

# **RIVEREYES OBSERVATIONS IN THE MIDDLE RIO GRANDE FOR THE 2013 IRRIGATION SEASON**

Prepared for

## **U.S. BUREAU OF RECLAMATION**

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## EXECUTIVE SUMMARY

Reconnaissance of portions of the Middle Rio Grande is mandated by Reasonable and Prudent Alternative Element C of the 2003 Biological Opinion (U.S. Fish and Wildlife Service 2003). Such reconnaissance is conducted under the project commonly referred to as “RiverEyes.” RiverEyes monitoring must be performed when flows are less than 300 cubic feet per second (cfs) at San Acacia Diversion Dam. RiverEyes provides current information on river flows that allow action agencies to react quickly to rapidly changing conditions on the river, facilitate coordination among the agencies to prevent unexpected drying, and prepare for Rio Grande silvery minnow (*Hybognathus amarus*) rescues.

Hydrologic conditions were monitored daily from May 7 (i.e., the date of receipt of the fully enacted contract) to September 30, 2013, and from October 17 through October 31, 2013, to document spatial and temporal effects of low flow regimes. There was a 16-day hiatus in observations from October 1 through October 16, 2013, as a consequence of a shutdown of functions of the federal government deemed nonessential. Channel drying was restricted to the Isleta and San Acacia reaches over the period of monitoring. The location and extent of channel drying varied over the period of monitoring in response to the magnitude and variance of in-stream flow, including flow dynamics linked to localized and regional storm events, as well as out-of-channel diversion of water. The location and extent of channel drying also appears to vary with macrotopographic features of the river and its adjacent corridor. Notable among these features is the elevation of the streambed relative to that of adjacent segments of drain canals that parallel the river (e.g., the river is more likely to remain wetted where the elevation of the river is equal or lower than that of adjacent drain canals).

For each day that hydrologic conditions in the Rio Grande were monitored, a brief summary report was prepared documenting spatial and temporal observations of flow (measured and visual estimates) and longitudinal limits of running water conditions. These reports were distributed via e-mail to recipients of water operations conference call notes. Similarly, verbal reports of field observations were made during water operations conference calls. Records of observed and measured hydrologic conditions were kept for the duration of the observation period.

The first occurrence of river channel drying in the Isleta Reach was observed on June 22, 2013, whereas the first occurrence of channel drying in the San Acacia Reach was observed on June 3, 2013. The last occurrence of river channel drying in the Isleta Reach was observed on September 11, 2013. The last occurrence of river channel drying in the San Acacia Reach was observed on September 7, 2013.

Channel drying in the Isleta Reach was restricted to two widely separated river segments. The northernmost intermittent river segment in the Isleta Reach was 7.82 miles long, extending downstream from a point 2.46 miles downstream of Los Lunas Bridge (River Mile [RM] 158.92) to a point 1.40 miles downstream of the Peralta Wasteway (RM 151.10). The southernmost intermittent river segment in the Isleta Reach was 3.17 miles long, extending downstream from a point 1.90 miles upstream of Abeytas Heading (RM 136.08) to a point 1.30 miles downstream of Abeytas Heading (RM 132.91). Channel drying in the San Acacia Reach was restricted to a 25.48-mile segment that extended downstream from a point 0.19 mile upstream of Otero Street, Socorro (RM 99.28), to a point 0.15 mile upstream of the confluence of the Rio Grande and the pump channel at the south boundary of the Bosque del Apache National Wildlife Refuge (RM

73.8). Descriptive statistics concerning the number of days the river dried in the Isleta and San Acacia reaches of the Middle Rio Grande during the 2013 irrigation season, and the extent and variability of that drying, are presented in Table 1 and Table 2 in this report.

Inclusive of the Isleta and San Acacia reaches of the Middle Rio Grande, overland running water habitat was absent from 36.47 unique miles of river channel on one or more days during the 2013 irrigation season. The maximum total extent of river channel drying observed for a single day during the 2013 irrigation season (i.e., 32.40 miles) occurred on September 5, 2013, when a total 8.20 miles of river in the Isleta Reach and 24.20 miles of river in the San Acacia Reach was dry or reduced to isolated pools.

Discharge measurements were performed near the U.S. Geological Survey (USGS) Bosque Farms gage location (USGS Gage 08331160) and at a variety of other sites when it was judged safe to wade in the stream, when flowing water was present, and within anticipated budgetary constraints. Likewise, irrigation wasteways were surveyed to determine the amount of water being discharged to the Rio Grande when it was judged safe to wade in the wasteways, when flowing water was present, and within anticipated budgetary constraints.

Appended tables present an overview of discharge at all USGS gages, as reported by the U.S. Army Corps of Engineers during morning conference calls (Appendix A). Appendix B presents a detailed account of spatial and temporal observations of hydrologic conditions, including longitudinal limits of running water conditions, along with measured and visual estimates of flow at select USGS sites and irrigation outfall locations. Appendix C presents a detailed record of Middle Rio Grande pumping operations. Records of the daily longitudinal extent of channel drying are visually represented in spreadsheets that provide a stylized representation of the Rio Grande at the half-mile scale (Appendix D). Finally, Appendix E provides project safety documentation.

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## INTRODUCTION

The variability of flow characteristics of the contemporary Middle Rio Grande<sup>1</sup>, resulting either from natural or regulated causes, imparts a patchiness of environmental types at the scale of river segments, including the extremes represented by hydrologic abundance and periodic discontinuity of flow, with a continuum of intermediate types between these extremes. Low flow conditions that often result in fish mortality have been linked to conditions of aridity, exacerbated by water diversion in the basin and episodic conditions of drought.

Real-time estimates of surface water discharge in the Middle Rio Grande are available at flow gages maintained by the U.S. Geological Survey (USGS) (web accessible at <http://waterdata.usgs.gov/nm/nwis/rt>). Rough correlations about hydrologic conditions between gages are possible at coarse scales of time and space. However, only coarse-scale patterns of autocorrelation exist in the temporal record of flow across the linear series of gage stations because intervening flows are subject to infiltration, evaporation, diversion, and the potential addition of irrigation and wastewater returns. Fine-scale dynamics in hydrologic conditions cannot be accurately deduced or interpolated from measured flow in the consecutive series of USGS gages, and continuous river conditions cannot be assured even when a consecutive series of flow gages registers that overland flow exists. The absence of continuous flow may result in fish mortality, including the federal and state endangered Rio Grande silvery minnow (*Hybognathus amarus*; silvery minnow). On-site river monitoring is used to guide adjustments to daily water management operations to reduce mortality to the silvery minnow and other aquatic life that occupy running water habitats along the Middle Rio Grande.

The silvery minnow is currently listed as endangered by the State of New Mexico, having first been listed on May 25, 1979, as an endangered endemic population of the Mississippi silvery minnow (*Hybognathus nuchalis*) (New Mexico Department of Game and Fish 1988). On July 20, 1994, the U.S. Fish and Wildlife Service (USFWS) published a final rule to list the silvery minnow as a federal endangered species with proposed critical habitat (Federal Register 1994). The species is also listed as endangered by Texas (Sections 65.171–65.184 of Title 31 Texas Administrative Code) and the Republic of Mexico (Secretaria de Desarrollo Social 1994).

The contemporary range of the silvery minnow in the Middle Rio Grande of New Mexico (Figure 1) extends downstream from the vicinity of Bernalillo to the headwaters of Elephant Butte Reservoir, a distance that fluctuates as the size of the pool of water in storage in Elephant Butte Reservoir changes, but approximates 150 river miles. Prevailing aridity and highly variable hydrologic conditions in the Middle Rio Grande represent significant factors that challenge efforts to develop and manage the region's water resources for consumptive uses while simultaneously maintaining local fishery resources, notably including the silvery minnow.

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<sup>1</sup> For reference in this document, the “Middle Rio Grande” is defined as the Rio Grande downstream from Cochiti Dam to the headwaters of Elephant Butte Reservoir. The Middle Rio Grande below Cochiti Dam is further designated by four reaches defined by locations of mainstream irrigation diversion dams. The Cochiti Reach extends from Cochiti Dam to Angostura Diversion Dam. The reach from Angostura Diversion Dam to Isleta Diversion Dam is called the Albuquerque Reach. The Isleta Reach is bounded upstream by Isleta Diversion Dam and downstream by San Acacia Diversion Dam. Finally, the reach below San Acacia Diversion Dam to the headwaters of Elephant Butte Reservoir is the San Acacia Reach.

This project, commonly known as “RiverEyes,” is mandated by Reasonable and Prudent Alternative Element C of the 2003 Biological Opinion (USFWS 2003). RiverEyes monitoring must be performed when flows are less than 300 cubic feet per second (cfs) at San Acacia Diversion Dam. RiverEyes provides current information on river flows that allow action agencies to react quickly to rapidly changing conditions on the river, facilitate coordination among the agencies to prevent unexpected drying, and prepare for silvery minnow rescues.

