.24	(31)	4.45	(31)				
Sep	7.36	(30)	0.29	(30)	5.94	(30)				
Oct	8.49	(31)	0.31	(17)	7.32	(17)				
Nov	4.44	(30)	0.00	(2)	0.00	(2)				
Dec	4.25	(31)								

Table 12. continued.

	Citizens-Animas Ditch		Cason Ditch		East Mesa Ditch		USBR ALP Nighthorse Diversion		Durango Santa Rita Diversion	
RM Distance to San Juan confluence	48.0		53.5		55.1		59.8		60.2	
Nearest Gage	09363500		09362520		09362520		09361500		09361500	
RM to Gage	8.2		6.2		4.6		1.7		1.3	
2009		(238)		(95)		(183)		(94)		
Jan	3.47	(7)								
Feb	0.00	(1)								
Mar	0.00	(1)								
Apr	0.26	(9)			0.00	(2)	0.47	(9)		
May	1.14	(31)	0.00	(2)	0.59	(28)	1.65	(31)		
Jun	3.10	(30)	0.02	(10)	1.06	(30)	16.38	(30)		
Jul	6.16	(31)	0.17	(22)	4.14	(31)	20.75	(24)		
Aug	8.90	(22)	0.43	(31)	6.63	(31)				
Sep	8.62	(30)	0.43	(28)	7.25	(30)				
Oct	9.30	(31)	0.00	(1)	6.79	(30)				
Nov	8.50	(30)	0.00	(1)	0.00	(1)				
Dec	10.14	(15)								
2010		(276)		(95)		(171)		(288)		
Jan										
Feb										
Mar	1.31	(11)			0.00	(1)	20.05	(22)		
Apr	0.80	(23)			0.00	(2)	22.78	(28)		
May	1.48	(28)	0.00	(2)	0.35	(29)	15.10	(31)		
Jun	3.29	(30)	0.06	(10)	2.06	(30)	18.05	(30)		
Jul	8.22	(31)	0.16	(22)	4.79	(29)	0.01	(30)		
Aug	5.17	(31)	0.21	(31)	4.39	(27)	15.07	(31)		
Sep	8.14	(30)	0.34	(28)	7.83	(30)	6.72	(30)		
Oct	8.64	(31)	0.00	(1)	6.13	(21)	11.58	(31)		
Nov	9.65	(30)	0.00	(1)	0.00	(2)	6.67	(25)		
Dec	4.53	(31)					17.31	(30)		
2011		(273)		(137)		(177)		(188)		
Jan	4.99	(18)					15.17	(31)		
Feb							94.11	(28)		
Mar	0.00	(3)	0.00	(2)	0.00	(3)	107.15	(31)		
Apr	1.92	(7)	0.00	(4)	1.49	(12)	39.83	(30)		
May	2.95	(31)	0.00	(3)	1.66	(27)	22.21	(31)		
Jun	1.11	(30)	0.03	(23)	0.64	(30)	6.64	(27)		
Jul	2.43	(31)	0.09	(31)	1.81	(31)				
Aug	7.23	(31)	0.12	(25)	4.42	(31)				
Sep	7.29	(30)	0.25	(30)	6.29	(30)				
Oct	7.10	(31)	0.13	(14)	4.95	(8)	0.12	(6)		
Nov	5.75	(30)	0.00	(4)	0.00	(4)	0.01	(4)		
Dec	4.33	(31)	0.00	(1)	0.00	(1)				
2012		(360)		(186)		(187)				
Jan	5.02	(31)							0.00	(n/a)
Feb	2.67	(29)	0.00	(2)	0.00	(2)			0.00	(n/a)
Mar	1.97	(31)	0.00	(1)	0.00	(1)			0.00	(n/a)
Apr	1.32	(24)	0.04	(27)	0.84	(9)			0.00	(n/a)
May	2.35	(31)	0.01	(6)	1.38	(31)			0.00	(n/a)
Jun	4.72	(30)	0.11	(30)	3.40	(30)			0.04	(n/a)
Jul	6.23	(31)	0.38	(31)	5.74	(31)			0.23	(n/a)
Aug	8.48	(31)	0.50	(31)	7.10	(31)			0.22	(n/a)
Sep	11.10	(30)	0.29	(30)	8.49	(30)			0.40	(n/a)
Oct	10.28	(31)	0.39	(25)	6.70	(19)			0.02	(n/a)
Nov	9.74	(30)	0.00	(3)	0.00	(3)			0.00	(n/a)
Dec	7.53	(31)							0.00	(n/a)

Table 12. continued.

	Citizens-Animas Ditch		Cason Ditch		East Mesa Ditch		USBR ALP Nighthorse Diversion		Durango Santa Rita Diversion	
RM Distance to San Juan confluence	48.0		53.5		55.1		59.8		60.2	
Nearest Gage	09363500		09362520		09362520		09361500		09361500	
RM to Gage	8.2		6.2		4.6		1.7		1.3	
2013		(335)		(166)		(179)				
Jan	7.94	(31)							0.00	(n/a)
Feb	8.59	(28)							0.00	(n/a)
Mar	4.25	(29)							0.00	(n/a)
Apr	3.72	(8)	0.04	(4)	2.10	(8)			0.00	(n/a)
May	2.32	(31)	0.07	(31)	1.44	(31)			0.09	(n/a)
Jun	5.39	(30)	0.16	(30)	3.50	(30)			0.20	(n/a)
Jul	8.69	(31)	0.31	(22)	6.86	(31)			0.39	(n/a)
Aug	7.14	(31)	0.16	(31)	4.37	(31)			0.23	(n/a)
Sep	5.03	(25)	0.11	(30)	3.22	(30)			0.06	(n/a)
Oct	2.74	(30)	0.07	(17)	1.73	(17)			0.02	(n/a)
Nov	4.94	(30)	0.00	(1)	0.00	(1)			0.00	(n/a)
Dec	2.82	(31)							0.00	(n/a)
2014		(221)		(147)		(160)		(61)		(n/a)
Jan	2.91	(9)							0.00	(n/a)
Feb	2.64	(4)							0.00	(n/a)
Mar	2.69	(28)							0.00	(n/a)
Apr	0.00	(1)	0.00	(1)	0.00	(1)			0.00	(n/a)
May	1.89	(26)	0.07	(26)	1.13	(26)	6.29	(31)	0.03	(n/a)
Jun	1.66	(30)	0.07	(30)	1.09	(30)	4.47	(30)	0.06	(n/a)
Jul	5.11	(31)	0.13	(31)	3.34	(31)			0.13	(n/a)
Aug	7.74	(31)	0.31	(31)	5.31	(26)			0.07	(n/a)
Sep	6.97	(30)	0.32	(24)	5.20	(30)			0.06	(n/a)
Oct	6.78	(31)	0.00	(4)	1.58	(16)			0.00	(n/a)
Nov									0.00	(n/a)
Dec									0.00	(n/a)
2015								(36)		(n/a)
Jan									0.00	(n/a)
Feb									0.00	(n/a)
Mar									0.00	(n/a)
Apr									0.00	(n/a)
May							1.91	(26)	0.00	(n/a)
Jun							0.21	(10)	0.02	(n/a)
Jul									0.02	(n/a)
Aug									0.05	(n/a)
Sep									0.00	(n/a)
Oct									0.02	(n/a)
Nov									0.00	(n/a)
Dec									0.00	(n/a)

Synthesis of Fisheries Information

Movement Data for Colorado Pikeminnow

The distance used in this report for Colorado Pikeminnow movement (upstream and downstream) is from Durst and Franssen (2014). Mean upstream movement (spring to summer) was 38.6 mi, and mean downstream movement (fall to spring) was 21.9 mi (Table 13). These values set the upstream and downstream boundaries around each diversion for Colorado Pikeminnow capture densities. Post-stocking movement distances of Colorado Pikeminnow were from Masslich and Holden (1996). Colorado Pikeminnow stocking locations in the assessment table are the number of stocking sites located upstream of each diversion. Current stocking locations (Tables 14 and 16) are those that have been and will likely be used for future stockings of both Colorado Pikeminnow and Razorback Sucker (D. Weston Furr, USFWS, pers. Comm.). They do not represent a comprehensive list of all past stocking locations**.**

Movement Data for Razorback Sucker

Both post-stocking and natural movement distances of Razorback Sucker were calculated from the 2015 PIT tag database maintained by SJRBRIP. Post-stocking movement was defined as the distance traveled between the stocking site and the first capture within the same calendar year (0 year) or in the calendar year following the stocking event (1 year). Captures occurring more than 2 years post-stocking were not analyzed, even if it was the first recorded post-stocking contact of that individual fish. The upstream (7.1 mi) and downstream (30.6 mi) post-stocking distance of the 75th percentile of Razorback Sucker recapture (instead of mean distance) was used to determine the number of stocking locations within range of each diversion structure (Table 13). Mean movement distance was not used because distribution data were skewed towards downstream movement.

Natural movement was the calculated distance between capture events, regardless of the duration between capture events. By definition, stocking events are considered encounter 1, first river capture as encounter 2, second river capture as encounter 3, etc. (SJRBRIP 2015 PIT tag database). Natural movement distance was the distance traveled after encounter 2; the first capture event after stocking was not considered natural movement. The natural distance traveled by the 75th percentile of Razorback Sucker were the values used to set the upstream (6.4 mi) and downstream (6.3 mi) boundaries around each diversion for Razorback Sucker capture densities.

Colorado Pikeminnow and Razorback Sucker were not collected in the Animas River and the only Animas River stockings location for these two species were within 4 river miles of its confluence with the San Juan River. This meant little could be inferred, using current endangered fish information, regarding potential interaction between endangered fish and Animas River diversion structures. Almost all inferences regarding endangered species-diversion structure interaction are for the San Juan River. Information presented shows those diversion sites located within river reaches with high densities of Colorado Pikeminnow and Razorback Sucker as well as those sites in close proximity to higher numbers of stocking locations. For both endangered species, density data and the number of stocking sites increased from upstream to downstream. The only exception to this pattern was the number of stocking locations for Razorback Sucker, which declined from six to five between RM 166.3 and RM 163.7 on the San Juan River.

Table 13. Movement distances used for Colorado Pikeminnow and Razorback Sucker.

SPECIES	UPSTREAM DISTANCE (RIVER MILES)	DOWNSTREAM DISTANCE (RIVER MILES)	SOURCE OF DATA
Colorado Pikeminnow	Post-stocking	Post-stocking	
	0	variable	Masslich W. and P. B. Holden. 1996
Colorado Pikeminnow	Natural movement	Natural movement	
	38.6	21.9	Durst, S. L. and N. R. Franssen. 2014.
Razorback Sucker	Post-stocking	Post-stocking	
	7.1	30.6	2015 SJRBRIP PIT-tag database
Razorback Sucker	Natural movement	Natural movement	
	6.4	6.3	2015 SJRBRIP PIT-tag database

Table 14. San Juan River diversion structures, location (RM), endangered fish stocking locations (shaded), and the number of stocking locations within the calculated movement distances of Colorado Pikeminnow and Razorback Sucker and the diversion site.

DIVERSION NAME STOCKING SITE NAME	RM	# OF STOCKING LOCATIONS IN RANGE OF COLORADO PIKEMINNOW	# OF STOCKING LOCATIONS IN RANGE OF RAZORBACK SUCKER
Montezuma Creek, Utah	93.0		
Four Corners Bridge (US Highway 160).	119.0		
Side channel accessed via Navajo Service Road 364	135.0		
Rescue point	135.5		
Side channel accessed via Navajo Service Road 364	136.5		
Shiprock Bridge (US Highway 64), Shiprock, NM	148.0		
Hogback Canal	158.7	6	5
APS Four Corners Units 4 & 5	163.7	6	5
PNM Pumping Plant Sluiceway, north side of river	166.0		
Jewett Valley Ditch	166.3	5	6
Nenahnezad Fish Ladder (PNM fish passage) south side of river	166.5		
San Juan Generating Station	166.7	4	6
Fruitland Irrigation Canal	178.4	4	4
Boyd Park, just downstream of the Miller Avenue bridge	Animas RM 1.0		
Berg Park, just downstream of the Browning Avenue bridge	Animas RM 4.0		
Animas River confluences with the San Juan River at Animas RM 0.0 and San Juan RM 180.7			
Wild Horse Road, Farmington, NM	186.0		
Williams Field Services Kutz Plant Diversion	195.6	1	1
Verde del Rio/River Walk Park, Bloomfield, NM	196.0		
Western Refinery Diversion	196.3	0	1
Bloomfield Municipal Diversion	197.3	0	1
Hammond Conservancy District Diversion	209.3	0	0
Turley-Manzanares Ditch	214.4	0	0
Bloomfield Irrigation District Diversion	217.8	0	0

Summary of Longitudinal Distribution of Endangered Fishes by Life Stage and Season in Reference to Pertinent Diversion Site Locations

San Juan River

The three fish monitoring programs being conducted through the SJRBRIP provided a robust dataset for examining densities of Colorado Pikeminnow and Razorback Sucker in the San Juan River. Of the 15 San Juan River diversion structures identified in the study area, four were not included in this analysis. The three pumping stations near Bluff, UT (Utah Pipe Diversion 1, Utah Pipe Diversion 2, and Utah Pipe Diversion 3), remove water via a 12" diameter pipe suspended in the river. These three units are located in a 1.6 river miles reach and about 76 river miles downstream from the closest other diversion site (Hogback Diversion Canal; RM 158.7). Since information on the operation of these units was unavailable, and they were not deemed an entrainment threat to adult fish, they are not included in this analysis. The Farmer Mutual Irrigation Ditch on the San Juan River (RM 179.6) was not included in this analysis as it is not recognized by NMOSE and there are no data on its diversion of water. This Farmer Mutual Irrigation Ditch diversion structure is located between two San Juan River diversion points. It is 2.6 river miles upstream from Fruitland Irrigation Ditch and 16.0 river miles downstream of Williams Field Service-Kutz Plant, both of which are included in the analysis.

For the 11 San Juan River diversion sites examined, electrofishing densities of Colorado Pikeminnow were 0.49 fish/hr at the farthest upstream diversion (RM 217.8) with densities increasing to 5.32 fish/hr at the APS Four Corners Units 4 & 5 (RM 163.7) and the Hogback Diversion Canal (RM 158.7), the two most downstream diversion structures (Table 15). A similar pattern of increasing Colorado Pikeminnow density was observed in the small-bodied and larval fish (only using age-1 or larger fish) monitoring dataset. Densities ranged from 0.0 fish/100 m^2 for the Bloomfield Irrigation District diversion (RM 217.8) to 0.56 fish/100 m^2 at the Hogback Canal diversion (RM 158.7).

Razorback Sucker density data were only available from the subadult and adult monitoring program. Neither small-bodied, nor larval fish monitoring programs have collected subadult Razorback Sucker (i.e., >300 mm TL). Natural upstream movement for Razorback Sucker was determined to be 6.4 river miles (Table 5). Since subadult and adult monitoring program was not conducted above RM 195.0, density of Razorback Sucker was extrapolated up to RM 201.4. Razorback Sucker density data are not available for the three diversions located between Bloomfield Irrigation District (RM 217.8) and Hammond Conservancy District (RM 209.3, Table 15). Densities of Razorback Sucker increased downstream from the City of Bloomfield Second Source Diversion structure (RM 197.3) to the Hogback Diversion Canal (RM 158.7). Values ranged from 0.34–8.92 Razorback Sucker/hr of electrofishing in this reach of the San Juan River.

Most of the 11 San Juan River diversion structures were in close proximity to Colorado Pikeminnow and Razorback Sucker stocking locations. Six diversions between Williams Field Services – Kutz Plant (RM 195.6) and Hogback Diversion Canal (RM 158.7) are downstream of current Colorado Pikeminnow stocking locations (Table 14). For Razorback Sucker, eight diversions from the City of Bloomfield Second Source Diversion structure (RM 197.3) to Hogback Diversion Canal (RM 158.7) are within the calculated post-stocking movement range of Razorback Sucker (Table 14). The three upper-most San Juan River diversion structures (8.5 river miles; Bloomfield Irrigation District, RM 217.8; Turley-Manzanares Ditch, RM 214.4; Hammond Conservancy District, RM 209.3) were not considered within the current range of movement of Razorback Sucker. Conversely, the upper five diversion sites (21.5 river miles) were deemed outside the current range of Colorado Pikeminnow (Bloomfield Irrigation District, RM 217.8. to Western Refinery Diversion, RM 196.3).

Table 15. Diversion structures, location (RM), and catch rate for Colorado Pikeminnow and Razorback Sucker on the San Juan River.

DIVERSION NAME	RM	COLORADO PIKEMINNOW (FISH/HR)*	COLORADO PIKEMINNOW (FISH/100 M^2)*	RAZORBACK SUCKER (FISH/HR)*
Hogback Canal*	158.7	5.32	0.56	8.92
APS Four Corners Units 4 & 5*	163.7	5.32	0.49	7.72
Jewett Valley Ditch	166.3	5.25	0.49	4.32
San Juan Generating Station*	166.7	5.24	0.49	4.32
Fruitland Irrigation Canal	178.4	4.76	0.41	1.48
Williams Field Services Kutz Plant Diversion	195.6	3.18	0.18	0.50
Western Refining Diversion	196.3	2.79	0.17	0.50
City of Bloomfield Second Source Diversion	197.3	2.65	0.14	0.34
Hammond Conservancy District Diversion	209.3	2.39	0.04	No data
Turley-Manzanares Ditch	214.4	1.19	0.01	No data
Bloomfield Irrigation District Diversion	217.8	0.49	0.00	No data
* = Reported upon but diversion site was not visited				

Animas River

Neither Colorado Pikeminnow nor Razorback Sucker were collected in the Animas River between during the study period (2005–2014). In Reach 1 of the Animas River, six species (and two hybrids) were collected by CPW between 2005–2014. Over 70% of the fish they reported were Rainbow Trout *Onchorhynchus mykiss* [52.3% (n = 1,621)] or Brown Trout *Salmo trutta* [18.5% (n = 572)]. The two most abundant native species collected were Bluehead Sucker and Mottled Sculpin *Cottus bairdii* (Table 17). In the next downstream reach (Reach 2), nine fish species and four hybrids were collected by SUIT (Table 18). Rainbow Trout and Brown Trout were again the two most abundant species taken accounting for over 55% (n = 7,031) of the overall catch. Bluehead Sucker and Flannelmouth Sucker were the two most abundant native species reported by SUIT comprising about 30% (n = 3,776) of the total catch. In Reach 3 of the Animas River, eight fish species and four hybrids were taken by SUIT (Table 19). In this reach, the ichthyofaunal composition was primarily native fish with Bluehead Sucker and Flannelmouth Sucker being the two most abundant taxa [44.8% (n = 1,705) and 37.1% (n = 1,414), respectively]. Rainbow Trout and Brown Trout were, collectively, 11.6% (n = 441) of the Reach 3 catch.

Most of the 24 Animas River diversion sites were not in close proximity to either Colorado Pikeminnow or Razorback Sucker stocking locations. The Berg Park stocking site for Colorado Pikeminnow at RM 4.0 is just upstream of diversion structures at Willet Ditch (RM 3.5) and Farmers Mutual Ditch (Animas River; RM 0.4). For Razorback Sucker, there are six Animas River diversion sites between RM 10.8 (Ranchmans Ditch) and RM 0.4 (Farmers Mutual Ditch) within the post-stocking movement range of Razorback Sucker (Table 16). The Animas River confluences (RM 0.0) with the San Juan River at approximately RM 180.7. Two diversion sites in the San Juan River are immediately downstream of the confluence. The San Juan River Farmers Mutual Ditch site is at RM 179.6 and Fruitland Irrigation Canal is RM 178.4. This latter diversion site is listed in the previous section and stated to be within the movement distance of four Colorado Pikeminnow and four Razorback Sucker stocking locations.

Table 16. Animas River diversion structures, locations (RM), endangered fish stocking locations (shaded), and the number of stocking locations within the calculated movement distances of Colorado Pikeminnow and Razorback Sucker and the diversion site.

DIVERSION NAME STOCKING SITE NAME	RM	# OF STOCKING LOCATIONS IN RANGE OF COLORADO PIKEMINNOW	# OF STOCKING LOCATIONS IN RANGE OF RAZORBACK SUCKER
Farmers Mutual Ditch (Animas River)	0.4	2	2
Boyd Park, just downstream of the Miller Avenue bridge	1.0		
Willet Ditch	3.5	1	2
Berg Park, just downstream of the Browning Avenue bridge	4.0		
North Farmington Ditch	4.6	0	2
Farmington-Echo-Allen Ditch	6.1	0	2
City of Farmington Animas Pump Station No. 2 *	9.5	0	1
Ranchmans Ditch	10.8	0	1
Halford-Independent Ditch	15.3	0	0
Kello-Blancett Ditch	16.8	0	0
Eledge Mill Ditch	19.8	0	0
Farmers Irrigation Ditch	21.4	0	0
Lower Animas Ditch	21.8	0	0
Sargent Ditch	24.6	0	0
Aztec Ditch	27.4	0	0
Stacey Ditch	29.6	0	0
Graves-Atterberry (Inca) Ditch	31.7	0	0
Cedar Ditch	33.8	0	0
Ralston Ditch	38.1	0	0
Twin Rock Ditch	39.7	0	0
Citizens-Animas Ditch	48.0	0	0
Dena (Little Fishes) Ditch	48.9	0	0
Cason Ditch	53.5	0	0
East Mesa Ditch	55.1	0	0
BR, Lake Nighthorse Diversion	59.8	0	0
Durango, Santa Rita Diversion	60.2	0	0

Table 17. Fisheries data from Animas River Reach 3.

FISHERIES DATA WITHIN ANIMAS RIVER REACH 3 (RM 0.0 – 37.1)		
COMMON NAME	PERCENT OF TOTAL	CPUE (FISH/HR)
Common Carp	1.6	3.3
Speckled Dace	0.9	1.8
White Sucker	0.9	1.7
Bluehead Sucker	44.8	89.6
Bluehead x Flannelmouth Sucker hybrid	0.1	0.1
Bluehead x White Sucker hybrid	0.3	0.7
Flannelmouth Sucker	37.1	74.3
Flannelmouth x White Sucker hybrid	0.3	0.6
Rainbow Trout	2.9	5.8
Rainbow x Snake River Cutthroat Trout hybrid	0.1	0.1
Brown Trout	8.7	17.4
Mottled Sculpin	2.4	4.7

Table 18. Fisheries data from Animas River Reach 2.

FISHERIES DATA WITHIN ANIMAS RIVER REACH 2 (RM 37.1 – 56.4)		
COMMON NAME	PERCENT OF TOTAL	CPUE (FISH/HR)
Common Carp	0.2	0.2
Speckled Dace	0.5	0.6
White Sucker	2.8	3.8
Bluehead Sucker	20.5	27.8
Bluehead x Flannelmouth Sucker hybrid	< 0.1	< 0.1
Bluehead x White Sucker hybrid	0.8	1.1
Flannelmouth Sucker	9.3	12.6
Flannelmouth x White Sucker hybrid	1.2	1.6
Snake River Cutthroat Trout	0.2	0.3
Rainbow Trout	28.1	38.1
Rainbow x Snake River Cutthroat Trout hybrid	0.4	0.5
Brown Trout	27.5	37.3
Mottled Sculpin	8.5	11.5

Table 19. Fisheries data from Animas River Reach 1.

FISHERIES DATA WITHIN ANIMAS RIVER REACH 1 (RM 57.4 – 62.2)		
COMMON NAME	PERCENT OF TOTAL	NUMBER OF FISH/MI
Speckled Dace	0.2	2.9
White Sucker (including 1 White Sucker hybrid)	0.6	3.4
Bluehead Sucker	13.4	646.7
Flannelmouth Sucker	0.2	1.3
Snake River Cutthroat Trout	0.2	1.9
Rainbow Trout (including 2 Rainbow x Cutthroat Trout hybrids)	52.3	1,106.9
Brown Trout	18.5	312.3
Mottled Sculpin	14.6	94.2

CONCLUSIONS

Numerous water diversions exist in the San Juan and Animas rivers. While the diversions are necessary for water distribution within the basin, they may contribute to entrainment of native fishes. The SJRBRIP initiated this project to compile and synthesize information on diversion structures and SJRBRIP fish collections in the drainage. This information is necessary for future management decisions about the need to assess entrainment risk or remediate entrainment risk at diversion structures as warranted.

A successful long-term Colorado Pikeminnow and Razorback Sucker augmentation program exists in the San Juan River. Several fish monitoring efforts conducted by the SJRBRIP have documented, through a variety of metrics, the success of the current augmentation programs for these two endangered fishes in the San Juan River. Annual reproduction by stocked Razorback Sucker has been verified, through the capture of larval specimens, since 1997 (Farrington et al. 2016). Likewise, larval Colorado Pikeminnow, presumed to be the product of stocked individuals, have been collected annually since 2013 and have been collected sporadically since 1993 (Farrington et al. 2016). Upstream range expansion by both species was inferred by collection of larvae higher in the system over the same period (Farrington et al. 2016). This upstream range expansion by both species and their expanded presence throughout the San Juan River may result in contact between endangered species and diversion structures.

The success of the augmentation programs for both Colorado Pikeminnow and Razorback Sucker in the presence and operation of the diversion structures is well documented. For both Colorado Pikeminnow and Razorback Sucker diversion structures are generally operational throughout their spawning season. The success of the SJRBRIP augmentation programs as evidenced by the increase in populations and expansion in range of the two endangered species does not mean that the diversion structures and practices do not negatively impact these two species. This project was not designed to determine potential or actual impacts of the diversion structures on the two endangered fishes.

An augmentation program for Colorado Pikeminnow and Razorback Sucker in the Animas River does not exist. Limited stocking of these two species occasionally occurs at two sites in the downstream-most reach of the Animas River (RM 4.0, RM 1.0) in close proximity to its confluence with the San Juan River. Potential upstream movement of both species, as indicated by records in the SJRBRIP PIT tag database, suggests that, though Colorado Pikeminnow and Razorback Sucker are not stocked extensively within the Animas River, it is possible for them to be present within the Animas River and in close proximity to diversions within the Animas River.

There are few contemporary records of either Colorado Pikeminnow or Razorback Sucker in the Animas River. It should be noted, however, that compared to the San Juan River, little effort is expended by the SJRBRIP sampling fish in the Animas River. Valdez (2008) reported three Colorado Pikeminnow from the Animas River (near the San Juan River confluence) in July 2004 and USFWS (B. Schleicher, USFWS, Grand Junction, CO, personal communication) collected 10 adult Razorback Sucker in that system (RM 1.4–9.0) in April 2015. Fish distribution data in this study are a synthesis of that previously collected during SJRBRIP small bodied and sub-adult/adult monitoring programs. As SJRBRIP fish monitoring is not conducted in the Animas River, any future assessment of the impact of Animas River diversions on endangered fishes will not be able to employ density data (as is available in the San Juan River). Physical characteristics such as the presence or absence of fish screens, length of diversion channel, number and location of returns to the river, and previous mitigation efforts (e.g. the fish passage at the PNM diversion and the weir wall at the Hogback diversion) would all factor into a specific assessment of a diversion structure. This project was not designed to generate data on fish in diversion canals. Sampling of diversion canals, to document the presence of endangered fish, may be part of future assessments.

This study provides the SJRBRIP a stand-alone document containing pertinent information on location and physical features of diversion structures and Colorado Pikeminnow and Razorback Sucker density, stocking locations, and movement. These data can be used by the Recovery Program to preliminarily address a suite of issues. For example, information related to augmentation of fishes, such as natural movement, post-stocking movement, and density of Colorado Pikeminnow and Razorback Sucker near diversions, may prove useful in helping to determine seasonality of stocking efforts or to identify augmentation sites that would minimize interaction between fishes and diversions.

In fulfillment of Study Objective 1, this final report contains information on water withdrawal amounts (as available) for San Juan and Animas rivers diversions as a proportion of river flow (Table 20). Data on water withdrawal were not available for all sites and the quality of those data varied between states. Withdrawal locations, ownership of facilities and information related to the physical structure of each diversion (Study Objectives 2, 3, 4, 5) are presented in Appendix A. Ground level digital images of diversion structures are presented in Appendix B (Study Objective 4) while geo-rectified aerial images provide overviews of diversion sites and associated pertinent structures (Study Objectives 2 and 4). Collectively, the data presented in this report (Study Objective 6) provides the Recovery Program an easily accessible source of information to assess management actions and to determine whether future entrainment studies are warranted.

Table 20. Documentation of fulfillment of project study objectives.

#	STUDY OBJECTIVES	LOCATION IN REPORT
1	Document withdrawal amounts (CFS and acre-feet) for each diversion and relate these to proportion of river flows	Tables 9, 10, 11, 12
2	Document withdrawal locations using GIS and legal descriptions	Appendices A and C
3	Identify ownership of diversion facilities	Appendix A
4	Document diversion locations with digital images and descriptions of diversions (aspect to river, height, width, gate structure, width of canal, etc.)	Appendix A, B, C
5	Synthesize information on diversion strictures including proportion of flow diverted, amount of screening currently present, proximity to stocking locations, quality of habitat upstream of diversion, and other metrics identified by the SJRIP biology committee and the “interested parties” workgroup.	Appendix A
6	Produce a draft and final report that summarizes and details 1–5 above	This document

Potential Partnership Opportunities for the Recovery Program to Collaborate with Diversion Operators and other Agencies

Should the Recovery Program determine through future studies that any non-federal agricultural or municipal diversions included in this study warrant infrastructure improvement for the purpose of mitigating entrainment risk, this section provides a summary of opportunities that could be explored collaboratively with diversion operators in order to secure funding and facilitate project planning, design, permitting, and construction.

- New Mexico Interstate Stream Commission Evaluation of Agricultural Infrastructure in the San Juan Basin in New Mexico - Utilizing $500,000 in Colorado River Basin Funds, the NMISC is collaborating with USBR's Western Colorado Area Office to conduct facility surveys, infrastructure improvement and operational recommendations, assessment-level designs and cost estimates for non-federal agricultural systems in New Mexico. The assessment, which commenced in the spring of 2016 and will conclude in late 2016, includes all irrigation ditches along the Animas, La Plata and the San Juan Rivers that are not part of the Hammond Conservancy District, the Navajo Indian Irrigation Project, the Fruitland-Cambridge Irrigation Project, and the Hogback-Cudei Irrigation Project. Field visits and interviews of facility operators conducted by NMISC and USBR staff will inform the assessments with regard to efficient operations (headgate and control structures capacity/condition, spills, other waste, etc.) and efficient water conveyance (reported inadequate canal capacities, excessive seepage, other losses, etc.). Recommendations for infrastructure improvement will be documented further in design options and associated appraisal-level cost estimates. Because completed project engineering design is a prerequisite for funding eligibility under some infrastructure funding programs, including the NMISC's Acequia Construction Program, this NMISC/USBR infrastructure evaluation project is important because project engineering will be completed for specific high-priority projects within the San Juan Basin in New Mexico. Many of these funding programs also have cost-share requirements, which will need to be met by the irrigation system operators or other partners. Project Contacts:
    - New Mexico Interstate Stream Commission, Colorado River Basin Program, Santa Fe, NM. (Kristin N. Green, Deputy Basin Manager, KristinN.Green@state.nm.us, 505-827-6145o)
    - USBR Western Colorado Area Office, Grand Junction, CO. (E. Ted Dunn II, Deputy Area Manager, EDunn@usbr.gov, 970-248-0690o/970-209-1370c; J. Mark Spears, Denver CO. jspears@usbr.gov, 303-445-2514o/303-957-6905c)
- Natural Resource Conservation Service (NRCS) Regional Conservation Partnership Program (RCPP) – This is a national program that supports public-private partnerships that maximize conservation benefits to soils, water, wildlife and plants. The New Mexico Association of Conservancy Districts, the New Mexico Acequia Association, and the New Mexico Interstate Stream Commission have received funding from the RCPP in 2014 and 2016 ($1 Million and $3 Million, respectively) for technical support and 50/50 cost-share for infrastructure improvements among New Mexico's acequia agricultural systems. Pre-proposal applications for FY18 RCPP funding will likely be due to the NRCS in early May 2017. This program provides a potential avenue for the Recovery Program to collaborate with San Juan Basin agricultural partners to secure funding and facilitate infrastructure improvements that meet mutual goals. The RCPP cost-share requirement will need to be met by the irrigation system operators or other partners. Program Contacts:
    - New Mexico Association of Conservation District (Norman Vigil, nvigilsr@hotmail.com, 575-684-0042)
    - Natural Resource Conservation Service, Aztec Service Center, Aztec, NM. (Chambliss Lantana, chambliss.lantana@nm.usda.gov, 505-334-6888)
    - San Juan Soil and Water Conservation District, Aztec. NM. (Melissa May, melissa.may@sanjuanswcd.com, 505-334-3090)
- The New Mexico Interstate Stream Commission (NMISC) Acequias Construction Programs (ACP) - Among the ACP subprograms, the 90/10 Acequia Grant Program is a likely source of cost-share funding for infrastructure improvement projects in the San Juan Basin. The New Mexico State Legislature appropriates funds from the Irrigation Works Construction Fund to the

State Engineer for grants for improvement and repair work on specific acequias. As mentioned previously, a pre-requisite for program funding is completed project engineering design. Under this subprogram, ninety percent of the project cost, up to $150,000 per project can be covered by the grant. Total construction costs under this program are capped at $167,000. This funding program presents another potential opportunity for the Recovery Program to collaborate with San Juan Basin agricultural partners to secure funding and facilitate infrastructure improvements that meet mutual goals. The funding program's cost-share requirement will need to be met by the irrigation system operators or other partners. Program Contacts

- New Mexico Interstate Stream Commission Acequia Program Staff (505-827-6160)
- New Mexico Interstate Stream Commission, Colorado River Basin Program, Santa Fe, NM. (Kristin N. Green, Deputy Basin Manager, KristinN.Green@state.nm.us, 505-827-6145).

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APPENDIX A. Physical data San Juan and Animas rivers diversion structures.