Appended tables present an overview of discharge at all USGS gages, as reported by the U.S. Army Corps of Engineers during morning conference calls (Appendix A). Appendix B presents a detailed account of spatial and temporal observations of hydrologic conditions, including longitudinal limits of running water conditions, along with measured and visual estimates of flow at select USGS sites and irrigation outfall locations. Appendix C presents a detailed record of Middle Rio Grande pumping operations. Records of the daily longitudinal extent of channel drying are visually represented in spreadsheets that provide a stylized representation of the Rio Grande at the half-mile scale (Appendix D). Finally, Appendix E provides project safety documentation.



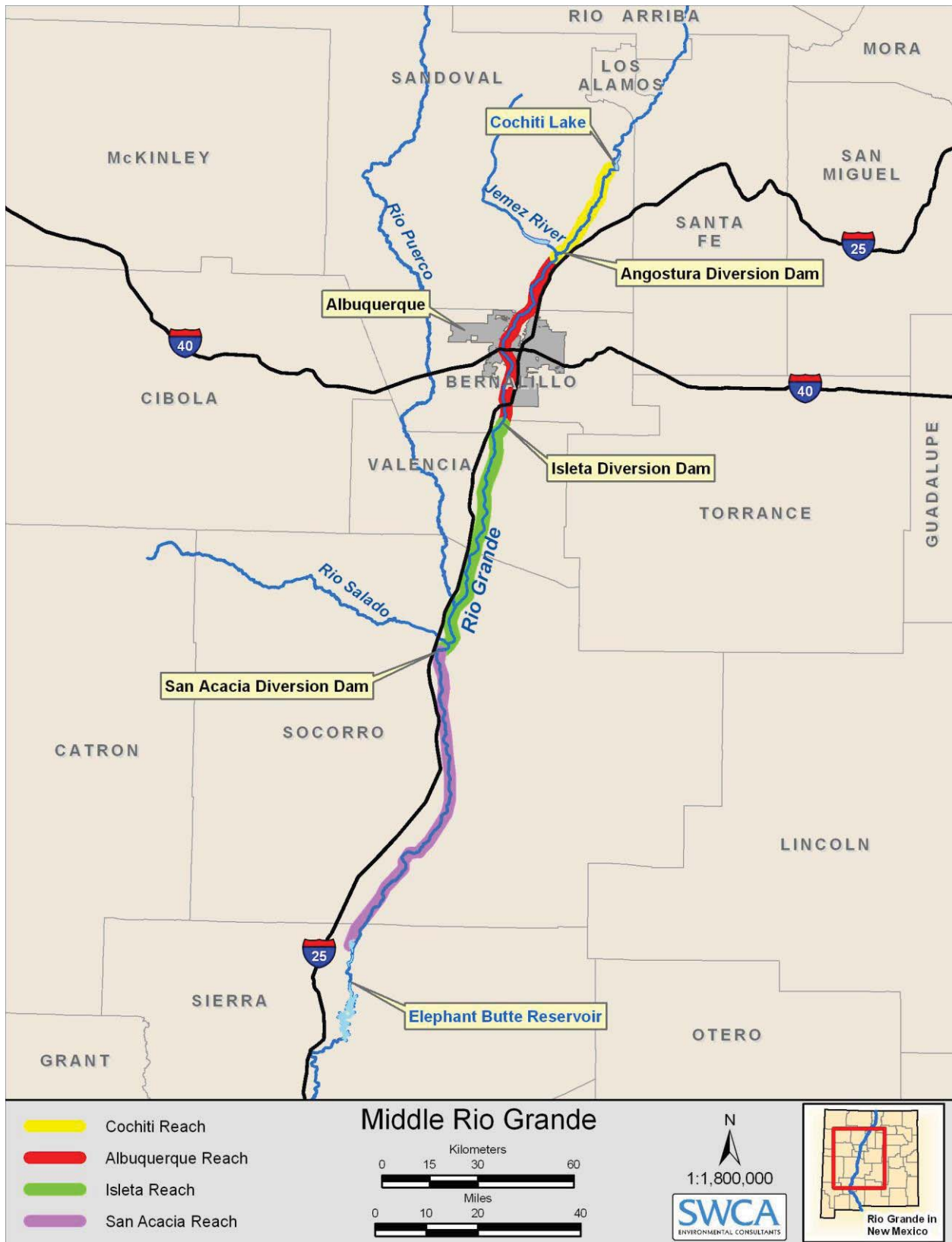


Figure 1. Overview of the Middle Rio Grande.

## METHODS

### *Daily Reconnaissance*

Hydrologic conditions were monitored daily from May 7 (i.e., the date of receipt of the fully enacted contract) to September 30, 2013, and from October 17 through October 31, 2013, to document spatial and temporal effects of low flow regimes. There was a 16-day hiatus in observations from October 1 through October 16, 2013, as a consequence of a shutdown of functions of the federal government deemed nonessential. This river reconnaissance was performed early enough in the day so that observations could be verbally relayed to water operations staff and fish rescue crews early in the morning (usually by about 5:00 a.m.). SWCA Environmental Consultants (SWCA) staff participated in early morning (8:30 a.m.) water operations conference calls to relay information concerning observed hydrologic conditions to concerned and affected stakeholders. Telephone reports were provided to designated U.S. Bureau of Reclamation (Reclamation) personnel and the USFWS Fish Rescue Coordinator (Thomas Archdeacon, or as appointed). A handheld global positioning system (GPS) unit was used to record spatial characteristics of receding and advancing edges of running water habitat. Point-specific location data were recorded using the Universal Transverse Mercator (UTM) system, North American Datum 1983, Zone 13. Point-specific location data were also recorded by fractions of river miles and were based on approximate mile-long segments superimposed on 2002 aerial photographs of the river by Pacific Western Technologies, Albuquerque, New Mexico.

### *Discharge Measurements*

Discharge measurements were performed as time and budget constraints permitted near the USGS Bosque Farms gage (USGS Gage 8331160) location when it was judged safe to wade in the river and on an as needed basis. Irrigation wasteways were surveyed within allotted time and budget constraints to determine the volume of water being discharged to the Rio Grande. Occasional discharge measurements were performed at other locations as requested by water operations or fish rescue personnel. Water depth (feet) and flow velocity (feet per second) were measured using a USGS top-setting wading rod fitted with a Marsh-McBirney Flo-Mate portable flow meter. Estimation of discharge (cfs) followed protocol specified by Marsh-McBirney Inc. (1990, 1994). Late afternoon follow-up reconnaissance was performed when requested by water operations or fish rescue personnel to determine hydrologic conditions, primarily within the Isleta and San Acacia reaches. Telephone reports were provided to designated Reclamation personnel and the USFWS Fish Rescue Coordinator on an as needed basis.

### *Daily Reports*

A daily summary report of observations was prepared and distributed via e-mail, and field observations were reported during water operations conference calls. The daily reports included information such as:

- observed river conditions for each location visited;
- visual estimates of flow rate;
- results of quantitative flow measurements;
- observations on the rate of drying/shrinkage if the river is actively receding;

- observations on the rate of rewetting if the river is advancing after a period of drying;
- observations of disconnected lateral pools; and
- forecasts of probable river conditions over the next 24 hours.

### ***Data Management***

A daily record of the longitudinal extent of river drying and rewetting was maintained. A relational database (Microsoft Access) and a spreadsheet database (Microsoft Excel) were developed for the storage, analysis, and retrieval of these data.

The logical construct of the relational database is helpful for envisioning the data collection and data analysis process across hierarchical scales of time and space, and in particular contributes to a unified frame of reference for investigations at the scale of river reach, user-defined river segments, and point-location data. The logical construct of the relational database also is helpful for envisioning how measured hydrologic data and RiverEyes data can be interactively employed to produce a more comprehensive understanding of river dynamics.

Daily RiverEyes data recorded at the scale of river reach include observations of river drying (yes/no, total river miles dried, extent of expansive drying, and rewetting events). Also narrative accounts of daily observations exist as database entries. Point-location observations are recorded by river mile (tenths and sometimes hundredths of a river mile) and meter (UTM coordinates, usually at a resolution less than 15 meters). Point-location data include observations of the upstream and downstream extent of river drying and observations of flow (measured and unmeasured estimates).

Data entry screens of the relational database incorporate logical data entry rules, along with queries designed to ease tasks of data validation at the time of data entry. The relational database queries provide much greater flexibility in selecting and sorting data than is possible with the limited sort and selection criteria of spreadsheet applications. The RiverEyes relational database provides numerous options for printing formatted reports, many of which have been anticipated as on-demand data outputs ranging from day-specific reports, range-of-date reports, reach-specific reports, and reports ordered chronologically by various search criteria, including reports ordered by extent of drying. The relational database also includes an automated report that searches for the maximum and minimum river miles and UTM coordinates of river drying—information crucial for recognizing expansive events of river recession (i.e., “new drying”).

### ***Safety***

A Job Hazard Analysis (JHA) was performed for this project (see Appendix E). Personnel were required to certify that they reviewed and complied with the JHA requirements each day in which work was performed on the project. Vehicle inspections were conducted at the start of each day (see Appendix E for a copy of the vehicle inspection form). All personnel that operated all-terrain vehicles received safety instruction in their operation. All safety requirements were followed.