Diversion Name	Utah Pipe Diversion 3	Utah Pipe Diversion 2	Utah Pipe Diversion 1
River Name	San Juan River	San Juan River	San Juan River
River Mile: San Juan River = from Lake Powell Animas River = from confluence with San Juan	80.7	81.0	82.3
State	UT	UT	UT
County	San Juan	San Juan	San Juan
Visit Date	7/30/15	7/30/15	7/30/15
Visit Time	9:10 AM	9:00 AM	8:45 AM
Visit Note	Visited via boat; participated in phone interview on 12/14/15.	Visited via boat; Declined to participate in phone interview on 12/14/15.	Visited via boat. Did not return call/message left on 12/10/15.
Diversion/Discharge Data Available/Collected	No	No	No
Entity	Bill Davis	Melvin and Bill (son) Gaines	Roger Atcity
Type of Entity	Individual	Individual	Individual
Type of Diversion	Agricultural Diversion	Agricultural Diversion	Agricultural Diversion
Entity Address	Abajo Archaeology, US Highway 191, Bluff, UT 84512	PO Box 335, Bluff, UT 84512	c/o Resolute Natural Resources Company, 5 Miles N Montezuma Creek, Montezuma Creek, UT 84534
ContactA_Name	Bill Davis	Melvin and Bill (son) Gaines	Roger Atcity
ContactA_Title	Owner		
ContactA_Phone	4356722209	4356722246	4356513277
ContactA_AltPhone	4356722272		
ContactA_Email			
ContactB_Name			
ContactB_Title			
ContactB_Phone			
ContactB_AltPhone			
ContactB_Email			
Location (GPS Coordinates)	629703.2278 E 4126645.1652 N; Zone 12 N, NAD 83	630146.2717 E 4126520.8096 N; Zone 12 N, NAD 83	632310.4256 E 4126904.5572 N; Zone 12 N, NAD 83
Access Route	Private property south of Utah State Route 162	Private property south of Utah State Route 162	Private property south of Utah State Route 162
Head/Grade Control Type (in main channel)	NA	NA	NA
Head/Grade Control Condition	NA	NA	NA
Head/Grade Control Maintenance	NA	NA	NA
Head/Grade Control Notes			
River Width at Diversion Channel Intake	53 m	52 m	61 m
River Width Notes	Measured from aerial photo.	Measured from aerial photo.	Measured from aerial photo.
Diversion Channel Intake Width	30 cm	30 cm	30 cm
Diversion Channel Intake Width Notes	12" diameter rubber pipe (30 cm)	Probably 12" diameter (30 cm)	Probably 12" diameter (30 cm)
Diversion Channel Intake Distance from Headgate	NA	NA	NA
Diversion Channel Notes			
First Spillway Location	NA	NA	NA
Spillway Type	NA	NA	NA
Spillway Width	NA	NA	NA
Head Gate Type	NA	NA	NA
Head Gate Count	NA	NA	NA
Open at time of field visit	NA	NA	NA
Head Gate Width Each	NA	NA	NA
Head Gate Normal Operating Position	NA	NA	NA
Screen Type	Milk crate attached to end of pipe	Unknown	Unknown
Screen Condition	Needs replacement often	Unknown	Unknown
Screen Height	NA	Unknown	Unknown
Screen Width	NA	Unknown	Unknown
Screen Mesh Opening	Approximately 3 cm x 3 cm (1" x 1")	Unknown	Unknown
Inlet Pipe at Headgate	NA	NA	NA
Maximum Diversion Rate cfs	NA	Unknown	Unknown
Normal Diversion Rate cfs	1-2 cfs	Unknown	Unknown

APPENDIX A. continued (San Juan River).

Diversion Name	APS Four Corners Units 4 & 5	Jewett Valley Ditch	PNM San Juan Generating Station
River Name	San Juan River	San Juan River	San Juan River
River Mile: San Juan River = from Lake Powell Animas River = from confluence with San Juan	163.7	166.3	166.7
State	NM	NM	NM
County	San Juan	San Juan	San Juan
Visit Date	NA	8/20/15	NA
Visit Time	NA	1:00 PM	NA
Visit Note	Did not visit; collected data and physical information via phone and email.	Field visit successfully completed.	Did not visit; collected data and physical information via phone and email.
Diversion/Discharge Data Available/Collected	Yes, monthly totals only	Yes, daily average	Yes, annual totals only
Entity	Arizona Public Service Company	Jewett Valley Ditch	Public Service Company of New Mexico, San Juan Generating Station
Type of Entity	Corporation	Ditch Association	Corporation
Type of Diversion	Industrial Diversion	Agricultural Diversion	Industrial Diversion
Entity Address	P.O. Box 355, Fruitland, NM 87416	PO Box 91, Water Flow, NM 87421	6800 N County Rd, Waterflow, NM 87421
ContactA_Name		Jim Rogers	Mike Greene
ContactA_Title	Project Manager	Irrigator	
ContactA_Phone	5053308799	5053300047	5059334214
ContactA_AltPhone	5055988210		5052412188
ContactA_Email	richard.grimes@aps.com	jimtrogers923@gmail.com	mike.greene@pnm.com
ContactB_Name			
ContactB_Title			
ContactB_Phone			
ContactB_AltPhone			
ContactB_Email			
Location (GPS Coordinates)	726657.2029 E 4069335.3439 N; Zone 12 N, NAD 83	730391.8142 E 4070199.2245 N; Zone 12 N, NAD 83	730930.1539 E 4070246.6210 N; Zone 12 N, NAD 83
Access Route			
Head/Grade Control Type (in main channel)	Concrete weir and steel pilings across main river channel.	Boulders and native bed material that extends across main river channel adjacent to diversion channel inlet.	Concrete dam across river, and concrete rip-rap on opposite bank from diversion.
Head/Grade Control Condition		Fair/Functioning but adequate head my not be available at lower river flows.	Good/Functioning
Head/Grade Control Maintenance	None	Requires maintenance about every 5 years.	No regular maintenance required.
Head/Grade Control Notes			
River Width at Diversion Channel Intake	38 m	63 m	52 m
River Width Notes	38 m wide main channel.	63 m wide main channel.	52 m wide main channel.
Diversion Channel Intake Width	8.5 m	6 m	6.4 m
Diversion Channel Intake Width Notes	8.5 m	6 m	6.4 m
Diversion Channel Intake Distance from Headgate	0	37 m	0
Diversion Channel Notes		There is no fish passage to allow escape from the diversion ditch upstream of the newer headgate, except back upstream.	
First Spillway Location	"sluice channel" at intake	At old headgate and spillway at old headgate at river channel; newer headgate/spillway approximately 37 m downstream of old headgate.	Just downstream of intake structure, all housed within the concrete structure.
Spillway Type	Sluiceway, no gate	Old spillway is radial gate. Active spillway (radial gate) is 37 m downstream of headgate. This downstream headgate/spillway essentially replaces the older structure located at the river channel.	PNM engineering drawings show "sluice channel" at intake.
Spillway Width	6 m	3.6 m	4.5 m
Head Gate Type	Concrete structure with slide gates	Concrete with square slide gates; won't seal. Old/need of replacement. Downstream sluice used to control flow rate.	Concrete structure with slide gates
Head Gate Count	2	2	2
Open at time of field visit	NA	Yes	NA
Head Gate Width Each	3.53 m	1.5 m	1.524 m
Head Gate Normal Operating Position	Unknown	Open	Unknown
Screen Type	Fine mesh screen at sluiceway/intake interface	None	Debris screen and trash rack at intake structure, then a rotating screen at pump house
Screen Condition	Good	NA	Good
Screen Height	about 2 m	NA	2.13 m
Screen Width	3.53 m	NA	53 cm
Screen Mesh Opening	2.5 cm x 7.5 cm mesh	NA	10.6 x 15.24 cm
Inlet Pipe at Headgate	pipe after pumps	NA	NA
Maximum Diversion Rate cfs		32	
Normal Diversion Rate cfs		32	33

APPENDIX A. continued (San Juan River).

Diversion Name	Fruitland Irrigation Canal	Farmers Mutual Ditch	Wiliams Field Service Kutz Plant
River Name	San Juan River	San Juan River	San Juan River
River Mile: San Juan River = from Lake Powell Animas River = from confluence with San Juan	178.4	179.6	195.6
State	NM	NM	NM
County	San Juan	San Juan	San Juan
Visit Date	8/20/15		NA
Visit Time	2:30 PM		NA
Visit Note	Field visit successfully completed.	Ditch operators did not indicate this was the primary diversion (See Farmers Mutual Ditch on Animas River)	Did not visit; collected data and physical information via phone and email.
Diversion/Discharge Data Available/Collected	Yes, daily average	No	Yes, monthly totals only
Entity	Navajo Nation, Dept. of Water Resources, Technical Construction and Operation Branch	Farmers Mutual Ditch Company	Wiliams Field Service/Williams Energy/Williams Companies, Inc.
Type of Entity	Tribal Nation	Ditch Association	Corporation
Type of Diversion	Agricultural Diversion	Agricultural Diversion	Industrial Diversion
Entity Address	PO Box 678, Fort Defiance, AZ 86504	PO Box 467 Kirtland, NM 87417	190 Road 4980, Bloomfield, NM 87413
ContactA_Name	Marlin Saggboy	Debra Currier & Danene Sherwood	Dave Quintana
ContactA_Title	Irrigation Supervisor		Manager, Technical Services
ContactA_Phone	5053681062	5055986159	5056324607
ContactA_AltPhone	5054067052	5053209646	5054866689
ContactA_Email	canal_dude@hotmail.com	sherwood7@me.com	david.quintana@williams.com
ContactB_Name			
ContactB_Title			
ContactB_Phone			
ContactB_AltPhone			
ContactB_Email			
Location (GPS Coordinates)	744549.8050 E 4068622.4464 N; Zone 12 N, NAD 83	747406.5108 E 4068101.6311 N; Zone 12 N, NAD 83	769062.2757 E 4065790.9174 N; Zone 12 N, NAD 83
Access Route	Indian Route 38 to 566		
Head/Grade Control Type (in main channel)	Boulders placed in main channel adjacent to diversion.	Aerial photograph indicates a substantial structure adjacent to headgate, likely comprised of larger boulders	NA
Head/Grade Control Condition	Fair/Function Impaired	Unknown	NA
Head/Grade Control Maintenance	Existing structure requires maintenance as boulders shift in channel. Improvements to diversion and grade control are in process.	Unknown	NA
Head/Grade Control Notes			
River Width at Diversion Channel Intake	45 m	50 m	16 m
River Width Notes	45 m wide main channel.		Measured from aerial photo. One of two main channels
Diversion Channel Intake Width	22 m	NA	2 m
Diversion Channel Intake Width Notes	22 m		The diversion inlet is a narrow, short ditch off of the main channel (which is in two sections)
Diversion Channel Intake Distance from Headgate	0		0
Diversion Channel Notes			
First Spillway Location	800 m downstream of diversion	Unknown	None
Spillway Type	Concrete structure with radial gate	Unknown	NA
Spillway Width	1.85 m	Unknown	NA
Head Gate Type	None (removed for improvements)	Unknown	Unknown
Head Gate Count		Unknown	Unknown
Open at time of field visit	Yes (removed for improvements)	NA	NA
Head Gate Width Each	None (removed for improvements)	NA	Unknown
Head Gate Normal Operating Position	Unknown	NA	Unknown
Screen Type	None	Unknown	Unknown
Screen Condition	NA	Unknown	Unknown
Screen Height	NA	Unknown	Unknown
Screen Width	NA	Unknown	Unknown
Screen Mesh Opening	NA	Unknown	Unknown
Inlet Pipe at Headgate	None	NA	Unknown
Maximum Diversion Rate cfs			Unknown
Normal Diversion Rate cfs	100		Unknown

APPENDIX A. continued (San Juan River).

Diversion Name	Western Refining	City of Bloomfield Second Source Diversion	Hammond Conservancy District
River Name	San Juan River	San Juan River	San Juan River
River Mile: San Juan River = from Lake Powell Animas River = from confluence with San Juan	196.3	197.9	209.3
State	NM	NM	NM
County	San Juan	San Juan	San Juan
Visit Date	8/20/15	8/20/15	NA
Visit Time	11:45 AM	10:00 AM	NA
Visit Note	Field visit successfully completed.	Field visit successfully completed.	Not visited; declined to participate
Diversion/Discharge Data Available/Collected	No	No	Yes, daily average
Entity	Western Refinery	City of Bloomfield	Hammond Conservancy District
Type of Entity	Corporation	Municipality	Conservancy District
Type of Diversion	Industrial Diversion	Municipal Diversion	Agricultural Diversion
Entity Address	50 CR4990, Bloomfield, NM 87413	915 N. First Street, Bloomfield, NM 87413	790 CR 4990, Bloomfield, NM 87413
ContactA_Name	Larry Hawkins	Teresa Brevik	Teresa Lane
ContactA_Title	Facility Manager	Special Projects Manager	
ContactA_Phone	5056324142	5056326352	5056323043
ContactA_AltPhone	5053306926	5052586316	5053209068
ContactA_Email	larry.hawkins@wnr.com	TBrevik@bloomfieldnm.com	hcd@peoplepc.com
ContactB_Name			
ContactB_Title			
ContactB_Phone			
ContactB_AltPhone			
ContactB_Email			
Location (GPS Coordinates)	770131.4564 E 4066017.0206 N; Zone 12 N, NAD 83	772140.6442 E 4067008.1759 N; Zone 12 N, NAD 83	784838.7049 E 4071430.2203 N; Zone 12 N, NAD 83
Access Route	Through Western Refining Facility		
Head/Grade Control Type (in main channel)	Native bed material	None	120 m long concrete head/grade control structure across river.
Head/Grade Control Condition	Good/Functioning	NA	Unknown
Head/Grade Control Maintenance	No regular maintenance required.	NA	Unknown
Head/Grade Control Notes			
River Width at Diversion Channel Intake	29 m	44 m	50 m
River Width Notes	29 m wide main channel.	44 m wide main channel.	Measured from aerial photo.
Diversion Channel Intake Width	6 m	1 m	5 m
Diversion Channel Intake Width Notes	6 m	1 m slide gate allows flow into intake structure, another 1 m gate controls flow in pipe to settling pond.	Measured from aerial photo.
Diversion Channel Intake Distance from Headgate	110 m	0	0
Diversion Channel Notes	The diversion channel returns to the main river channel, allowing for fish passage.		
First Spillway Location	NA	all flow that is not taken by pipe to settling pond returns immediately to river	Unknown
Spillway Type	NA	NA	Unknown
Spillway Width	NA	NA	Unknown
Head Gate Type	Pump House	Slide Gate	Unknown
Head Gate Count	2	1	Unknown
Open at time of field visit	Yes (but not pumping/diverting)	No	Unknown
Head Gate Width Each	2 m	1 m	Unknown
Head Gate Normal Operating Position	Unknown	Unknown	Unknown
Screen Type	Metal grid screen	None	Unknown
Screen Condition	Clean	NA	Unknown
Screen Height	2 m	NA	Unknown
Screen Width	4 m	NA	Unknown
Screen Mesh Opening	1 cm	NA	Unknown
Inlet Pipe at Headgate	Yes, unknown diameter	None	Unknown
Maximum Diversion Rate cfs	Unknown	Unknown	
Normal Diversion Rate cfs	Unknown	Unknown	

APPENDIX A. continued (San Juan River).

Diversion Name	Turley-Manzanares Ditch	Bloomfield Irrigation District	Jaquez Ditch
River Name	San Juan River	San Juan River	San Juan River
River Mile: San Juan River = from Lake Powell Animas River = from confluence with San Juan	214.4	217.8	NA
State	NM	NM	NM
County	San Juan	San Juan	San Juan
Visit Date	8/20/15	8/20/15	NA
Visit Time	10:00 AM	8:00 AM	NA
Visit Note	Field visit successfully completed.	Field visit successfully completed.	Not visited; same diversion as Bloomfield Irrigation District.
Diversion/Discharge Data Available/Collected	Yes, daily average	Yes, daily average	NA
Entity	Turley-Manzanares Ditch	Bloomfield Irrigation District	Jaquez Ditch
Type of Entity	Ditch Association	Irrigation District	Ditch Association
Type of Diversion	Agricultural Diversion	Agricultural Diversion	NA
Entity Address	211 Hwy 511, Blanco, NM 87412	P.O. Box 606, 1205 E. Broadway, Bloomfield, NM. 87413	San Juan River Outfitters and Livery Co., #200 Rd. 4599, Blanco, NM 87412
ContactA_Name	Steve Chavez	Stacy Dodd	John Jaquez
ContactA_Title		Office Coordinator	
ContactA_Phone	5056322112	5056322800	5056320250
ContactA_AltPhone			5756216158
ContactA_Email		bloomfield@qwestoffice.net	
ContactB_Name	Pat Montoya	Mike & Mike	
ContactB_Title	Ditch Rider, irrigator	Ditch Rider & Asst Ditch Rider	
ContactB_Phone	5053203296		
ContactB_AltPhone			
ContactB_Email			
Location (GPS Coordinates)	790818.8772 E 4073618.8535 N; Zone 12 N, NAD 83	792958.0423 E 4076841.5096 N; Zone 12 N, NAD 83	
Access Route		SJ4277 past octagon inn, right on 4275 at fishing access point	
Head/Grade Control Type (in main channel)	100 m long total length, 30 m of poured concrete, remainder is mix of boulders (>2ft dia.) and cobbles placed in channel, partially vegetated, extends across most of the channel.	At inlet of diversion channel, push-up dam is constructed to keep big flow out during peak dam releases.	NA
Head/Grade Control Condition	Good/Functioning	Good/Functioning	NA
Head/Grade Control Maintenance	Requires maintenance about every other year in spring when water level is lowest.	Requires maintenance seasonally.	NA
Head/Grade Control Notes	There is a large pool formed at the headgate by the head/grade control structure. Significant flow overtops the head/grade control structure allowing for some fish passage.		NA
River Width at Diversion Channel Intake	40 m	52 m	NA
River Width Notes	40 m wide main channel.	52 m wide main channel.	NA
Diversion Channel Intake Width	17 m	18.5 m	NA
Diversion Channel Intake Width Notes	17 m	18.5 m	NA
Diversion Channel Intake Distance from Headgate	0	450 m	NA
Diversion Channel Notes		The spillway gates at the headgate normally remain open during diversion, allowing for some fish passage back to main river channel.	NA
First Spillway Location	At headgate	At headgate (main spillway), but several natural spillways along secondary channel above headgate.	NA
Spillway Type	Two slide gates, one 36" and one 24" (always closed).	Spillways used to maintain head in canal (3 1.9 m wide slide gates)	NA
Spillway Width	0.94 m	4.7 m	NA
Head Gate Type	Concrete structure with slide gate (36")	Non-operable headgates; operable spillway gates used to maintain head.	NA
Head Gate Count	1	5 open slots where gates used to be	NA
Open at time of field visit	Yes	Yes	NA
Head Gate Width Each	0.91 m	1 m	NA
Head Gate Normal Operating Position	Fully open	Open	NA
Screen Type	Trash rack/screen using about 5 mm wire	No fish screen. Existing trash rack	NA
Screen Condition	Good	NA	NA
Screen Height	6 ft from ground to top of screen	NA	NA
Screen Width	1.8 m	NA	NA
Screen Mesh Opening	10 cm x 10 cm	NA	NA
Inlet Pipe at Headgate	36" pipe for about 1,000 ft downstream of headgate	None	NA
Maximum Diversion Rate cfs			NA
Normal Diversion Rate cfs	6-6.7		NA

APPENDIX A. continued (San Juan River).

Diversion Name	La Pumpa Ditch
River Name	San Juan River
River Mile: San Juan River = from Lake Powell Animas River = from confluence with San Juan	NA
State	NM
County	San Juan
Visit Date	NA
Visit Time	NA
Visit Note	Not visited; same diversion as Bloomfield Irrigation District.
Diversion/Discharge Data Available/Collected	NA
Entity	La Pumpa Ditch
Type of Entity	Ditch Association
Type of Diversion	NA
Entity Address	662 CR 4599, Blanco NM 87412
ContactA_Name	Mario Ulibarri
ContactA_Title	
ContactA_Phone	5056322643
ContactA_AltPhone	
ContactA_Email	
ContactB_Name	
ContactB_Title	
ContactB_Phone	
ContactB_AltPhone	
ContactB_Email	
Location (GPS Coordinates)	
Access Route	
Head/Grade Control Type (in main channel)	NA
Head/Grade Control Condition	NA
Head/Grade Control Maintenance	NA
Head/Grade Control Notes	NA
River Width at Diversion Channel Intake	NA
River Width Notes	NA
Diversion Channel Intake Width	NA
Diversion Channel Intake Width Notes	NA
Diversion Channel Intake Distance from Headgate	NA
Diversion Channel Notes	NA
First Spillway Location	NA
Spillway Type	NA
Spillway Width	NA
Head Gate Type	NA
Head Gate Count	NA
Open at time of field visit	NA
Head Gate Width Each	NA
Head Gate Normal Operating Position	NA
Screen Type	NA
Screen Condition	NA
Screen Height	NA
Screen Width	NA
Screen Mesh Opening	NA
Inlet Pipe at Headgate	NA
Maximum Diversion Rate cfs	NA
Normal Diversion Rate cfs	NA

APPENDIX A. continued (Animas River).

Diversion Name	Farmers Mutual Ditch	Willett Ditch	North Farmington Ditch
River Name	Animas River	Animas River	Animas River
River Mile: San Juan River = from Lake Powell Animas River = from confluence with San Juan	0.4	3.5	4.6
State	NM	NM	NM
County	San Juan	San Juan	San Juan
Visit Date	8/19/15	8/19/15	8/19/15
Visit Time	11:00 AM	10:00 AM	8:30 AM
Visit Note	Field visit successfully completed.	Field visit successfully completed.	Field visit successfully completed.
Diversion/Discharge Data Available/Collected	Yes, daily average	Yes, daily average	Yes, daily average
Entity	Farmers Mutual Ditch Company	Willett Ditch operated by City of Farmington, Electric Utility	North Farmington Ditch
Type of Entity	Ditch Association	Municipality	Ditch Association
Type of Diversion	Agricultural Diversion	Agricultural & Municipal/Industrial Diversion	Agricultural Diversion
Entity Address	PO Box 467 Kirtland, NM 87417	101 N Browning Pkwy, Farmington, NM 87401	2114 W. Apache, Farmington, NM.
ContactA_Name	Debra Currier, Danene Sherwood	Richard Miller	Patty Baysinger
ContactA_Title		Generation Superintendent	
ContactA_Phone	5055986159	5055998304	5053251134
ContactA_AltPhone	5053209646	5055998411	5053303495
ContactA_Email	sherwood7@me.com	rmiller@fmtn.org	pattyb3654@yahoo.com
ContactB_Name		Anthony Chavez	Clinton Gooding
ContactB_Title		Operator	Ditch Rider
ContactB_Phone		5055998304	5053600039
ContactB_AltPhone			
ContactB_Email		achavez@fmtn.org	
Location (GPS Coordinates)	748674.5264 E 4066798.2675 N; Zone 12 N, NAD 83	752322.1377 E 4069117.7276 N; Zone 12 N, NAD 83	752826.1840 E 4069928.4039 N; Zone 12 N, NAD 83
Access Route		Follow service road past the riverside nature center parking lot. Gate Access required. Diversion located on city park land.	Travel down road next to feed store. Take left at bottom of the hill. Diversion off of secondary channel behind Sinclair Gas Station
Head/Grade Control Type (in main channel)	Head/grade control adjacent to and extending upstream from headgate structure, comprised of native bed material. May be a natural river feature.	Concrete and large diameter boulders (>4 ft dia.) as part of river park/kayak area	Large cobble and bed material, visible from behind Farmington Museum.
Head/Grade Control Condition	Good/Functioning	Good/Functioning	Good/Functioning
Head/Grade Control Maintenance	Does not appear to need maintenance.	Does not appear to need maintenance.	Typically needs maintenance 1-2 times per year.
Head/Grade Control Notes			
River Width at Diversion Channel Intake	56 m	12 m	27 m
River Width Notes	56 m wide main channel; 26 m wide wetted channel at time of field visit.	12 m wide main channel at diversion; widens immediately downstream of "kayak course".	27 m main channel.
Diversion Channel Intake Width	NA	13 m	9
Diversion Channel Intake Width Notes	No separate intake channel	13 m wide at intake of diversion channel.	9 m wide diversion channel.
Diversion Channel Intake Distance from Headgate	0	93 m	200 m
Diversion Channel Notes		There is no fish passage to allow escape from the diversion channel upstream of the headgate, except back upstream.	There is no fish passage to allow escape from the diversion channel upstream of the headgate, except back upstream.
First Spillway Location	Further than 200 m downstream of headgate	Downstream of headgate	At headgate
Spillway Type	Unknown	Unknown	Concrete structure with radial gates
Spillway Width	Unknown	Unknown	2.44 m
Head Gate Type	Square slide gates	Concrete structure with slide gates	Concrete structure with radial gate and spillway gate
Head Gate Count	2	5	1
Open at time of field visit	Yes	3/5 Yes	Yes
Head Gate Width Each	2 m	1.5 m	2.4 m
Head Gate Normal Operating Position	Varies based on river stage	Unknown	Fully open
Screen Type	None	None	None
Screen Condition	NA	NA	NA
Screen Height	NA	NA	NA
Screen Width	NA	NA	NA
Screen Mesh Opening	NA	NA	NA
Inlet Pipe at Headgate	None	None	NA
Maximum Diversion Rate cfs	110		
Normal Diversion Rate cfs	85		

APPENDIX A. continued (Animas River).

Diversion Name	Farmington-Echo-Allen Ditch	City of Farmington Animas Pump Station No. 2	Ranchmans Ditch
River Name	Animas River	Animas River	Animas River
River Mile: San Juan River = from Lake Powell Animas River = from confluence with San Juan	6.1	9.5	10.8
State	NM	NM	NM
County	San Juan	San Juan	San Juan
Visit Date	8/19/15	NA	8/18/15
Visit Time	1:00 PM	NA	5:24 PM
Visit Note	Only visited head/grade control structure at confluence with main river channel. First spillway downstream was on locked private property.	Not visited; collected data via email.	Field visit successfully completed.
Diversion/Discharge Data Available/Collected	Yes, daily average	Yes, daily average	Yes, daily average
Entity	Farmington-Echo Ditch Company	City of Farmington	Ranchmans Ditch
Type of Entity	Ditch Association	Municipality	Ditch Association
Type of Diversion	Agricultural Diversion	Municipal Diversion	Agricultural Diversion
Entity Address	PO Box 2935, Farmington, NM 87499	101 N Browning Pkwy, Farmington, NM 87401	c/o Sam Gonzales at Los Hermanitos Restaurant, 3501 East Main St # A Farmington, NM 87402
ContactA_Name	Tommy Bolack	Paul Montoia	Sam Gonzales
ContactA_Title		Water Resources Manager	
ContactA_Phone	5053254275/5053257255	5055991394	5053202213
ContactA_AltPhone	5053600518		
ContactA_Email			iamhispappa@yahoo.com
ContactB_Name	Tom Easley		
ContactB_Title	Ditch Rider		
ContactB_Phone	5053279560		
ContactB_AltPhone	5053306099		
ContactB_Email			
Location (GPS Coordinates)	755039.2151 E 4071405.8102 N; Zone 12 N, NAD 83	758588.4862 E 4074720.8277 N; Zone 12 N, NAD 83	760333.7449 E 4075234.5499 N; Zone 12 N, NAD 83
Access Route			
Head/Grade Control Type (in main channel)	Push-up dam of native bed/bank material, constructed across the entire river. Evident bank erosion and rip-rap of larger concrete pieces on opposite side of river.	Concrete structure across entire river channel; approximately 1 m high.	Head/grade control push-up dam comprised of river bed material, large cobbles. Located 41 m downstream of headgate along main channel.
Head/Grade Control Condition	Fair/Function Impaired	Good/Functioning	Fair/Functioning with high maintenance
Head/Grade Control Maintenance	Requires frequent maintenance, particularly after spring runoff.	None	Typically needs maintenance with heavy equipment annually.
Head/Grade Control Notes	The head/grade control push up dam stretches all the way across the river, and impedes fish passage.		The head/grade control dam extends across the entire channel, is several feet higher than downstream bed elevation, and may be an impediment to fish passage.
River Width at Diversion Channel Intake	40 m	63 m	31 m
River Width Notes	40 m wide main channel.	Measured from aerial photo.	31 m wide main channel.
Diversion Channel Intake Width	12 m	NA	NA
Diversion Channel Intake Width Notes	12 m		Diversion structure and head gates are located on main river channel bank, with only a head/grade control dam adjacent to diversion. No diversion
Diversion Channel Intake Distance from Headgate	Unknown	0	0
Diversion Channel Notes			
First Spillway Location	Unknown	NA	First spillway downstream of headgate, another spillway further downstream, upstream of NMOSE gage.
Spillway Type	Unknown	NA	Unknown
Spillway Width	Unknown	NA	Unknown
Head Gate Type	Unknown	Pipe diversion	Concrete structure with slide gate
Head Gate Count	Unknown	NA	1
Open at time of field visit	Unknown	NA	Yes
Head Gate Width Each	Unknown	NA	7.2 m
Head Gate Normal Operating Position	Unknown	NA	Fully open
Screen Type	Unknown	Unknown	None
Screen Condition	NA	Unknown	NA
Screen Height	NA	Unknown	NA
Screen Width	NA	Unknown	NA
Screen Mesh Opening	NA	Unknown	NA
Inlet Pipe at Headgate	None	Yes	36" diameter, 20 ft long pipe, then open ditch
Maximum Diversion Rate cfs			8.63
Normal Diversion Rate cfs			

APPENDIX A. continued (Animas River).

Diversion Name	Halford-Independant Ditch	Kello-Blancett Ditch	Eledge Mill Ditch
River Name	Animas River	Animas River	Animas River
River Mile: San Juan River = from Lake Powell Animas River = from confluence with San Juan	15.3	16.8	19.8
State	NM	NM	NM
County	San Juan	San Juan	San Juan
Visit Date	8/18/15	8/18/15	8/18/15
Visit Time	11:30 AM	11:00 AM	1:00 PM
Visit Note	Field visit successfully completed.	Field visit successfully completed.	Field visit successfully completed.
Diversion/Discharge Data Available/Collected	Yes, daily average	Yes, daily average	Yes, daily average
Entity	Halford Ditch/Halford-Independent Ditch	Kello-Blancett Ditch	Eledge Ditch Company
Type of Entity	Ditch Association	Ditch Association	Ditch Association
Type of Diversion	Agricultural Diversion	Agricultural Diversion	Agricultural Diversion
Entity Address	PO Box 42, Flora Vista, NM 87415-0042	PO Box 505, Aztec, NM 87410	PO Box 261, Flora Vista, NM 87415
ContactA_Name	Joe Jaquez	Shirley Shelby	Olan and Valerie Hopper
ContactA_Title	Director		
ContactA_Phone	5053272958	5053342484	5052150513
ContactA_AltPhone			
ContactA_Email		sashelby@gmail.com	ValerieHopper54@gmail.com
ContactB_Name	Ron Williams		
ContactB_Title	Ditch Rider		
ContactB_Phone	5052158945		
ContactB_AltPhone			
ContactB_Email			
Location (GPS Coordinates)	765308.9128 E 4078627.0493 N; Zone 12 N, NAD 83	766766.1919 E 4079106.3329 N; Zone 12 N, NAD 83	767879.1643 E 4080319.8019 N; Zone 12 N, NAD 83
Access Route	Off of west Aztec Blvd, West of Town	We accessed the diversion from the Aztec sports complex. Difficult access over private property.	
Head/Grade Control Type (in main channel)	Native bed material in main channel; diversion channel berm is vegetated; adjacent to headgate head/grade control dam has eroded	Older structure exists in main channel. Secondary diversion/channel has concrete weir, and the elevation of the control has been raised using wooden boards supported by vertical steel rods.	Boulders/rocks; 18 m long, extending out into channel, but not to the opposite other bank.
Head/Grade Control Condition	Fair/Function Impaired	Fair/Function Impaired	Good/Functioning
Head/Grade Control Maintenance	Head/grade control in main channel not maintained, at least not in recent memory. Head/grade control in diversion channel adjacent to head gate requires regular maintenance.	Secondary/diversion channel structure needs frequent maintenance.	Last maintained about 10 years ago.
Head/Grade Control Notes	Head/grade control in diversion channel adjacent to head gate is an impediment to fish passage.	The head/grade control structure built across the width of the diversion channel is an impediment to fish passage.	
River Width at Diversion Channel Intake	46 m	20 m	45 m
River Width Notes	46 m wide main channel.	main river 20 m wide at time of visit; main channel thalweg approximately 6 m from diversion.	45 m wide main channel.
Diversion Channel Intake Width	6 m	7 m	10 m
Diversion Channel Intake Width Notes	6 m wide diversion channel.	7 m	10 m
Diversion Channel Intake Distance from Headgate	53 m	40 m	0
Diversion Channel Notes	There is no fish passage to allow escape from the diversion channel upstream of the headgate, except back upstream.	There is no fish passage to allow escape from the diversion channel upstream of the headgate, except back upstream.	
First Spillway Location	Upstream of headgate is the spillway/return channel that was plugged at the time of field visit; air photos indicate the secondary return channel normally flows,	At headgate	Downstream of headgate
Spillway Type	At time of visit, completely plugged with a push up dam. No flow through spillway. Historically may have flowed.	Square slide gate	Native bed material
Spillway Width	NA	1.3 m	0.6 m
Head Gate Type	Concrete structure with radial gate	Concrete structure with slide gates	Concrete structure with slide gate
Head Gate Count	1	2	1
Open at time of field visit	Yes	Yes	Yes
Head Gate Width Each	2.5 m	0.75 m	1.5 m
Head Gate Normal Operating Position	Unknown	Unknown	Fully open
Screen Type	No screen, trash rack located downstream of headgate.	None	None
Screen Condition	NA	NA	NA
Screen Height	NA	NA	NA
Screen Width	NA	NA	NA
Screen Mesh Opening	NA	NA	NA
Inlet Pipe at Headgate	None	NA	4 ft dia., for ca. 25 ft, then open ditch
Maximum Diversion Rate cfs	7.5		8.3
Normal Diversion Rate cfs			

APPENDIX A. continued (Animas River).