## RESULTS

### *Daily Reconnaissance*

Records were maintained of observed and measured hydrologic conditions over the duration of the monitoring period, the details of which accompany this report in various database formats (i.e., spreadsheet and relational databases; see Appendices A–D). A brief daily summary report of observations was prepared and distributed via e-mail to recipients of water operations conference call notes, and verbal reports of field observations were made during water operations conference calls.

Channel drying was restricted to the Isleta and San Acacia reaches over the period of monitoring. The location and extent of channel drying varied within each reach over the period of monitoring in response to the magnitude and variance of in-stream flow, including flow dynamics linked to localized and regional storm events, as well as out-of-channel diversion of water. The location and extent of channel drying also appear to vary with macrotopographic features of the river and its adjacent corridor. Notable among these features is the elevation of the streambed relative to that of adjacent segments of drain canals that parallel the river. The river is more likely to remain wetted where the elevation of the river is equal or lower than that of adjacent drain canals.

The first occurrence of river channel drying in the Isleta Reach was observed on June 22, 2013, whereas the first occurrence of channel drying in the San Acacia Reach was observed on June 3, 2013. The last occurrence of river channel drying in the Isleta Reach was observed on September 11, 2013. The last occurrence of river channel drying in the San Acacia Reach was observed on September 7, 2013.

Channel drying in the Isleta Reach was restricted to two widely separated river segments. The northernmost intermittent river segment in the Isleta Reach was 7.82 miles long, extending downstream from a point 2.46 miles downstream of Los Lunas Bridge (River Mile [RM] 158.92) to a point 1.40 miles downstream of the Peralta Wasteway (RM 151.10). The southernmost intermittent river segment in the Isleta Reach was 3.17 miles long, extending downstream from a point 1.90 miles upstream of Abeytas Heading (RM 136.08) to a point 1.30 miles downstream of Abeytas Heading (RM 132.91). Channel drying in the San Acacia Reach was restricted to a 25.48-mile segment that extended downstream from a point 0.19 mile upstream of Otero Street, Socorro (RM 99.28), to a point 0.15 mile upstream of the confluence of the Rio Grande and the pump channel at the south boundary of the Bosque del Apache National Wildlife Refuge (RM 73.8). Descriptive statistics concerning the number of days the river dried in the Isleta and San Acacia reaches of the Middle Rio Grande during the 2013 irrigation season, and the extent and variability of that drying, are presented in Table 1 and Table 2.

Inclusive of the Isleta and San Acacia reaches of the Middle Rio Grande, overland running water habitat was absent from 36.47 unique miles of river channel on one or more days during the 2013 irrigation season. The maximum total extent of river channel drying observed for a single day during the 2013 irrigation season occurred on September 5, 2013 when 32.40 miles were observed dry or reduced to isolated pools. Of this drying, 8.20 miles existed in the Isleta Reach, while 24.20 miles existed in the San Acacia Reach.

River reach- and month-specific median values of the length of river channel without overland running water during the 2013 irrigation season are specified in Table 1 and Table 2, and illustrated in Figure 2 and Figure 3.

**Table 1. Statistics Concerning the Occurrence and Extent of River Drying in the Isleta Reach during the 2013 Irrigation Season**

Monthly Statistics for Isleta Reach (2013)						
Month (2013)	Days of Channel Drying	Mean Num. of River Miles Dry/Day	Std. Dev.	Std. Error	C.I. of Mean	Max. Num. of River Miles Dry
April	0	0.000	0.000	0.000	0.000	0.000
May	0	0.000	0.000	0.000	0.000	0.000
June	9	1.816	2.855	0.521	1.066	6.730
July	24	3.935	2.543	0.457	0.933	7.190
August	18	3.378	3.168	0.569	1.162	7.630
September	11	2.849	3.864	0.705	1.443	8.430
October	0	0.000	0.000	0.000	0.000	0.000

C.I. = confidence interval.

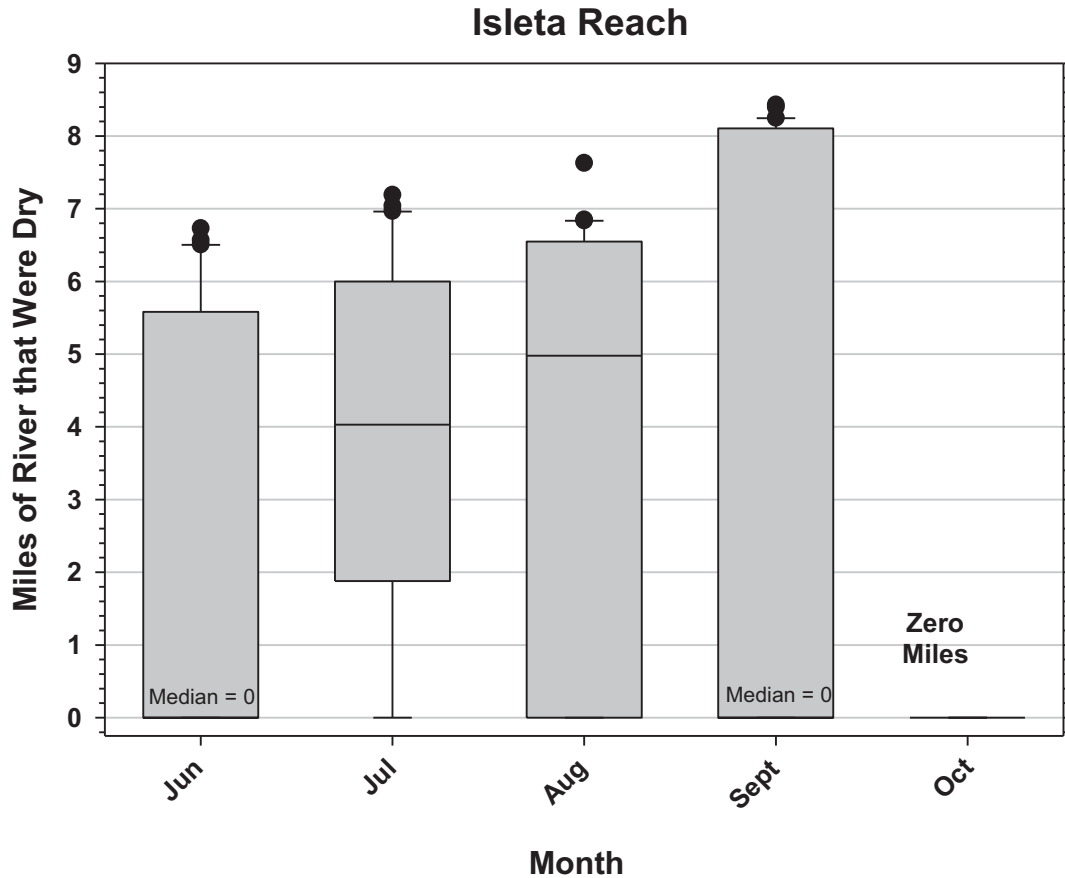
**Table 2. Statistics Concerning the Occurrence and Extent of River Drying in the San Acacia Reach during the 2013 Irrigation Season**

Monthly Statistics for San Acacia Reach (2013)						
Month (2013)	Days of Channel Drying	Mean Num. of River Miles Dry/Day	Std. Dev.	Std. Error	C.I. of Mean	Max. Num. of River Miles Dry
April	0	0.000	0.000	0.000	0.000	0.000
May	0	0.000	0.000	0.000	0.000	0.000
June	28	16.495	7.807	1.425	2.915	25.480
July	10	6.685	9.867	1.772	3.619	25.410
August	7	3.825	7.593	1.364	2.785	21.200
September	7	4.343	8.227	1.502	3.072	24.200
October	0	0.000	0.000	0.000	0.000	0.000

C.I. = confidence interval.

River channel segments without running water during the 2013 irrigation season were generally much longer and more variable in the San Acacia Reach compared to the Isleta Reach (see Table 1 and Table 2). Whereas drought conditions during the 2013 irrigation season appear to have been relatively severe in the San Acacia Reach, as is evident from the greater number of river miles dried and the duration of channel drying, intermittent portions of the San Acacia Reach were also highly subject to short-term rewetting during 2013. Rewetting of intermittent portions of the Middle Rio Grande can be linked primarily to occasional significant inputs of stormwater runoff from large contributing watersheds that are confluent with the Rio Grande a short distance upstream of the San Acacia Reach, notably including the Rio Salado and Rio Puerco.

The box plots in Figure 2 indicate that the median and maximum extent of river channel drying in the Isleta Reach during the 2013 irrigation progressively increased from June to August. Although the maximum extent of river channel drying in the Isleta Reach during the 2013 irrigation season was reached during September, the median extent of channel drying abruptly declined that month. Beginning on September 12, 2013, the Rio Grande in the Isleta Reach was through-flowing over the duration of the irrigation season.