Diversion Name	Farmers Irrigation District	Lower Animas Ditch	Sargent Ditch
River Name	Animas River	Animas River	Animas River
River Mile: San Juan River = from Lake Powell Animas River = from confluence with San Juan	21.4	21.8	24.6
State	NM	NM	NM
County	San Juan	San Juan	San Juan
Visit Date	8/18/15	8/20/15	NA
Visit Time	2:00 PM	8:00 AM	NA
Visit Note	Field visit successfully completed.	Field visit successfully completed.	Not visited; did not return call.
Diversion/Discharge Data Available/Collected	Yes, daily average	Yes, daily average	Yes, daily average
Entity	Farmers Irrigation District	Lower Animas Community Ditch	Sargent Ditch
Type of Entity	Irrigation District	Ditch Association	Ditch Association
Type of Diversion	Agricultural Diversion	Agricultural Diversion	Agricultural Diversion
Entity Address	PO Box 261, Aztec, NM 87410	PO Box 404, Aztec, NM 87410	445 CR 2900, Aztec, NM 87410
ContactA_Name	Dennis Taylor	Earnest Smith	Leon Knowlton
ContactA_Title		Ditch Rider, irrigator	
ContactA_Phone	5053300274	5052152907	5053346051
ContactA_AltPhone			
ContactA_Email		earnestdsmith@yahoo.com	
ContactB_Name			
ContactB_Title			
ContactB_Phone			
ContactB_AltPhone			
ContactB_Email			
Location (GPS Coordinates)	770455.0274 E 4084759.3734 N; Zone 12 N, NAD 83	770961.4524 E 4085142.9072 N; Zone 12 N, NAD 83	773548.8158 E 4088023.1746 N; Zone 12 N, NAD 83
Access Route	CR 2845, turn left after crossing ditch. Follow ditch to diversion.		
Head/Grade Control Type (in main channel)	Concrete diversion dam across river; built around 2005-2007 with assistance from City of Farmington.	Large boulders and native bed material.	Large boulders and native bed material.
Head/Grade Control Condition	Good/Functioning	Good/Functioning	Unknown
Head/Grade Control Maintenance	None	Requires maintenance every 1-2 years.	Unknown
Head/Grade Control Notes	Concrete head/grade control weir across main river channel is likely an impediment to fish movement upstream.		
River Width at Diversion Channel Intake	61 m	56 m	35 m
River Width Notes	61 m wide main channel.	56 m wide main channel.	Measured from aerial photo.
Diversion Channel Intake Width	4 m	7 m	5 m
Diversion Channel Intake Width Notes	Two gates: one 1.2 m wide, the other 2.5 m wide. Additional flow control available at spillway located approximately 95 m downstream from intake.	7 m	Measured from aerial photo.
Diversion Channel Intake Distance from Headgate	0	0	0
Diversion Channel Notes			
First Spillway Location	Immediately downstream of headgate	At headgate	Unknown
Spillway Type	Radial gate	Slide gate	Unknown
Spillway Width	3 m (closed at time of field visit)	3 m	Unknown
Head Gate Type	Concrete structure with slide gates	Concrete structure with radial headgate and spillway	Unknown
Head Gate Count	2	1	Unknown
Open at time of field visit	Yes	Yes	NA
Head Gate Width Each	3.7 m	3 m	Unknown
Head Gate Normal Operating Position	Unknown	Half open	Unknown
Screen Type	None	None	Unknown
Screen Condition	NA	NA	Unknown
Screen Height	NA	NA	Unknown
Screen Width	NA	NA	Unknown
Screen Mesh Opening	NA	NA	Unknown
Inlet Pipe at Headgate	NA	NA	Unknown
Maximum Diversion Rate cfs	80		
Normal Diversion Rate cfs	55	65	

APPENDIX A. continued (Animas River).

Diversion Name	Aztec Ditch	Stacey Ditch	Graves-Atterberry (Inca) Ditch
River Name	Animas River	Animas River	Animas River
River Mile: San Juan River = from Lake Powell Animas River = from confluence with San Juan	27.4	29.6	31.7
State	NM	NM	NM
County	San Juan	San Juan	San Juan
Visit Date	NA	8/18/15	NA
Visit Time	NA	4:00 PM	NA
Visit Note	Not visited; did not return call.	Field visit successfully completed.	Not visited; declined to participate.
Diversion/Discharge Data Available/Collected	Yes, daily average	Yes, daily average	Yes, daily average
Entity	Aztec Ditch	Stacey Ditch	Graves-Atterberry Ditch
Type of Entity	Ditch Association	Ditch Association	Ditch Association
Type of Diversion	Agricultural Diversion	Agricultural Diversion	Agricultural Diversion
Entity Address	28 CR 2800, Aztec, NM 87410	c/o Misty Wright, 649 CR Road 2900, Aztec, NM 87410	PO Box 144, Aztec, NM 87401
ContactA_Name	Susan Hare	Helen Root	Bill Moss
ContactA_Title			
ContactA_Phone	5053346113	5053341568	5053349093
ContactA_AltPhone			
ContactA_Email			billmossinc00@msn.com
ContactB_Name		Mike Currothers and Misty Wright	
ContactB_Title		Ditch Rider	
ContactB_Phone		5053346061	
ContactB_AltPhone		5057936061	
ContactB_Email		mkbj_carruthers@live.com; docholiday09@q.com	
Location (GPS Coordinates)	775254.1092 E 4090556.1266 N; Zone 12 N, NAD 83	777243.9549 E 4091665.2302 N; Zone 12 N, NAD 83	777604.4845 E 4093605.4341 N; Zone 12 N, NAD 83
Access Route			
Head/Grade Control Type (in main channel)	Large boulders and native bed material.	Larger rocks and native bed material across most of main river channel.	Large cobble bar in main channel.
Head/Grade Control Condition	Unknown	Good/Functioning	Unknown
Head/Grade Control Maintenance	Unknown	None	Unknown
Head/Grade Control Notes			
River Width at Diversion Channel Intake	45 m	41 m	55 m
River Width Notes	Measured from aerial photo.	41 m wide main channel. Thalweg in middle of channel.	Measured from aerial photo.
Diversion Channel Intake Width	7 m	15 m	3 m
Diversion Channel Intake Width Notes	Measured from aerial photo.	15 m wide diversion channel	Measured from aerial photo.
Diversion Channel Intake Distance from Headgate	0	700 m	0
Diversion Channel Notes		There diversion channel berm has eroded in several locations, and spill way is at headgate, both allowing for some fish passage back to main channel.	
First Spillway Location	Unknown	At headgate	Unknown
Spillway Type	Unknown	Slide gate	Unknown
Spillway Width	Unknown	1.93 m	Unknown
Head Gate Type	Unknown	Concrete structure with slide gate	Unknown
Head Gate Count	Unknown	1	Unknown
Open at time of field visit	NA	Yes	NA
Head Gate Width Each	Unknown	1.8 m	Unknown
Head Gate Normal Operating Position	Unknown	Unknown	Unknown
Screen Type	Unknown	None	Unknown
Screen Condition	Unknown	NA	Unknown
Screen Height	Unknown	NA	Unknown
Screen Width	Unknown	NA	Unknown
Screen Mesh Opening	Unknown	NA	Unknown
Inlet Pipe at Headgate	Unknown	NA	Unknown
Maximum Diversion Rate cfs			
Normal Diversion Rate cfs			

APPENDIX A. continued (Animas River).

Diversion Name	Cedar Ditch	Ralston Ditch	Twin Rock Ditch
River Name	Animas River	Animas River	Animas River
River Mile: San Juan River = from Lake Powell Animas River = from confluence with San Juan	33.8	38.1	39.7
State	NM	CO	CO/NM
County	San Juan	La Plata	La Plata, CO/San Juan, NM
Visit Date	8/18/15	NA	8/17/15
Visit Time	3:00 PM	NA	4:20 PM
Visit Note	Field visit successfully completed.	Not visited; not available for site visit, requires access to private land.	Field visit successfully completed.
Diversion/Discharge Data Available/Collected	Yes, daily average	Yes, daily average	Yes, daily average
Entity	Cedar Ditch	Ralston Ditch	Twin Rocks Ditch Company
Type of Entity	Ditch Association	Ditch Association	Ditch Association
Type of Diversion	Agricultural Diversion	Agricultural Diversion	Agricultural Diversion
Entity Address	PO Box 1382, Aztec, NM 87410	PO Box 295, Farmington, NM 87499	P.O. Box 731 Aztec, NM. 87410
ContactA_Name	Michael Schwebach	Mr. Linn and Tweety Blancett	John Saul
ContactA_Title			Ditch commissioner, treasurer, secretary
ContactA_Phone	5053345111	5052151201	2817700041
ContactA_AltPhone	5053213252	5052151200	
ContactA_Email	mdschwebach@gmail.com		
ContactB_Name		Ray Kaiser	Brian Bills
ContactB_Title			Mayor Domo
ContactB_Phone			5053201475
ContactB_AltPhone			
ContactB_Email			
Location (GPS Coordinates)	778526.7406 E 4095691.5900 N; Zone 12 N, NAD 83	778277.8187 E 4101439.4984 N; Zone 12 N, NAD 83	777966.9185 E 4103445.6759 N; Zone 12 N, NAD 83
Access Route	End of county Rd 2125, past house		
Head/Grade Control Type (in main channel)	Boulders, rocks, concrete highway barriers, supported by steel railroad rails driven vertically, exposed above water surface.	Large boulders and native bed material across most of main river channel.	Large diameter boulders (>2ft dia.) and cobbles placed across channel.
Head/Grade Control Condition	Fair/Functioning but vertical steel supports are a safety hazard.	Unknown	Good/Functioning
Head/Grade Control Maintenance	Requires frequent maintenance, after spring flows.	Unknown	Requires maintenance about every other year.
Head/Grade Control Notes	Head control/grade structure poses a safety hazard to boaters/fishermen.		
River Width at Diversion Channel Intake	44 m	64 m	47 m
River Width Notes	44 m wide main channel.	Measured from aerial photo.	47 m wide main channel.
Diversion Channel Intake Width	NA - no separate diversion channel	5 m	5 m
Diversion Channel Intake Width Notes	Diversion structure is located on river bank, adjacent to head/grade control structure.	Measured from aerial photo.	5 m
Diversion Channel Intake Distance from Headgate	0	0	0
Diversion Channel Notes			
First Spillway Location	Approximately 400 m downstream of headgate.	Unknown	Downstream of headgate
Spillway Type	Unknown	Unknown	Unknown
Spillway Width	Unknown	Unknown	Unknown
Head Gate Type	Concrete structure with slide gate	Unknown	Concrete structure with slide gate
Head Gate Count	1	Unknown	1
Open at time of field visit	Yes	NA	Yes
Head Gate Width Each	1 m	Unknown	0.91 m
Head Gate Normal Operating Position	Unknown	Unknown	Unknown
Screen Type	None	Unknown	No fish screen. Existing trash rack (1.53 m width, 26 cm openings).
Screen Condition	NA	Unknown	NA
Screen Height	NA	Unknown	NA
Screen Width	NA	Unknown	1.53 m
Screen Mesh Opening	NA	Unknown	
Inlet Pipe at Headgate	NA	Unknown	NA
Maximum Diversion Rate cfs			
Normal Diversion Rate cfs			

APPENDIX A. continued (Animas River).

Diversion Name	Citizens-Animas Ditch	Dena Ditch_Little Fishes Wildlife Habitat Enhancement Project	Cason Ditch
River Name	Animas River	Animas River	Animas River
River Mile: San Juan River = from Lake Powell Animas River = from confluence with San Juan	48.0	48.9	53.5
State	CO	CO	CO
County	La Plata	La Plata	La Plata
Visit Date	NA	8/17/15	8/17/15
Visit Time	NA	3:00 PM	5:00 PM
Visit Note	Not visited; did not return call.	Field visit successfully completed.	Field visit successfully completed.
Diversion/Discharge Data Available/Collected	Yes, daily average	No	Yes, daily average
Entity	Citizens-Animas Ditch	Little Fishes LLC.	Cason Ditch
Type of Entity	Ditch Association	Individual/Company	Ditch Association
Type of Diversion	Agricultural Diversion	Recreational Diversion	Agricultural Diversion
Entity Address	Unknown	536 CR307, Durango, CO. 81301	11202 Co Rd 213, Durango, CO 81303
ContactA_Name	Tom Bonds	Lonnie Malouff	Shirley Isgar & David Alfred
ContactA_Title			Irrigator
ContactA_Phone	9702593950	9702592463	9703854537
ContactA_AltPhone		9707595555	9703855069
ContactA_Email			bluelakeranch@gmail.com
ContactB_Name	Chad McKee	Dena Malouff	John Huff
ContactB_Title	Board member		Irrigator
ContactB_Phone			9707491455
ContactB_AltPhone			
ContactB_Email			
Location (GPS Coordinates)	776115.2753 E 4114560.2497 N; Zone 12 N, NAD 83	776487.5193 E 4115538.7099 N; Zone 12 N, NAD 83	778550.6090 E 4121135.0929 N; Zone 12 N, NAD 83
Access Route		one mile south of the Weaselskin Bridge on La Posta Road (County Road 213)	
Head/Grade Control Type (in main channel)	Approximate 80 m long partially vegetated (willow & grass), earthen berm upstream of headgate. At the furthest extent of the vegetated berm, a head/grade control comprised of native bed material extends across most of the rest of the channel.	15 m long weir comprised of large diameter boulders (>2ft dia.) and cobbles placed in channel; does not extend completely across channel	Approximate 225 m long partially vegetated (willow & grass), earthen berm upstream of headgate Native bed material, does not extend across river channel.
Head/Grade Control Condition	Unknown	Good/Functioning	Good/Functioning
Head/Grade Control Maintenance	Unknown	None	Not maintained, at least not in recent memory
Head/Grade Control Notes			
River Width at Diversion Channel Intake	55 m	21 m	41 m
River Width Notes	Measured from aerial photo.	21 m wide main channel.	41 m wide main channel.
Diversion Channel Intake Width	5 m	7 m	5 m
Diversion Channel Intake Width Notes	Measured from aerial photo.	7 m	5 m
Diversion Channel Intake Distance from Headgate	90 m	0	0
Diversion Channel Notes			
First Spillway Location	Unknown	None	At headgate
Spillway Type	Unknown	NA	Concrete and large rocks, no gate.
Spillway Width	Unknown	NA	3 m
Head Gate Type	Unknown	Slide gate (circular 16") mounted on 16" pipe along bank of main river channel.	Earthen and concrete structure with wheel operated slide gate (24")
Head Gate Count	Unknown	1	1
Open at time of field visit	NA	Yes	Yes
Head Gate Width Each	Unknown	0.4 m	0.6 m
Head Gate Normal Operating Position	Unknown	Fully open	Unknown
Screen Type	Unknown	None	None
Screen Condition	Unknown	NA	NA
Screen Height	Unknown	NA	NA
Screen Width	Unknown	NA	NA
Screen Mesh Opening	Unknown	NA	NA
Inlet Pipe at Headgate	Unknown	16 in diameter	24" for about 100 ft, then open ditch
Maximum Diversion Rate cfs			
Normal Diversion Rate cfs		2	

APPENDIX A. continued (Animas River).

Diversion Name	East Mesa Ditch	USBR Animas-La Plata Project Lake Nighthorse Diversion	City of Durango Santa Rita Diversion
River Name	Animas River	Animas River	Animas River
River Mile: San Juan River = from Lake Powell Animas River = from confluence with San Juan	55.1	59.8	60.2
State	CO	CO	CO
County	La Plata	La Plata	La Plata
Visit Date	8/18/15	8/17/15	8/17/15
Visit Time	10:00 AM	1:00 PM	2:00 PM
Visit Note	Field visit successfully completed.	Field visit successfully completed.	Field visit successfully completed.
Diversion/Discharge Data Available/Collected	Yes, daily average	Yes, daily average	Yes, monthly totals only
Entity	East Mesa Ditch Company	USBR, Western Colorado Area Office	City of Durango
Type of Entity	Ditch Association	Federal Agency	Municipality
Type of Diversion	Agricultural Diversion	Agricultural Diversion	Municipal Diversion
Entity Address	1550 CR 215, Durango, CO 81303	185 Suttle Street, Suite 2, Durango, CO 81303	105 Sawyer Dr., Durango, CO 81303
ContactA_Name	Kevin McCulloch	Tyler Artichocker	Matt Holden
ContactA_Title	Ditch Rider	Chief, Facilities Maintenance Group	Utilities Engineer
ContactA_Phone	9702474736	9703856557	9703754813
ContactA_AltPhone	9707498499	9707593277	9703175721
ContactA_Email	kmcculloch@animas.net	Tartichoker@usbr.gov	matt.holden@durangogov.org
ContactB_Name		Jim Darling	
ContactB_Title		WCAO/FCCO, Mechanical Engineering Tech	
ContactB_Phone		9703856516	
ContactB_AltPhone		9707495125	
ContactB_Email		jdarling@usbr.gov	
Location (GPS Coordinates)	779796.5748 E 4122284.0092 N; Zone 12 N, NAD 83	776897.9577 E 4128196.0389 N; Zone 12 N, NAD 83	776571.3938 E 4128735.8518 N; Zone 12 N, NAD 83
Access Route	Trestle Ln off of frontage road across River Road from Durango Home Depot. Downstream of wastewater treatment plant (behind gate).	Behind fence on USBR property. Contact USBR. 125 Smelter Place	Behind sewer treatment plant. Accessible from public trail along Animas river. Downstream of Santa Rita boat ramp that is used during competitions.
Head/Grade Control Type (in main channel)	Approximate 160 m long partially vegetated (willow & grass), earthen berm upstream of headgate, does not extend across river channel.	Boulders and native bed material installed across channel just downstream of diversion intake, presumably at the time of the project construction.	Large diameter boulders (>3ft dia.) and cobbles placed in channel; does not extend completely across channel.
Head/Grade Control Condition	Good/Functioning	Good/Functioning	Fair/Functioning but main channel thalweg is moving away from the diversion over time, as evidenced by cut bank on opposite side of river. City is discussing efforts to keep river near diversion on river left, including permanent weir across river.
Head/Grade Control Maintenance	Requires occasional maintenance	None	City performed maintenance in 2015.
Head/Grade Control Notes			
River Width at Diversion Channel Intake	37 m	37 m	57 m
River Width Notes	37 m wide channel at diversion channel inlet, 54 m wide main channel at intake structure.	37 m wide main channel.	57 m wide main channel.
Diversion Channel Intake Width	20 m	11.7 m	3.65 m
Diversion Channel Intake Width Notes	20 m	Three 3.9 m (14 ft) with solid "bulkheads" comprise the intake; gate adjusted using an obermeyer bladder system. Intake flows are perpendicular to river flow.	3.65 m
Diversion Channel Intake Distance from Headgate	1 m	0	15 m
Diversion Channel Notes			The boulders that comprise the relatively short "diversion channel" allow fish passage back to the main channel.
First Spillway Location	At headgate	Fish passage return, downstream of diversion structure.	NA
Spillway Type	Boulder grade control	Slide gate controls flow in fish passage return via 36" HDPE pipe.	NA
Spillway Width	4 m	0.91 m	NA
Head Gate Type	Concrete structure with slide gates (36")	Bladder-obermeyer gate and solid metal doors to eliminate all flow.	Concrete structure with trash rack (8 cm), square 1 m slide gate, leading into 3 ft diameter pipe gravity feed to Santa Rita Pump Station
Head Gate Count	2	3	1
Open at time of field visit	No (water returned to river via spillway)	Yes	No
Head Gate Width Each	0.91 m	4.27 m	1 m
Head Gate Normal Operating Position	Unknown	Varies based on river stage	Fully open
Screen Type	No fish screen. Existing trash rack (horizontal, skims surface).	Trash rack and fish screen (1 cm mesh opening)	No fish screen. Existing trash rack (8 cm pipe spacing).
Screen Condition	NA	Well maintained, automatic brushes.	clean
Screen Height	NA	about 2 m	NA
Screen Width	NA	about 10 m	NA
Screen Mesh Opening	NA	2 mm screen opening (0.069"); trash rack spacing 5 cm (0.18')	NA
Inlet Pipe at Headgate	two 36" diameter intake pipes	NA	36" diameter
Maximum Diversion Rate cfs	27	280	
Normal Diversion Rate cfs			

APPENDIX B. Ground photographs of San Juan and Animas rivers diversion structures.

RM 80.7 Utah Pipe Diversion 3

View of pipe diversion from raft.

APPENDIX B. continued (San Juan River).

RM 81.0 Utah Pipe Diversion 2

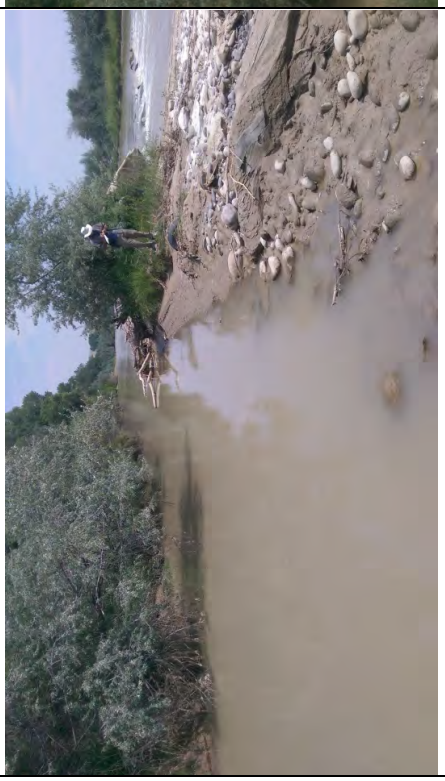
View of pipe diversion from raft.

APPENDIX B. continued (San Juan River).

RM 82.3 Utah Pipe Diversion 1

View of pipe diversion from raft.

APPENDIX B. continued (San Juan River).

RM 166.3 Jewett Valley Ditch (1 of 2)		View downstream at headgate.		View upstream from headgate of head/grade control structure stretching across main channel.
		Headgate with non-functioning spillway at left.		View upstream from headgate of diversion channel, with head/grade control structure in main channel at right.

APPENDIX B. continued (San Juan River).

RM 166.3 Jewett Valley Ditch (2 of 2)		Non-functioning spillway gate at headgate		Head/grade control structure
		View upstream of old headgate structure		View downstream from current headgate of old headgate

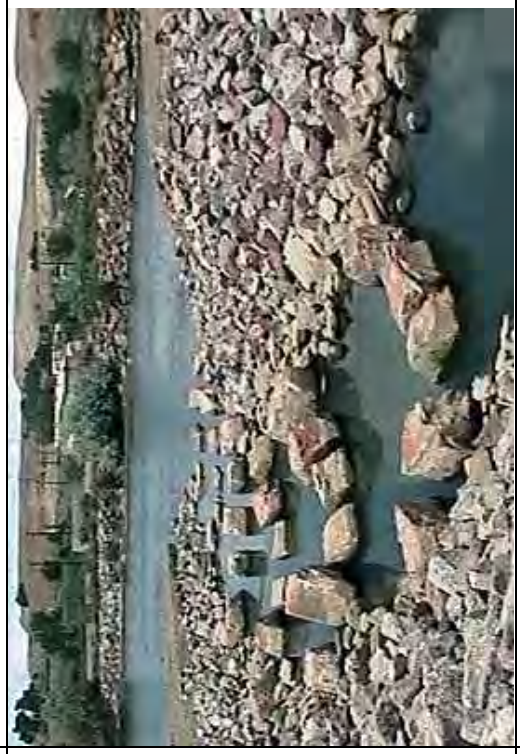
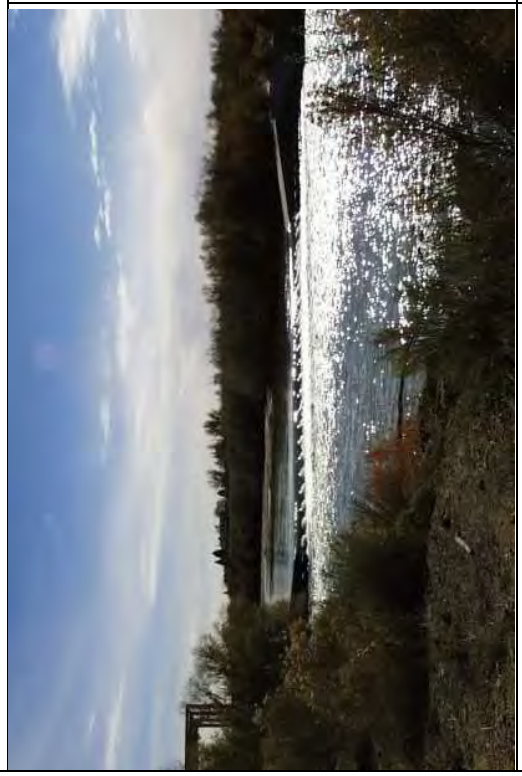
APPENDIX B. continued (San Juan River).

RM 163.7 APS Four Corners Units 4 & 5 (1 of 2)		Concrete head/grade control structure.		Diversion structure inlet openings with debris/fish screens.
		View upstream of diversion structure.		View upstream of diversion channel outlet gate.

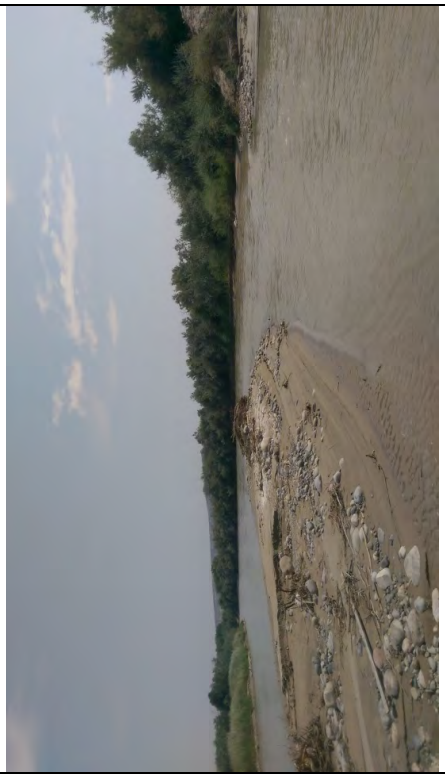
APPENDIX B. continued (San Juan River).

RM 163.7 APS Four Corners Units 4 & 5 (2 of 2)		View upstream of head/grade control structure		Concrete head/grade control structure.
		Debris/fish screens across diversion/pump inlets.		View upstream of diversion channel.

APPENDIX B. continued (San Juan River).

RM 166.7 PNM San Juan Generating Station				Entrance of fish passage on opposite bank.
		View upstream of concrete head/grade control structure, diversion headgate at left.		

APPENDIX B. continued (San Juan River).

RM 178.4 Fruitland Irrigation Canal/Shiprock Irrigation (1 of 2)		Headgate structure.		Headgate structure.
		View downstream of headgate structure with gate operators removed.		View downstream of canal from headgate.

APPENDIX B. continued (San Juan River).

RM 178.4 Fruitland Irrigation Canal/Shiprock Irrigation (2 of 2)		Head/grade control structure.		Spillway with diverted water.
		View upstream of headgate structure.		Spillway gate.

APPENDIX B. continued (San Juan River).

RM 195.6 Williams Field Services Kutz Plant		Inlet channel with "Gilligan's Island" in background.		View downstream of return channel.
		Pumphouse with debris/fish screens across pump inlet.		Debris/fish screens across pump inlet/opening.

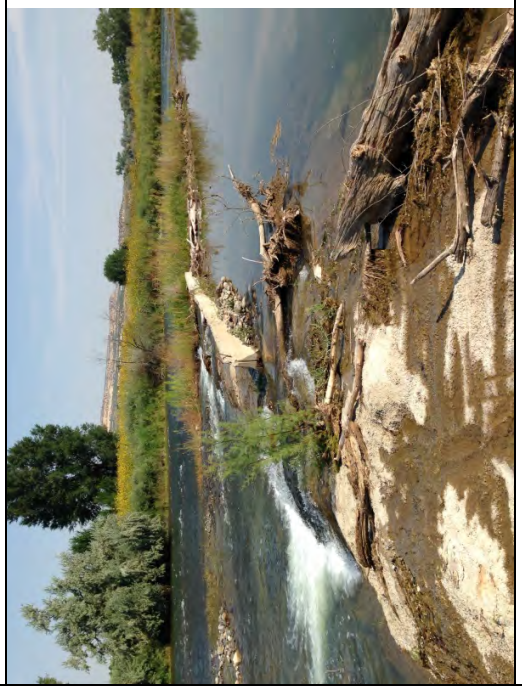
APPENDIX B. continued (San Juan River).

RM 197.9 City of Bloomfield Second Source		View downstream of diversion channel and headgate (right).		View upstream of headgate and across river.
		View downstream of diversion inlet gate.		View upstream of diversion channel.

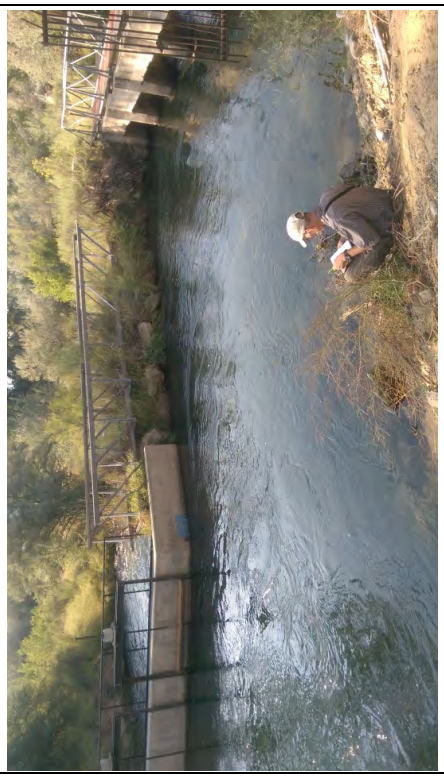
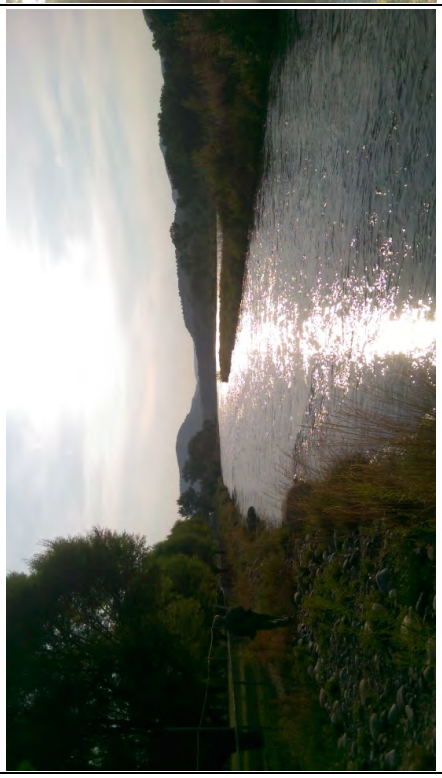
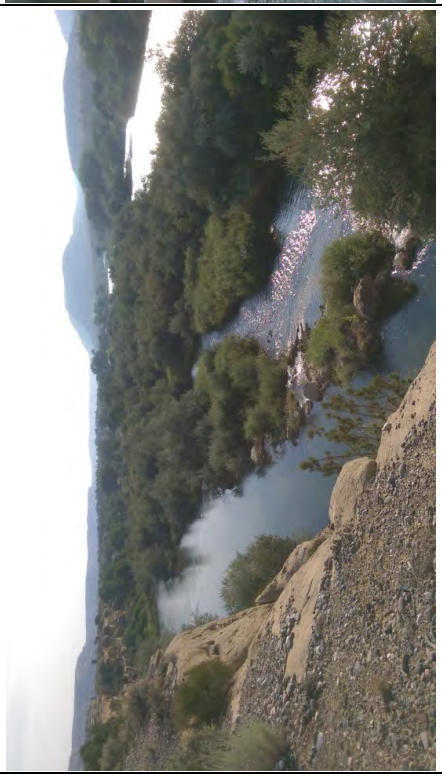
APPENDIX B. continued (San Juan River).

RM 214.4 Turley-Manzanares Ditch (1 of 2)		Headgate with trash rack.		Spillway gate and return channel in background.
		View downstream of headgate and spillway.		Primary and secondary headgates (secondary seldom used).

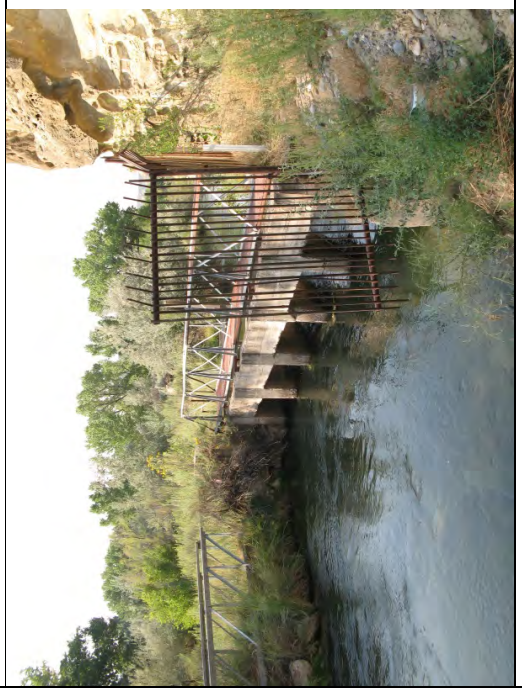
APPENDIX B. continued (San Juan River).