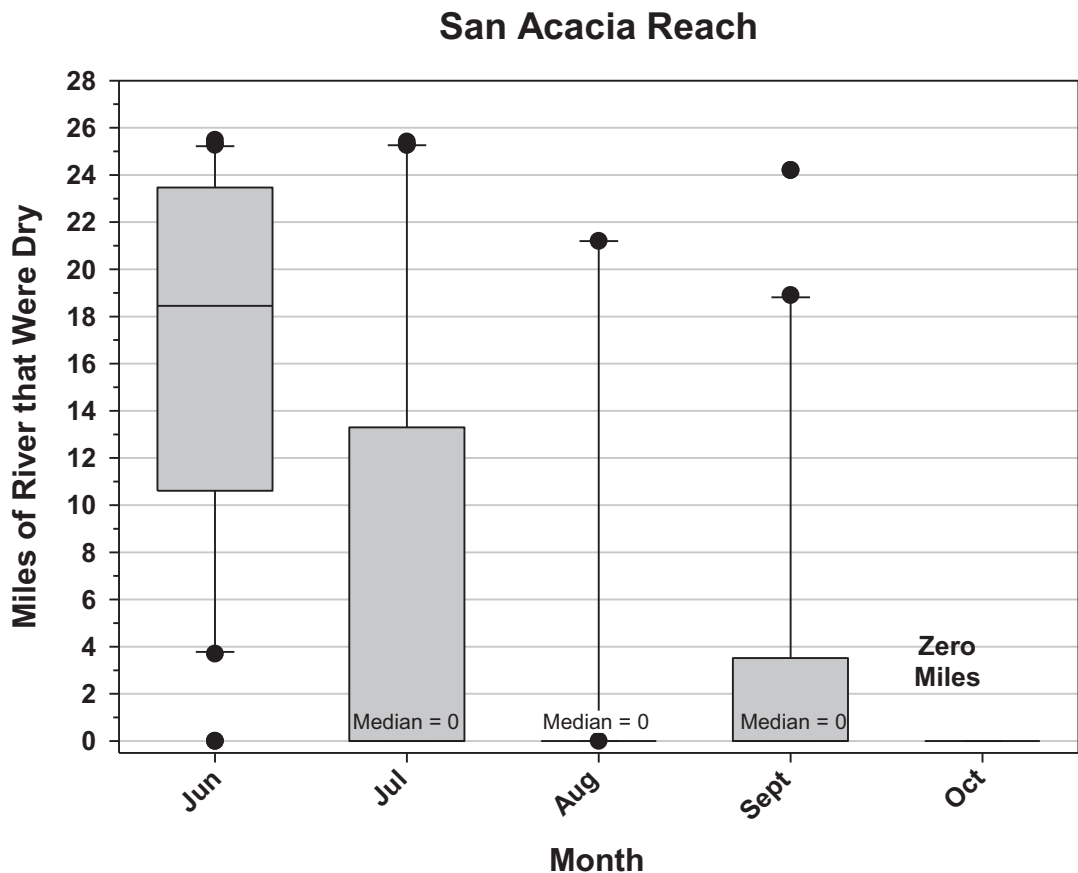


**Figure 2.** Occurrence and extent of river drying in the Isleta Reach of the Middle Rio Grande for June through October of the 2013 irrigation season.<sup>2</sup>

<sup>2</sup> The boundary of the box closest to zero indicates the 25th percentile. The line within the box marks the median, and the boundary of the box farthest from zero indicates the 75th percentile. Error bars above and below the box indicate the 90th and 10th percentiles, respectively. The circle symbols represent outlying points.



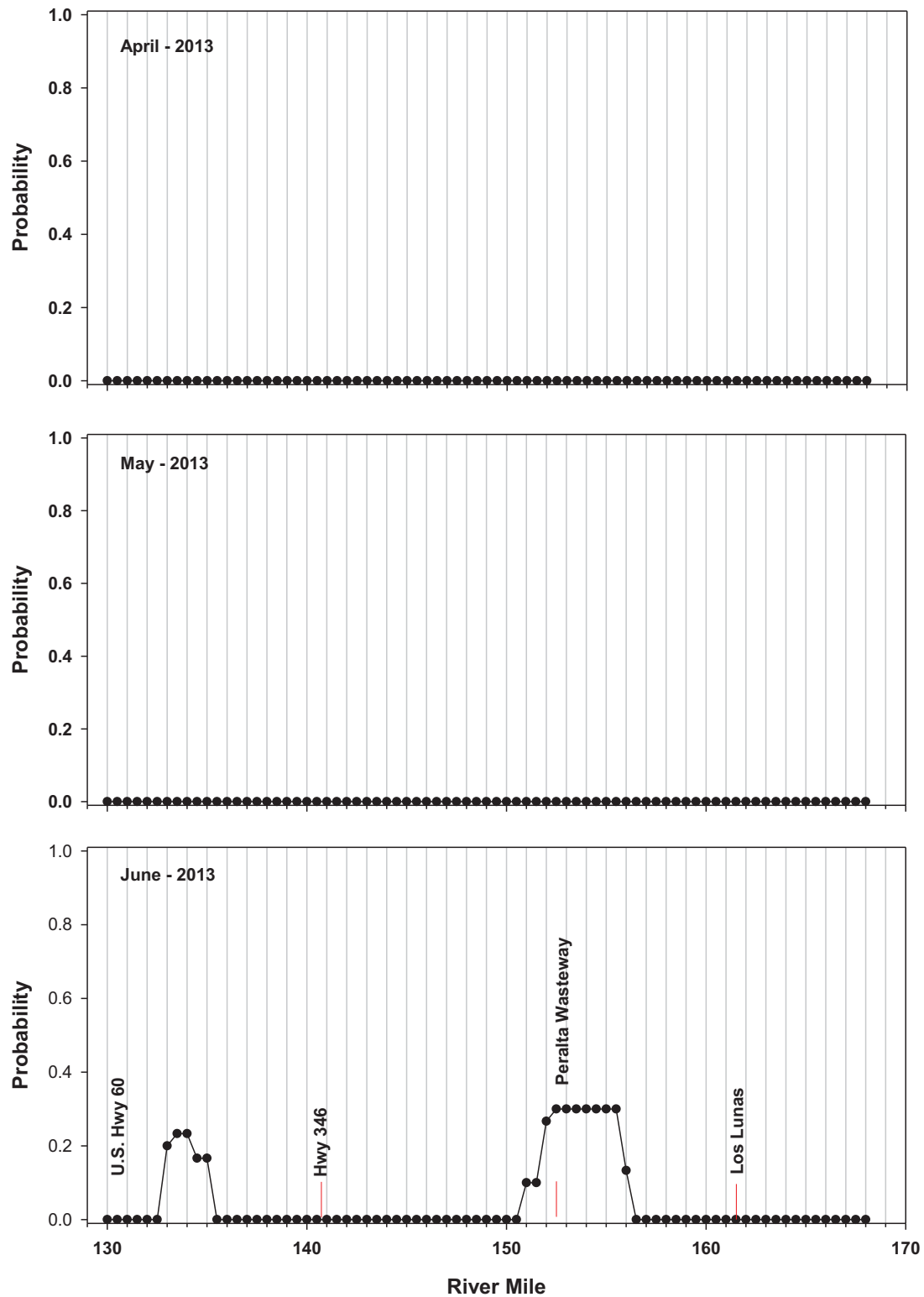
The box plots in Figure 3 indicate that the maximum extent and median values of river channel that dried in the San Acacia Reach during the 2013 irrigation season occurred in June. The maximum extent of river channel drying was nearly identical during June and July. There were an insufficient number of records of river drying in the San Acacia Reach during August to compute the 5th, 10th, 90th and 95th percentiles (statistically requiring at least nine records). However, recession of running water habitat was quite variable during June and July. In contrast, the longitudinal expanse of river dried in the San Acacia Reach during August was relatively uniform and nearly confined to one block of time. Beginning September 8, 2013, the Rio Grande in the San Acacia Reach was through-flowing over the duration of the irrigation season.



**Figure 3. Occurrence and extent of river drying in the San Acacia Reach of the Middle Rio Grande for June through October of the 2013 irrigation season<sup>3</sup>.**