RM 214.4 Turley-Manzanares Ditch (2 of 2)		Head/grade control structure.		View upstream of ponded area upstream of diversion.
		Head/grade control structure.		Head/grade control structure with main channel in background.

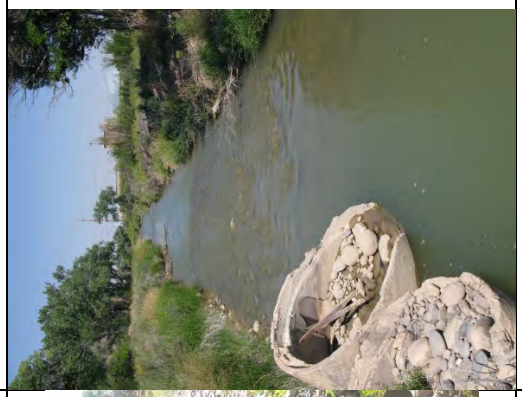
APPENDIX B. continued (San Juan River).

RM 217.8 Bloomfield Irrigation District (1 of 2)		Spillway gates and return channel in background.		Spillway and headgate structure.
		View upstream of diversion channel inlet.		Diversion channel, with loss back to main river channel.

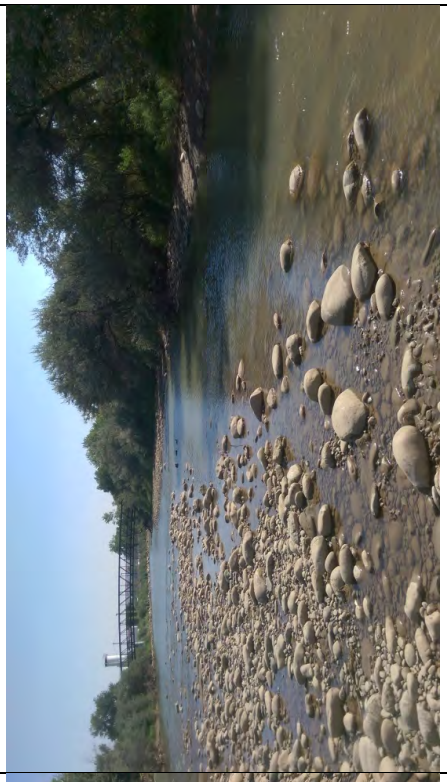
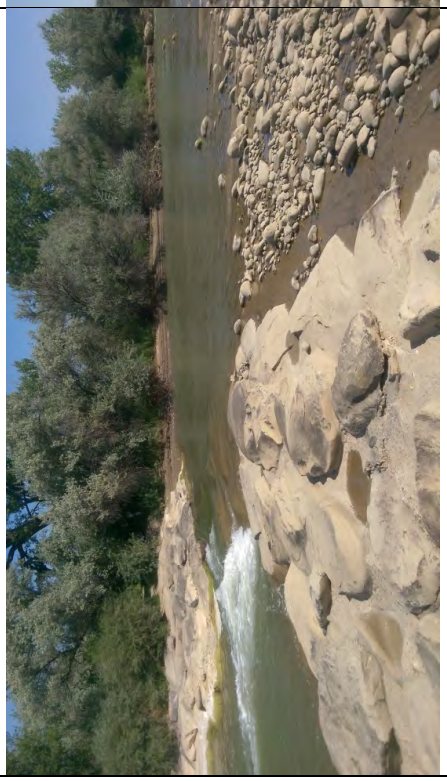
APPENDIX B. continued (San Juan River).

RM 217.8 Bloomfield Irrigation District (2 of 2)		View downstream of headgate structure.		View downstream of diversion channel inlet, at right.
		Headgate structure, gates removed.		Spillway and headgate structure.

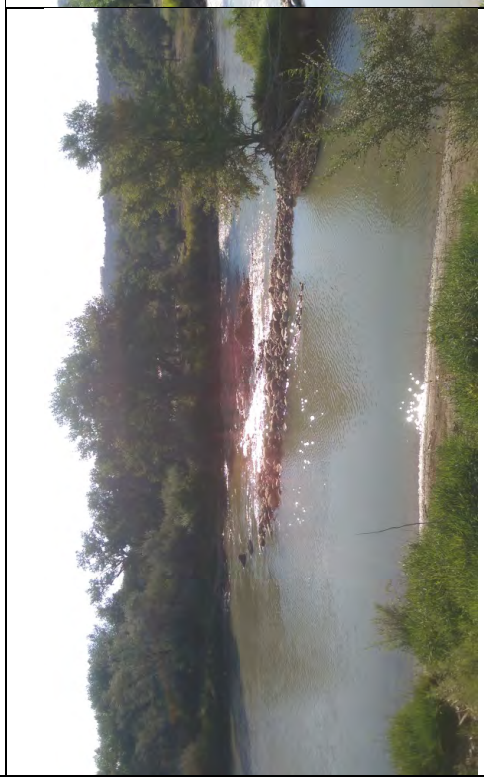
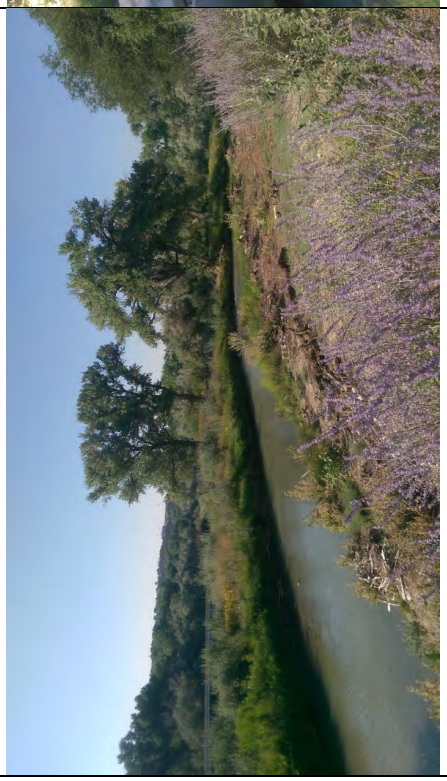
APPENDIX B. continued (Animas River).

RM 0.4 Farmers Mutual Ditch		Concrete headgate structure.		View downstream of ditch, from headgate.
		View upstream of diversion channel inlet, from headgate; head/grade control structure in main river channel at right.		Back of headgate structure, with radial gates.

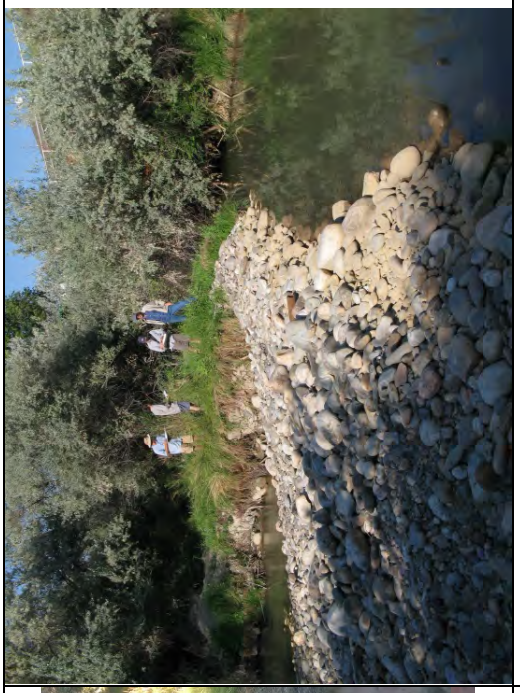
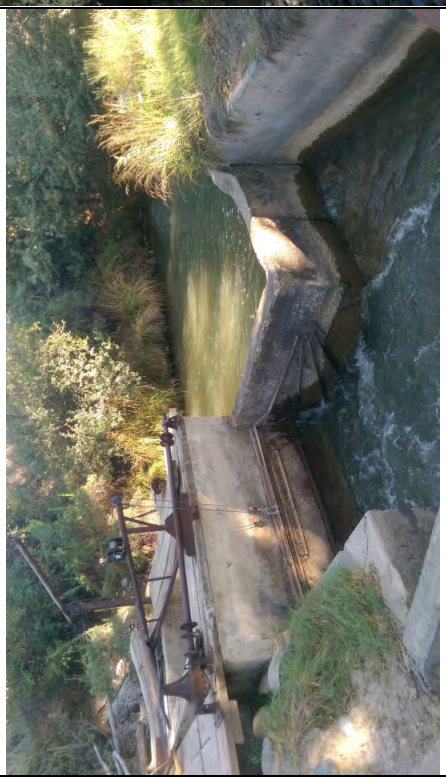
APPENDIX B. continued (Animas River).

RM 3.5 Willet Ditch		View downstream of headgate structure at left and concrete/boulder head/grade control structure at right.		View upstream, diversion channel at right, head/grade control structure at left.
		Headgate structure with concrete/boulder head/grade control structure at right.		View upstream of concrete/boulder head/grade control structure with kayak hole downstream.

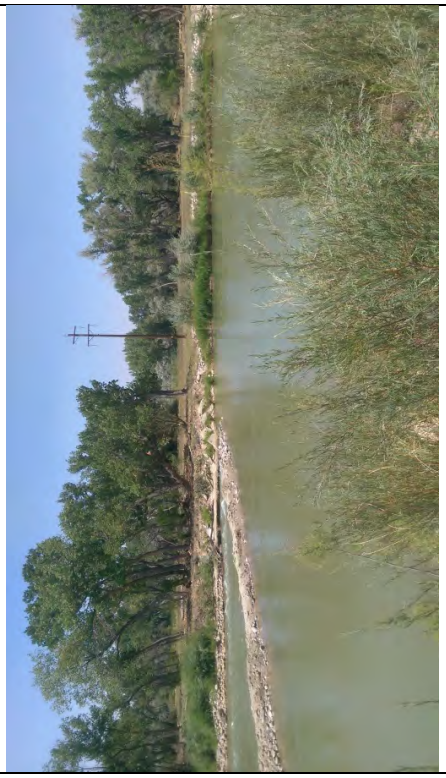
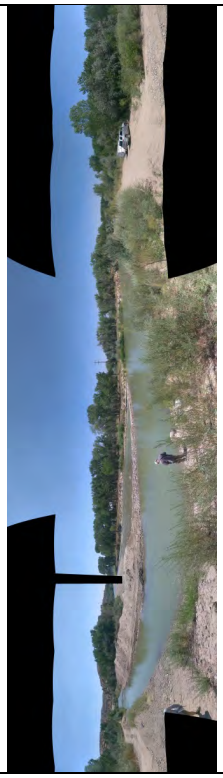
APPENDIX B. continued (Animas River).

RM 4.6 North Farmington Ditch (1 of 2)		Diversion channel inlet.		Concrete headgate and spillway structure with radial gates.
		Diversion channel inlet (at right) with head/grade control structure in background stretching across main river channel.		View downstream of diversion channel, below inlet at main channel.

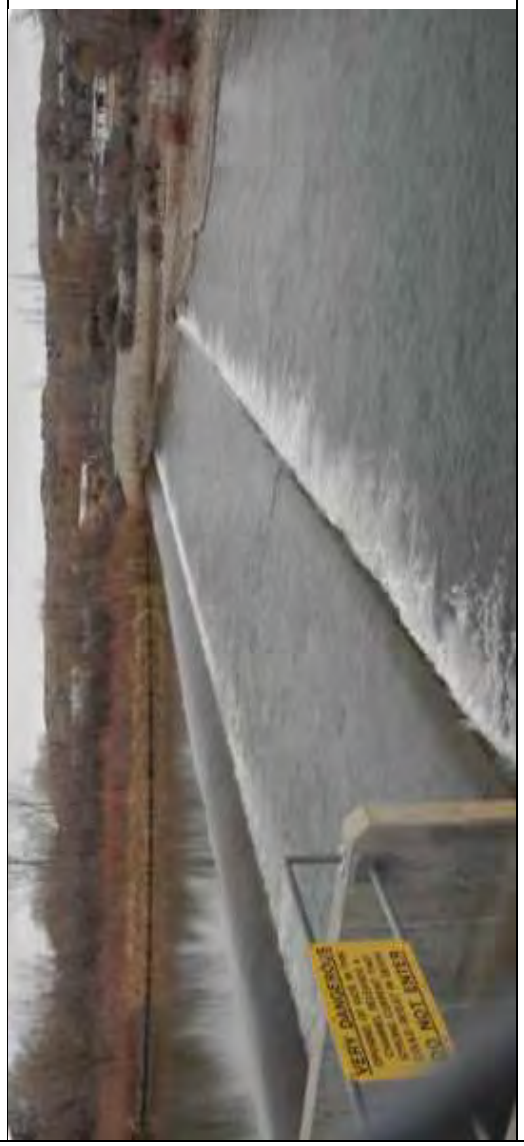
APPENDIX B. continued (Animas River).

RM 4.6 North Farmington Ditch (2 of 2)		Secondary head/grade control structure across diversion channel; headgate behind field crew.		View downstream of secondary head/grade control overflow return channel.
		Spillway gate in foreground, main headgate in background.		Secondary head/grade control structure, headgate at left.

APPENDIX B. continued (Animas River).

RM 6.1 Farmington-Echo-Allen Ditch		Head/grade control structure at left stretching across main river channel.		Panoramic view of diversion channel inlet and head/grade control structure.
		Diversion channel inlet with head/grade control structure at left stretching across main river channel.		View downstream of diversion channel.

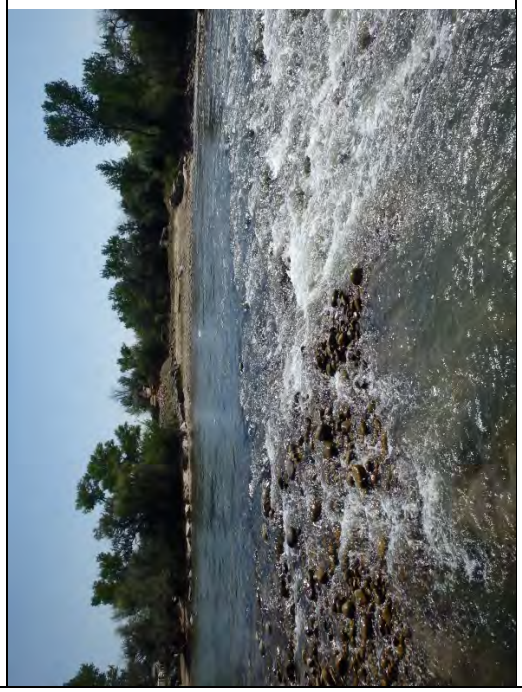
APPENDIX B. continued (Animas River).

RM 9.5 City of Farmington Animas Pump Station No. 2		Head/grade control structure, with diversion inlet in foreground.		View upstream of head/grade control structure.

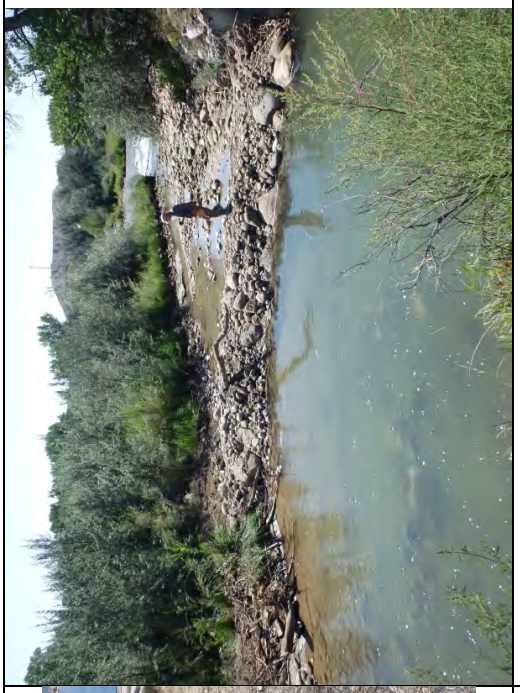
APPENDIX B. continued (Animas River).

RM 10.8 Ranchmans Ditch		Head/grade control structure in main channel 40 meters downstream of headgate.		
		Concrete headgate structure along main river channel.		View downstream of ditch, from headgate.

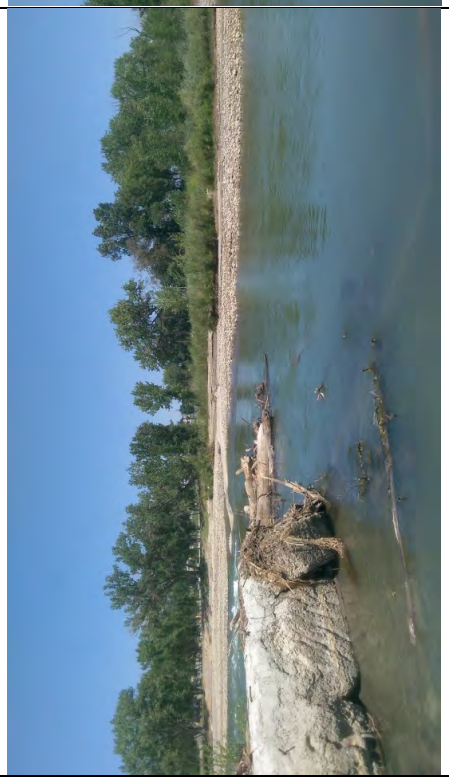
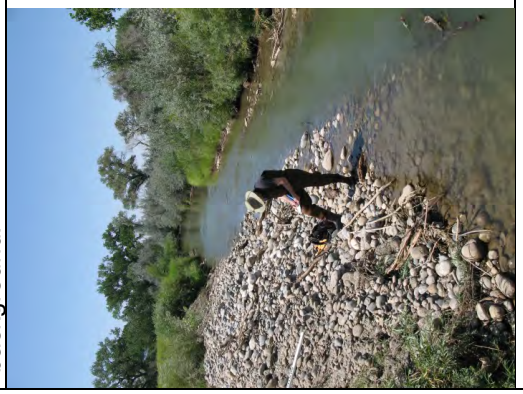
APPENDIX B. continued (Animas River).