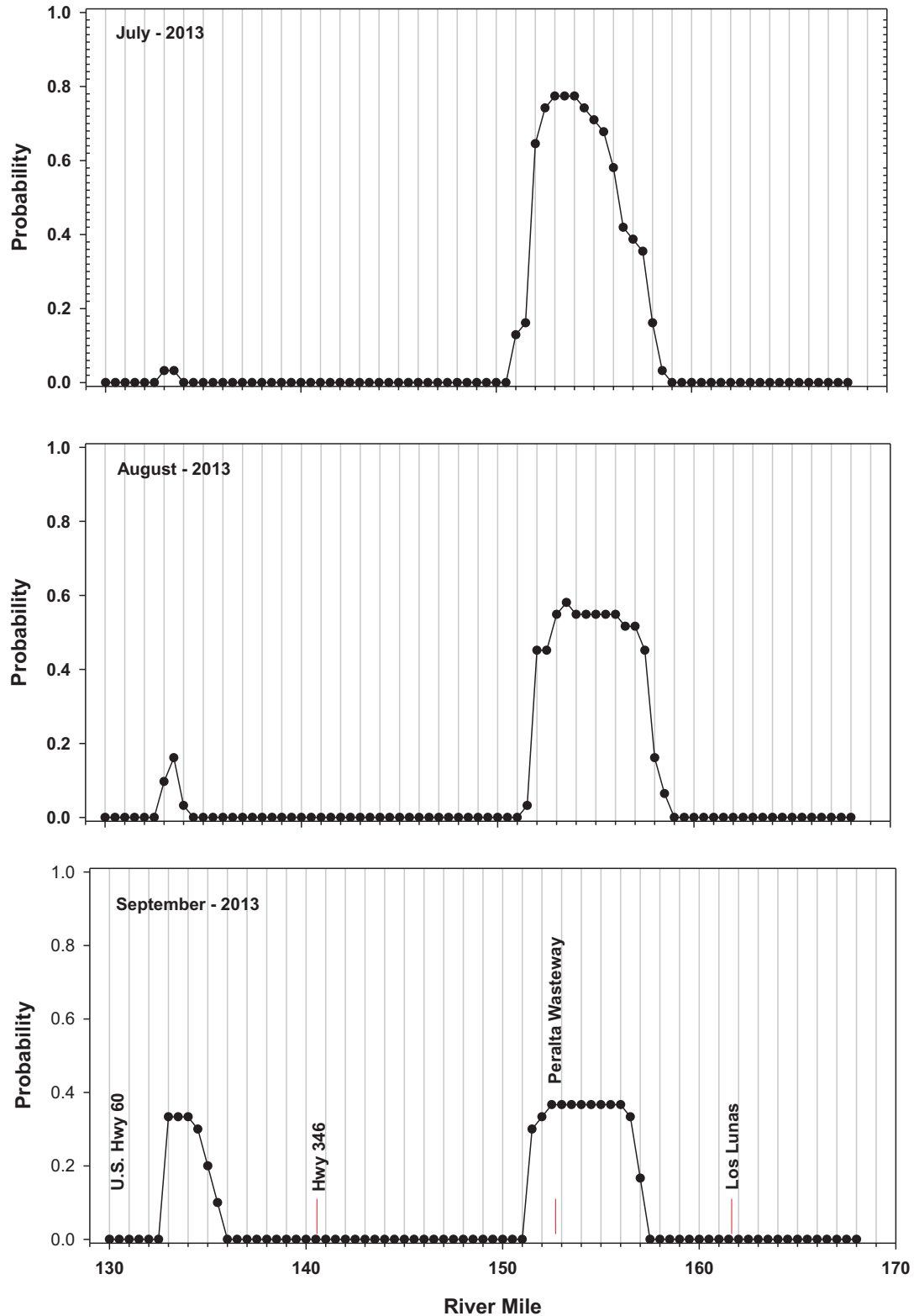
Probabilities of channel drying at a given point in the Isleta Reach (at the scale of 0.5 mile) are illustrated in Figure 4 (for April, May, and June 2013), Figure 5 (for July, August, and September 2013), and Figure 6 (for October 2013).

<sup>3</sup> The boundary of the box closest to zero indicates the 25th percentile. The line within the box marks the median, and the boundary of the box farthest from zero indicates the 75th percentile. Error bars above and below the box indicate the 90th and 10th percentiles, respectively. The circle symbols represent outlying points.

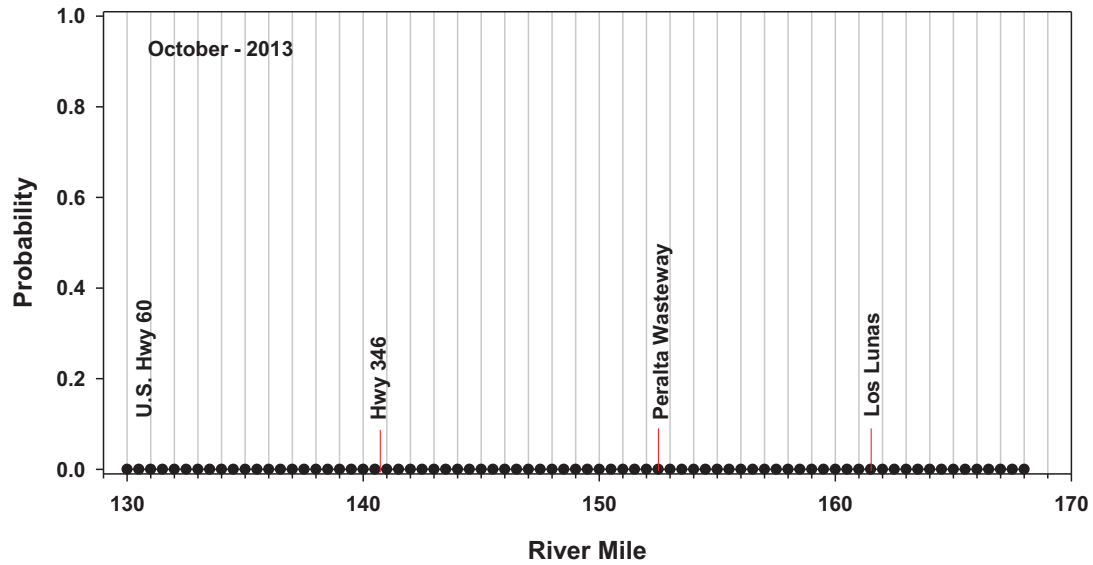


**Figure 4.** Probabilities of river channel drying at a given point in the Isleta Reach (at the scale of 0.5 mile) for April, May, and June 2013.



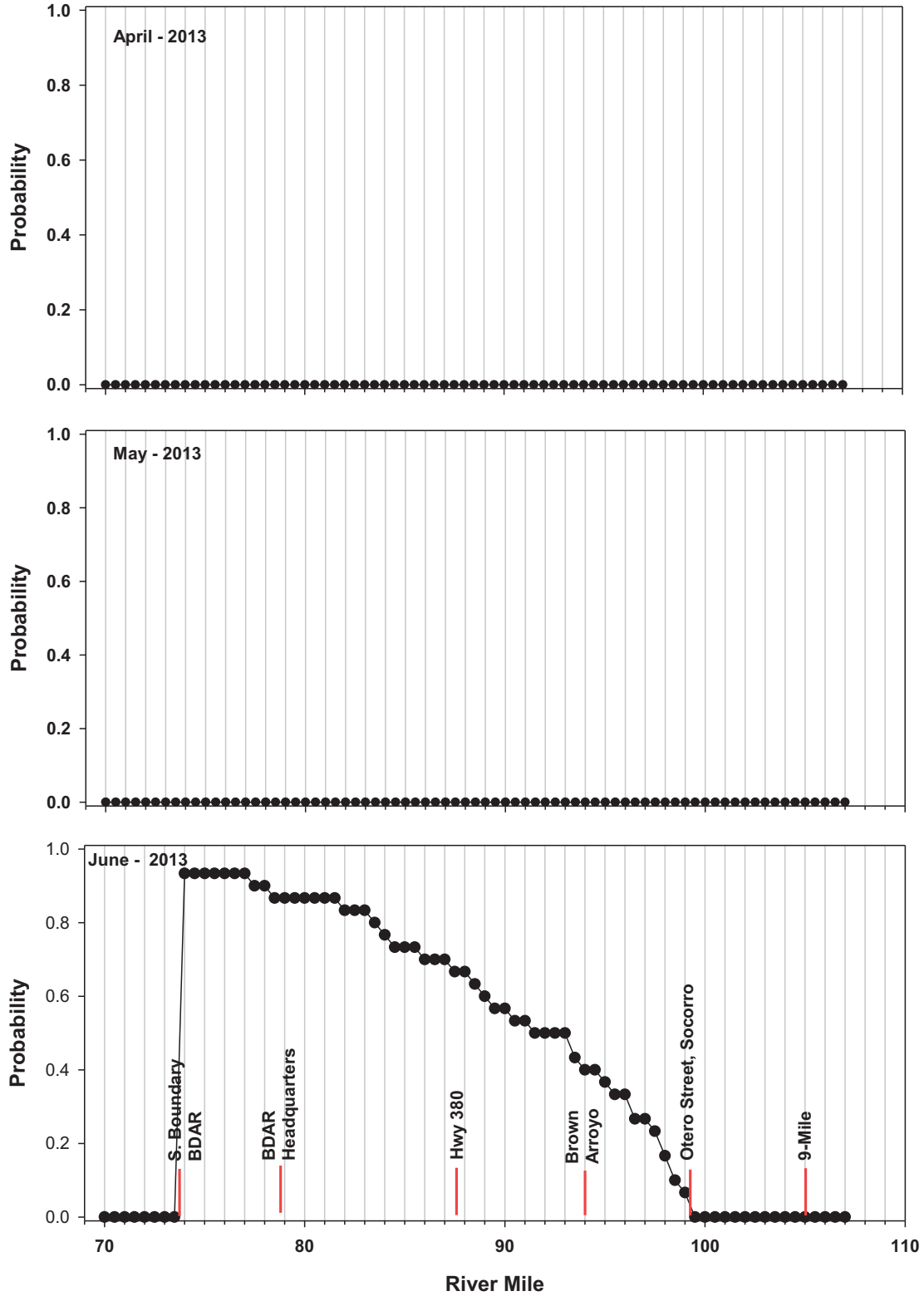


**Figure 5.** Probabilities of river channel drying at a given point in the Isleta Reach (at the scale of 0.5 mile) for July, August, and September 2013.

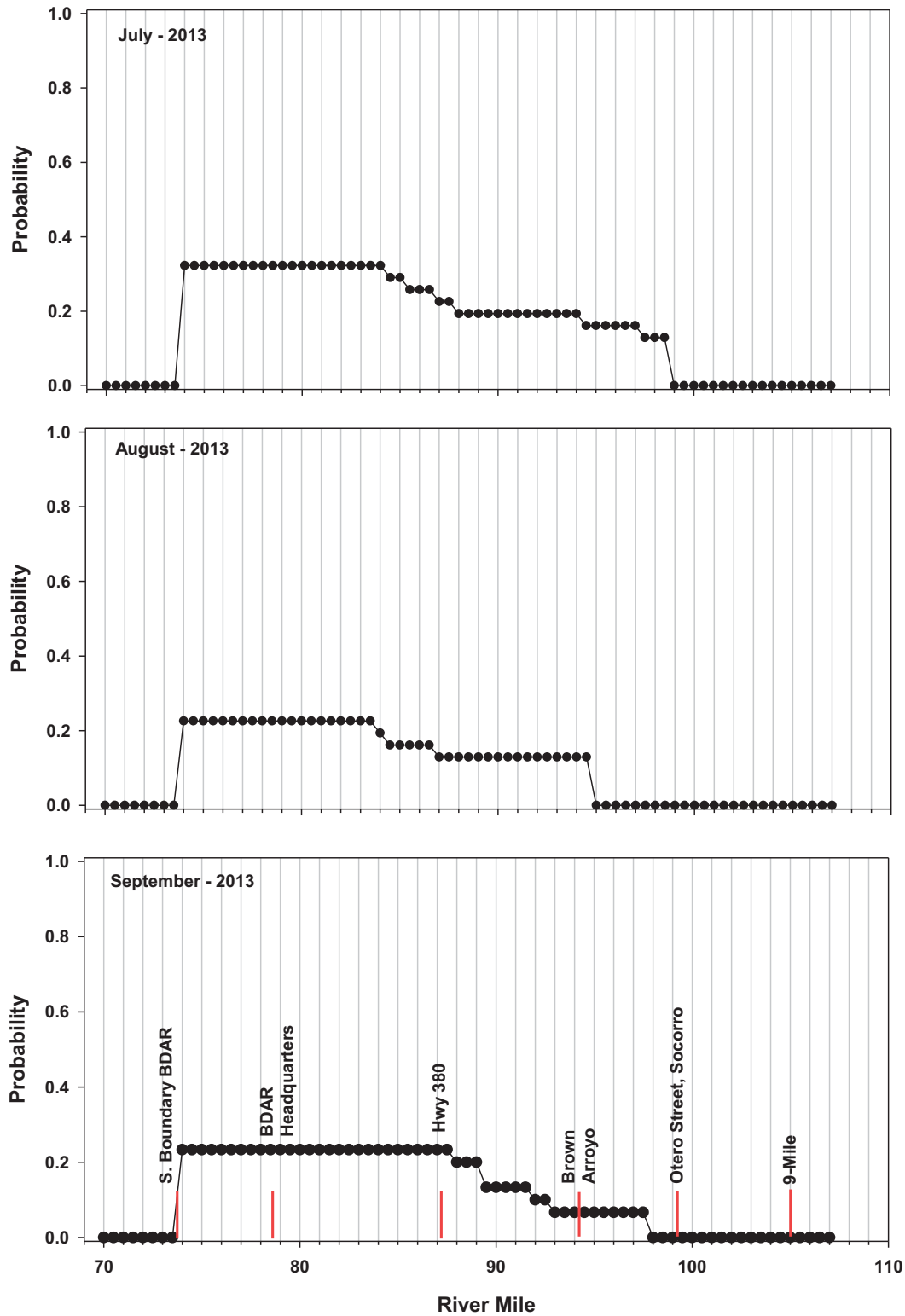


**Figure 6.** Probabilities of river channel drying at a given point in the Isleta Reach (at the scale of 0.5 mile) for October 2013.

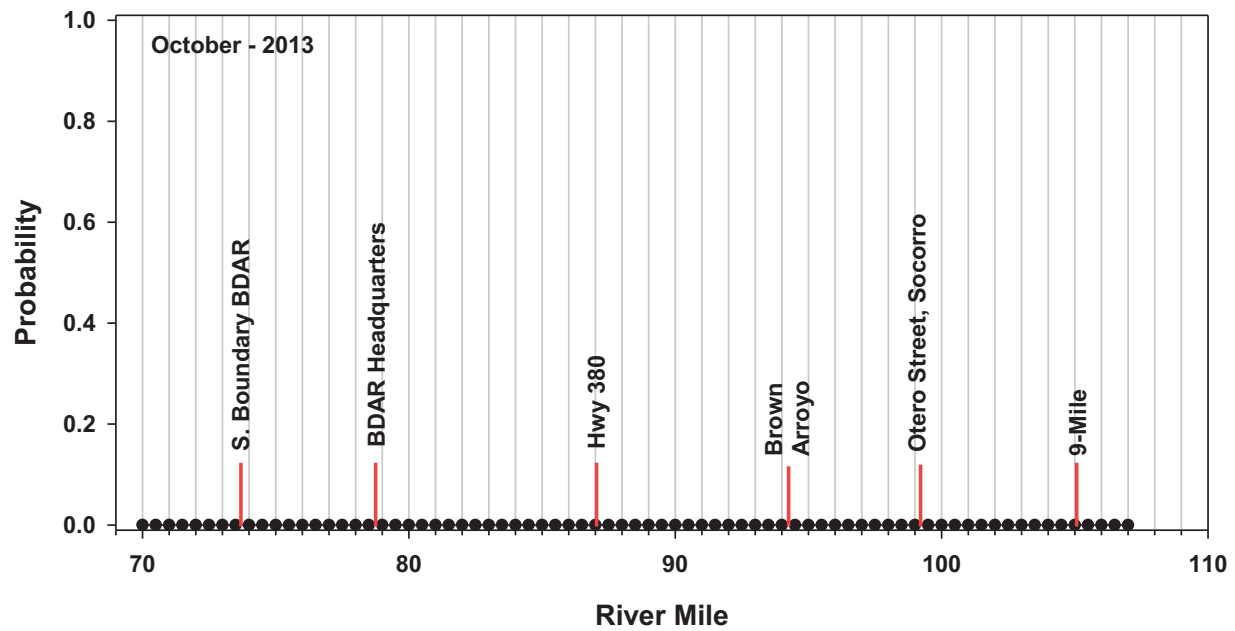
The probabilities of channel drying at a given point in the San Acacia Reach (at the scale of 0.5 mile) are illustrated in Figure 7 (for April, May, and June 2013), Figure 8 (for July, August, and September 2013), and Figure 9 (for October 2013).



**Figure 7.** Probabilities of river channel drying at a given point in the San Acacia Reach (at the scale of 0.5 mile) for April, May, and June 2013.

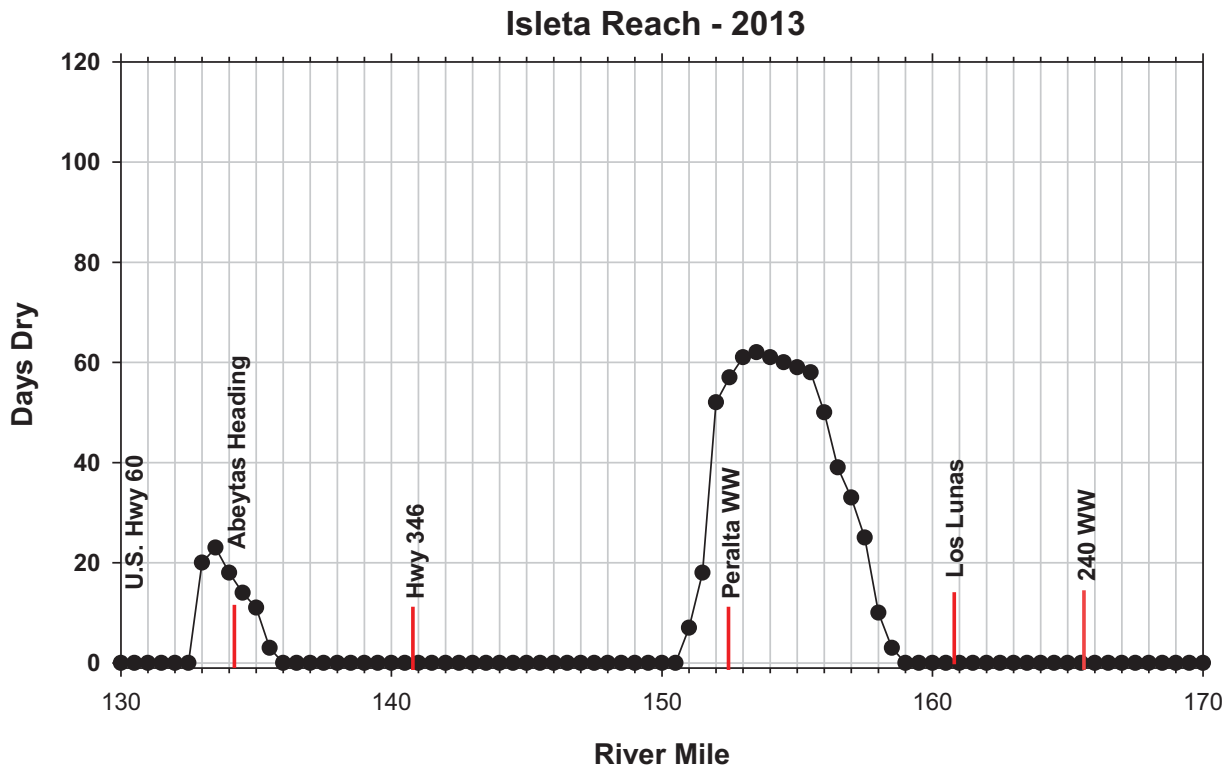


**Figure 8.** Probabilities of river channel drying at a given point in the San Acacia Reach (at the scale of 0.5 mile) for July, August, and September 2013.