RM 15.3 Halford-Independent Ditch (1 of 2)		View upstream of diversion channel, from headgate.		Headgate structure with uncontrolled spillway at left, river return in background.
		Diversion channel inlet, in foreground.		View of main channel from diversion channel inlet.

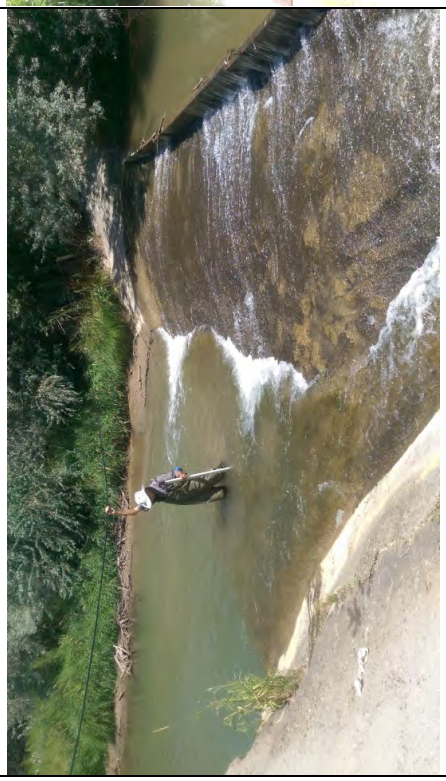
APPENDIX B. continued (Animas River).

RM 15.3 Halford-Independent Ditch (2 of 2)		Secondary head/grade control structure, headgate at right.		View upstream of return channel below secondary head/grade control.
		Back of radial headgate.		View downstream of ditch, from headgate.

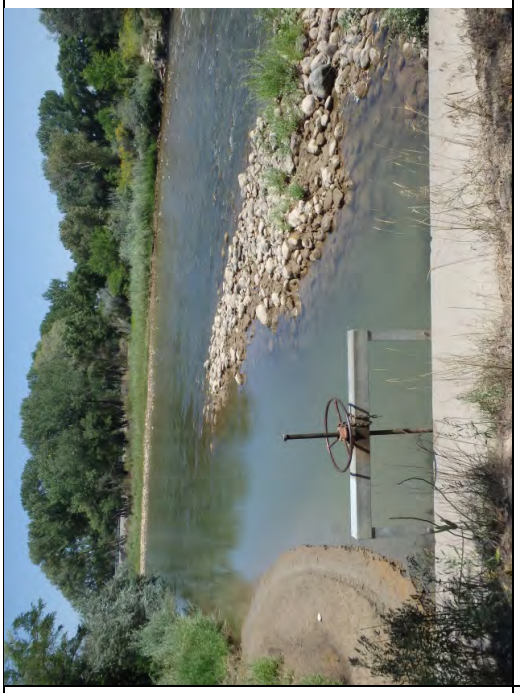
APPENDIX B. continued (Animas River).

RM 16.8 Kello-Blancett Ditch (1 of 2)		View upstream from diversion channel inlet.		Headgate, spillway gate, and secondary head/grade control structure.
		At diversion channel inlet, head/grade control structure in background.		View downstream of diversion channel.

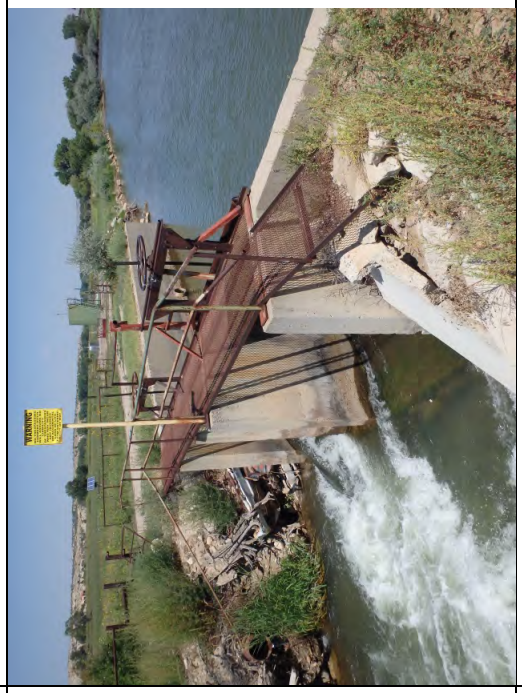
APPENDIX B. continued (Animas River).

RM 16.8 Kello-Blancett Ditch (2 of 2)		Headgate structure.		Secondary concrete head/grade control structure.
		View of secondary concrete head/grade control structure, from headgate.		Secondary concrete head/grade control structure.

APPENDIX B. continued (Animas River).

RM 19.8 Eledge Mill Ditch		View upstream from headgate.		View downstream of ditch, from headgate.
		Headgate structure with trash rack.		View upstream from headgate.

APPENDIX B. continued (Animas River).

RM 21.4 Farmers Irrigation District (1 of 2)		Concrete head/grade control structure.		View upstream of headgate structure.
		Headgate structure and head/grade control structure at left.		Headgates.

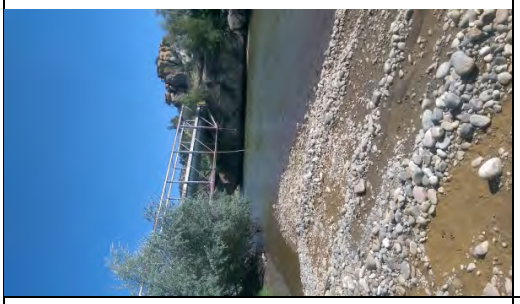
APPENDIX B. continued (Animas River).

RM 21.4 Farmers Irrigation District (2 of 2)		Close-up of head/grade control structure.		Spillway gate.
		View upstream of head/grade control structure.		View upstream of spillway structure, located downstream of headgate.

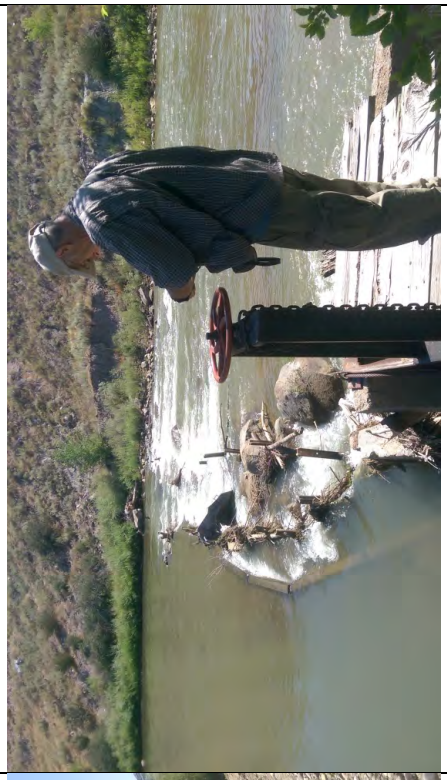
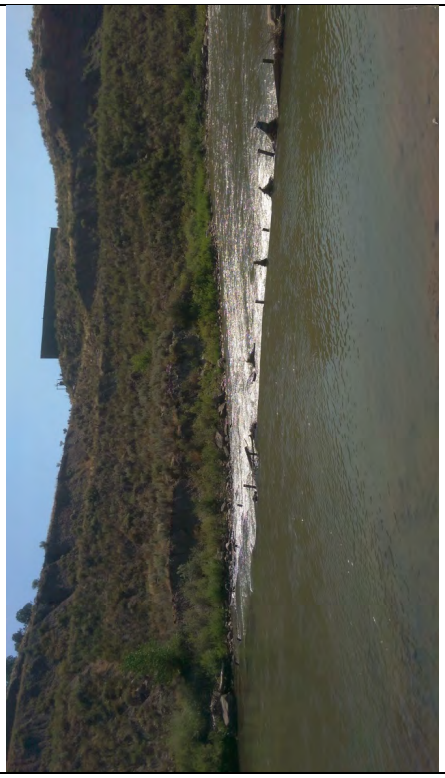
APPENDIX B. continued (Animas River).

RM 21.8 Lower Animas Ditch		Head/grade control structure, extending partially across channel.		Radial spillway gate.
		View upstream of head/grade control structure, from headgate.		Radial headgate.

APPENDIX B. continued (Animas River).

RM 29.6 Stacey Ditch		View upstream of diversion channel inlet.		Spillway with return to main river channel.
		View downstream of diversion channel inlet.		Headgate structure, with spillway to left.

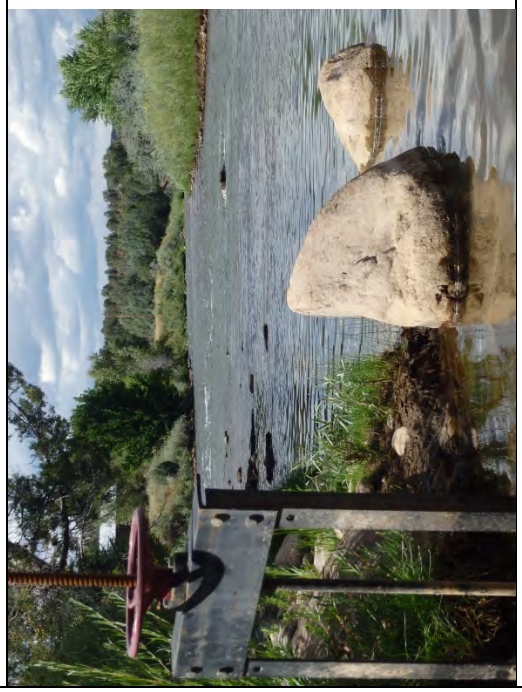
APPENDIX B. continued (Animas River).

RM 33.8 Cedar Ditch		View of head/grade control structure, from headgate.		View downstream of head/grade control structure.
		View downstream of head/grade control structure and headgate.		View upstream of head/grade control structure.

APPENDIX B. continued (Animas River).

RM 39.7 Twin Rock Ditch		View upstream of head/grade control structure.		Trash rack.
		Diversion structure with trash rack.		View downstream of ditch, from diversion structure.

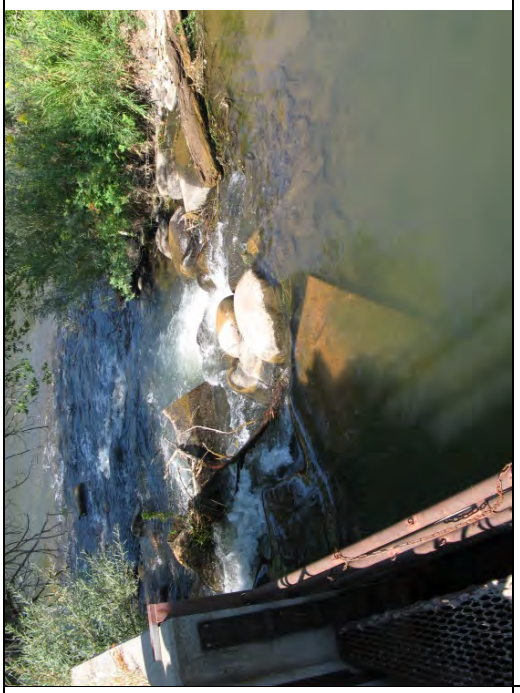
APPENDIX B. continued (Animas River).

RM 48.9 Dena Ditch/Little Fishes Wildlife Habitat Enhancement Project		View downstream of head/grade control comprised of large boulders.		Boulders extending partially across channel.
		Headgate at pipe inlet.		View upstream from headgate.

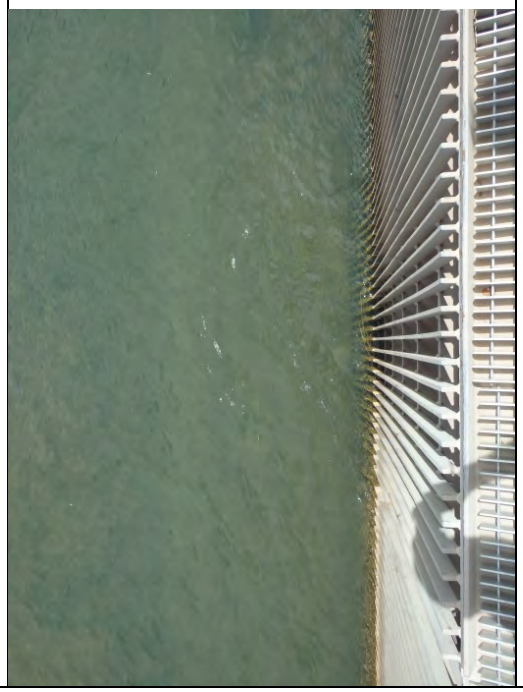
APPENDIX B. continued (Animas River).

RM 53.5 Cason Ditch		Uncontrolled spillway adjacent to headgate structure.		Diversion channel upstream of headgate.
		Headgate structure.		View upstream of headgate and spillway.

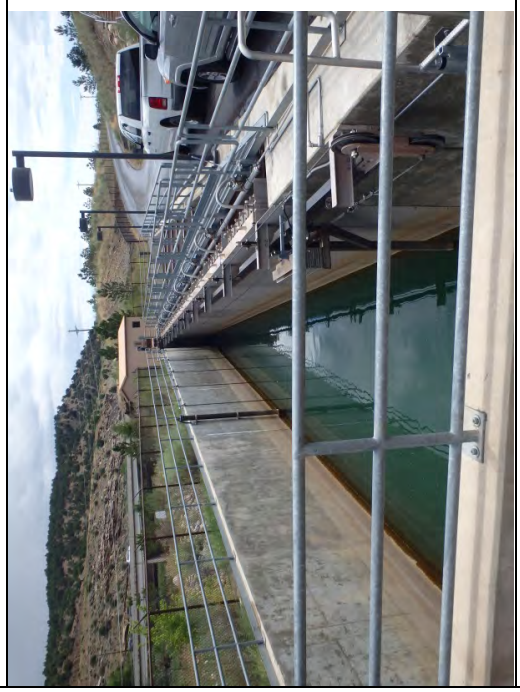
APPENDIX B. continued (Animas River).

RM 55.1 East Mesa Ditch		Uncontrolled spillway return to main channel.		View upstream along diversion channel.
		Headgate structure and uncontrolled spillway return to main channel.		Headgates and trash rack.

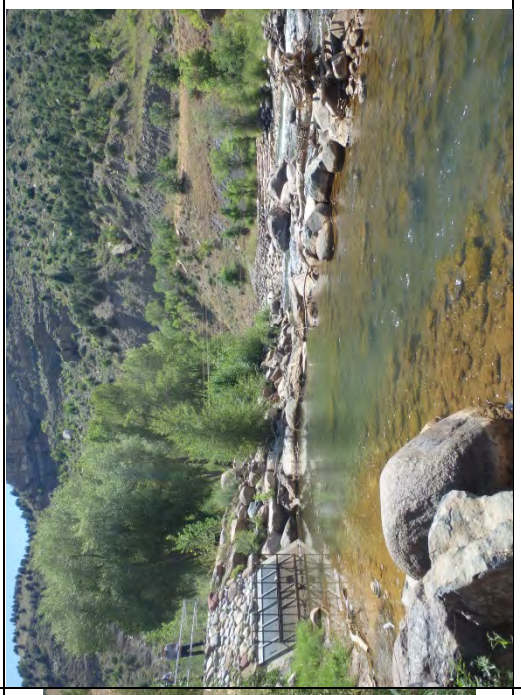
APPENDIX B. continued (Animas River).

RM 59.8 USBR Animas-La Plata Project/Lake Nighthorse Diversion (1 of 2)		View upstream of diversion.		Walls that can be installed to close diversion.
		View downstream of diversion structure.		Debris/fish screen across intake structure.

APPENDIX B. continued (Animas River).

RM 59.8 USBR Animas-La Plata Project/Lake Nighthorse Diversion (2 of 2)				
		View of settling pond, fish screen sluice structure.		View of settling pond, fish screen sluice structure.
		View of settling pond, fish screen sluice structure.		View of settling pond, fish screen sluice structure.

APPENDIX B. continued (Animas River).

RM 60.2 City of Durango Santa Rita Diversion		View downstream of diversion structure and short head/grade control structure.		View downstream of diversion structure.
		Diversion intake structure		View upstream of head/grade control structure (boulders), from diversion structure.