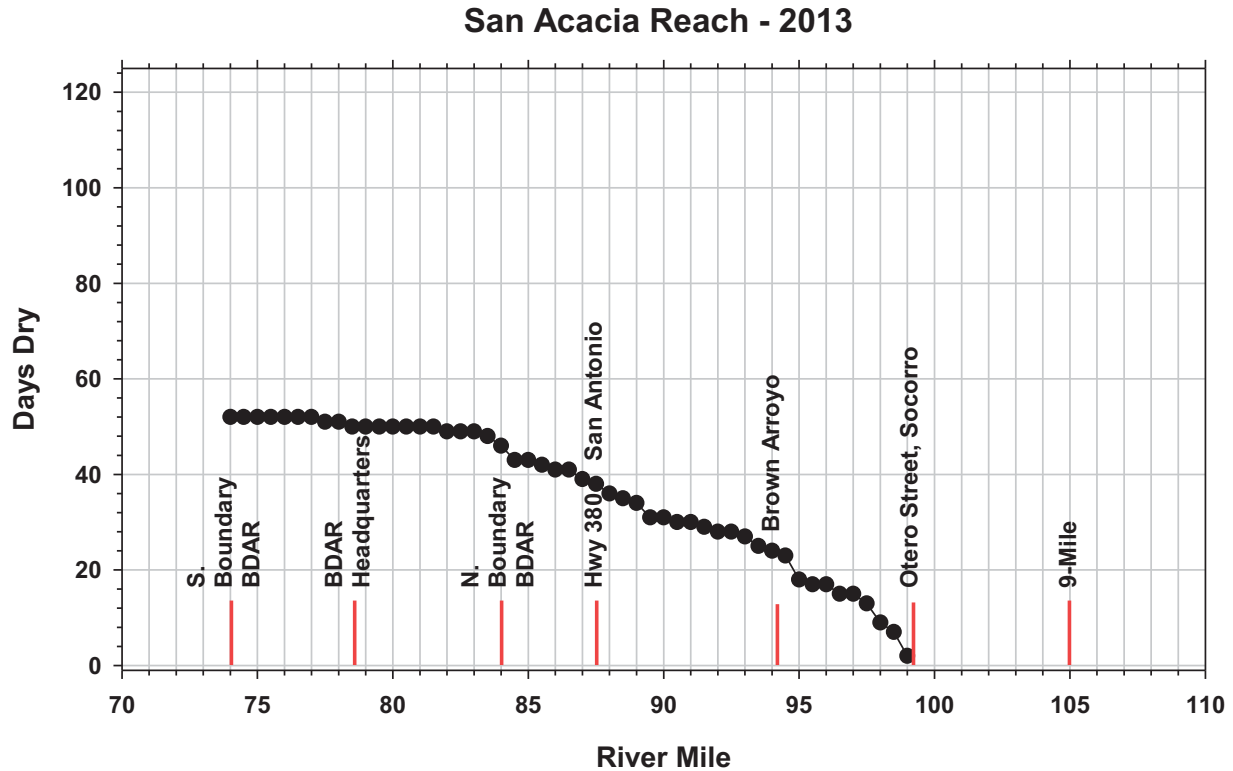


**Figure 9.** Probabilities of river channel drying at a given point in the San Acacia Reach (at the scale of 0.5 mile) for October 2013.

The number of days half-mile segments of river were observed without overland running water during the 2013 irrigation season is illustrated in Figure 10 (Isleta Reach) and Figure 11 (San Acacia Reach). These figures indicate that two channel segments in the Isleta Reach are relatively abruptly subject to the onset and termination of channel desiccation. In the San Acacia Reach, the duration of channel desiccation increases gradually from north to south and terminates abruptly at the south boundary of Bosque del Apache National Wildlife Refuge where water is pumped from the low flow conveyance channel to the river to abruptly terminate channel desiccation. The maximum duration in which one or more half-mile segments of river were observed without overland running water during the 2013 irrigation season is 62 days in the Isleta Reach and 52 days in the San Acacia Reach (see Figure 10 and Figure 11).



**Figure 10.** The number of days that half-mile segments of the Isleta Reach of the Middle Rio Grande were observed without overland running water during the 2013 irrigation season. For reference, the location of select geographic features is indicated along the river mile axis. Note: “WW” is an abbreviation for “Wasteway.”



**Figure 11.** The number of days that half-mile segments of the San Acacia Reach of the Middle Rio Grande were observed without overland running water during the 2013 irrigation season. For reference, the location of select geographic features is indicated along the river mile axis. Note: “BDAR” is an abbreviation for “Bosque del Apache Refuge.”

## **ACKNOWLEDGMENT AND CREDITS**

Pauletta Dodge was responsible for most observations of river dynamics in the Isleta Reach of the Middle Rio Grande. Gregory Pargas was responsible for observations of river dynamics in the San Acacia Reach of the Middle Rio Grande. Michael Hatch developed and maintained database systems that generated much of the content of this report. We are grateful to the Middle Rio Grande Conservancy District for granting access to the Rio Grande and its adjacent riparian corridor within their respective jurisdictions.



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**APPENDIX A -  
OVERVIEW OF 2013 MIDDLE RIO GRANDE GAGED RIVER FLOWS**

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Middle Rio Grande Water Operations - 2013

Date	Del Norte	Lobato	Embudo	Rio Grande at Embudo	La Puente	El Vado (DS of Dam)	Abiquiu (US of Res)	Abiquiu (DS of Res)	Chamita	Otowi	Cochiti (DS of Res)	Jemez Springs	Jemez Spgs. (DS of Res)	Albuq.	Bosque Farms	Hwy. 346	Rio Puerco	San Acacia	Escondida	Hwy. 380	San Marcial	E. Butte (DS of Res)	Cabillo (DS of Res)
18-Mar-2013	227	460	29	683	103	104	126	57	102	725	612	85	46	385	277	160	0	248	201	136	57	0	0
25-Mar-2013	350	630	44	1156	140	208	248	210	232	1322	1346	88	12	830	506	266	0	406	422	194	160	0	0
01-Apr-2013	305	298	19	494	160	107	118	316	295	781	683	42	16	385	212	96	0	207	225	100	64	1	0
05-Apr-2013	330	320	20	533	209	151	166	509	521	973	776	34	5	453	200	90	0	161	129	37	44	0	0
08-Apr-2013	356	325	13	523	265	155	166	509	537	966	860	38	0	527	206	82	0	156	145	42	53	0	0
10-Apr-2013	373	262	18	563	222	251	271	558	631	1110	861	66	29	533	215	92	0	169	171	60	44	0	0
12-Apr-2013	413	107	14	431	214	251	268	558	596	1020	861	69	26	551	224	114	0	165	158	65	51	0	0
15-Apr-2013	320	97	10	315	241	246	265	558	605	852	862	45	12	533	212	128	0	174	171	69	55	0	0
17-Apr-2013	413	60	6	287	357	311	325	602	675	858	823	54	12	464	215	124	0	174	179	69	53	0	0
19-Apr-2013	290	85	14	298	227	316	334	629	693	902	765	63	15	447	200	235	0	168	183	71	56	0	0
22-Apr-2013	340	53	8	277	291	311	331	615	648	864	765	47	2	447	187	192	0	168	201	74	56	0	0
24-Apr-2013	555	49	9	273	351	343	365	609	684	858	756	68	11	436	178	98	0	168	152	72	53	0	0
26-Apr-2013	673	43	12	267	430	656	649	662	711	934	831	61	29	475	218	105	0	140	101	53	48	0	0
29-Apr-2013	1220	44	12	263	958	751	755	700	776	980	933	116	38	639	221	136	0	156	140	65	41	0	0
01-May-2013	2048	47	15	280	1320	743	755	754	814	1030	999	114	36	607	212	133	0	155	140	65	46	0	0
03-May-2013	1635	54	20	294	881	751	755	800	823	1050	1000	47	35	570	212	133	0	152	140	65	44	0	0
06-May-2013	1770	87	16	291	843	845	854	962	891	1190	1118	29	11	693	218	186	0	160	177	76	56	0	0
08-May-2013	1319	145	14	312	728	837	848	981	872	1160	1051	30	13	699	221	146	0	165	192	84	53	0	0
10-May-2013	1010	154	11	369	539	837	820	882	804	1200	1062	27	7	666	215	131	0	163	196	84	55	0	0
13-May-2013	1040	117	8	329	599	829	825	813	738	1100	1052	34	28	639	209	131	0	161	192	93	62	12	0
15-May-2013	1840	97	6	326	654	837	825	783	702	1030	1008	31	11	563	206	133	0	168	217	93	53	11	0
17-May-2013	2896	78	11	315	678	494	514	813	738	1060	990	27	5	551	218	166	0	212	207	86	60	11	0
20-May-2013	2288	80	8	294	430	616	608	913	804	1160	990	23	1	551	209	128	0	188	203	114	62	12	0
22-May-2013	1968	68	7	305	374	591	592	913	814	1170	992	16	1	539	215	126	0	200	213	93	53	12	0
28-May-2013	2482	75	7	358	301	584	576	921	862	1130	959	8	0	588	187	121	0	188	192	63	41	1960	0
31-May-2013	2080	58	4	291	227	684	671	1020	931	1190	1068	17	0	614	191	119	0	168	161	51	27	1950	0
03-Jun-2013	1558	49	4	270	201	706	692	1070	942	1190	1099	16	0	639	209	139	0	158	119	27	26	2020	2580
04-Jun-2013	1546	44	4	277	196	699	688	1040	942	1190	1078	13	0	595	215	139	0	155	114	31	26	1740	2570
05-Jun-2013	1583	66	4	267	196	699	683	1080	931	1220	1097	13	0	720	206	124	0	145	107	25	26	1740	2570
07-Jun-2013	1378	115	4	270	146	699	683	1020	872	1160	1041	12	0	699	243	119	0	116	89	15	27	1730	2550
10-Jun-2013	1143	62	4	305	106	774	760	856	794	1050	999	11	0	527	224	94	0	90	69	1	26	1690	2680
12-Jun-2013	1010	49	4	260	83	789	765	783	748	934	996	9	0	464	146	82	0	84	66	0	26	1850	2450
14-Jun-2013	875	71	4	246	68	706	692	913	852	1040	1029	15	0	533	118	47	0	77	80	0	25	2050	2440
17-Jun-2013	713	49	4	263	46	706	679	974	872	1120	1039	12	0	539	99	29	0	63	69	0	26	2120	2179

Date	Del Norte	Lobato	Embudo	Rio Grande at Embudo	La Puente	El Vado (DS of Dam)	Abiquiu (US of Res)	Abiquiu (DS of Res)	Chamita	Otowi	Cochiti (DS of Res)	Jemez Springs	Jemez Spgs. (DS of Res)	Albuq.	Bosque Farms	Hwy. 346	Rio Puerco	San Acacia	Escondida	Hwy. 380	San Marcial	E. Butte (DS of Res)	Cabillo (DS of Res)
19-Jun-2013	658	47	4	246	38	692	679	890	814	1030	1000	14	0	492	80	18	0	52	57	0	26	1840	2090
21-Jun-2013	583	46	4	223	28	699	679	978	872	1080	1005	13	0	395	68	10	0	39	38	0	26	1880	2079
24-Jun-2013	494	24	4	220	22	789	765	1070	982	1170	1124	5	0	533	62	4	0	35	32	0	24	1940	2068
26-Jun-2013	443	20	1	200	20	797	760	1070	1000	1160	1133	11	0	539	78	9	0	32	25	0	21	1980	2068
28-Jun-2013	378	27	1	187	16	782	750	1010	952	1050	1080	11	0	595	64	9	0	29	18	0	18	2020	2002
01-Jul-2013	407	28	1	197	21	360	368	994	962	1100	1058	7	0	633	64	11	4	34	22	0	18	2160	2002
02-Jul-2013	419	33	1	206	24	348	362	697	711	846	1004	7	0	595	48	17	0	38	25	0	19	1730	1893
03-Jul-2013	401	33	1	206	22	346	378	456	497	682	577	17	0	557	41	12	1	46	63	0	19	2190	1731
05-Jul-2013	362	32	1	206	22	605	580	401	464	601	433	15	0	289	39	11	2	19	29	34	19	1160	1636
08-Jul-2013	346	24	1	216	23	360	381	297	319	549	544	9	0	420	39	11	0	15	9	0	18	1040	1356
10-Jul-2013	346	23	1	203	21	360	378	108	134	353	456	28	0	267	36	12	0	21	35	79	21	18	1366
15-Jul-2013	390	11	4	203	28	261	334	197	176	340	370	22	1	224	38	23	96	44	203	25	35	7	0
17-Jul-2013	384	16	1	203	31	261	290	151	127	364	363	16	0	119	38	19	171	79	112	254	86	7	750
19-Jul-2013	384	27	1	187	22	261	279	171	137	326	336	14	0	87	42	20	10	37	32	71	86	7	0
22-Jul-2013	437	9	2	213	24	256	353	79	82	438	328	50	34	212	277	189	7	71	32	68	28	9	0
24-Jul-2013	356	9	2	193	24	251	279	74	47	260	383	23	11	105	32	22	305	261	223	157	134	9	0
26-Jul-2013	325	11	2	177	35	256	276	144	161	902	365	52	44	1500	30	96	14	37	70	112	199	6	0
29-Jul-2013	507	58	3	193	157	256	385	82	57	336	433	24	13	515	829	1400	257	1600	951	1140	519	7	0
31-Jul-2013	431	41	3	223	53	256	293	197	154	294	403	16	0	453	396	498	59	732	897	1090	684	5	0
02-Aug-2013	413	46	3	223	43	261	394	200	192	454	334	19	148	263	212	376	47	770	550	428	234	5	0
05-Aug-2013	598	33	2	229	70	256	662	197	188	475	327	21	1030	425	88	114	36	409	469	223	346	6	0
07-Aug-2013	754	68	2	233	86	265	282	292	290	586	495	33	9	276	24	112	307	383	296	110	138	4	0
09-Aug-2013	1220	100	1	284	118	270	310	521	488	747	584	18	5	356	32	26	130	160	266	191	114	6	0
12-Aug-2013	1060	130	2	287	125	256	310	515	497	764	592	15	0	405	32	25	55	169	234	366	262	9	0
14-Aug-2013	1010	122	2	326	---	251	265	193	184	491	419	13	0	333	24	44	138	248	406	320	244	6	0
21-Aug-2013	635	32	5	273	49	246	255	224	172	404	231	18	0	280	41	4	7	52	15	19	25	6	0
23-Aug-2013	620	43	3	243	63	598	252	224	192	434	349	13	0	75	44	5	1	37	27	2	23	6	0
26-Aug-2013	866	34	1	229	106	251	404	445	370	540	453	15	0	116	46	13	11	214	427	2	24	7	0
28-Aug-2013	983	38	1	220	68	256	260	386	313	487	447	13	1	131	44	14	0	22	19	82	24	5	0
30-Aug-2013	770	73	1	216	57	251	255	297	301	708	327	11	1	108	41	11	0	23	18	2	22	6	0
03-Sep-2013	713	33	1	250	49	251	633	257	219	487	381	24	0	134	44	11	0	20	13	0	20	5	0
04-Sep-2013	635	32	1	240	53	202	331	257	257	423	501	25	0	297	41	10	0	19	10	0	22	5	0
06-Sep-2013	555	56	2	223	51	101	117	257	201	357	375	13	0	102	41	10	0	17	12	0	20	6	0
09-Sep-2013	520	54	1	226	43	101	104	302	228	392	351	11	0	55	41	10	2	17	13	22	24	6	0
16-Sep-2013	2080	289	272	715	138	95	184	141	257	1280	361	152	343	1280	1950	3910	5100	7721	6893	3870	3190	1310	0
17-Sep-2013	1770	266	169	619	112	114	195	141	210	1330	361	123	339	1350	2930	1270	2560	7390	5630	5908	3410	---	0

<i>Date</i>	<i>Del Norte</i>	<i>Lobato</i>	<i>Embudo</i>	<i>Rio Grande at Embudo</i>	<i>La Puente</i>	<i>El Vado (DS of Dam)</i>	<i>Abiquiu (US of</i>	<i>Abiquiu (DS of Res)</i>	<i>Chamita</i>	<i>Otowi</i>	<i>Cochiti (DS of Res)</i>	<i>Jemez Springs</i>	<i>Jemez Spgs. (DS of Res)</i>	<i>Albuq.</i>	<i>Bosque Farms</i>	<i>Hwy. 346</i>	<i>Rio Puerco</i>	<i>San Acacia</i>	<i>Escondida</i>	<i>Hwy. 380</i>	<i>San Marcial</i>	<i>E. Butte (DS of</i>	<i>Cabillo (DS of Res)</i>
18-Sep-2013	1486	230	142	635	100	107	128	244	295	1640	361	75	413	642	1920	1409	2160	5040	3630	3290	3270	---	0
20-Sep-2013	1840	223	109	548	164	190	224	108	257	1030	515	69	385	863	1260	505	387	1140	423	520	3180	0	0
23-Sep-2013	3040	375	166	845	362	186	1100	108	397	1750	660	112	362	1330	894	772	157	906	395	433	1770	0	0
25-Sep-2013	2176	390	82	704	164	186	212	257	537	1110	660	79	293	626	545	764	424	1570	815	1170	795	---	0
27-Sep-2013	1700	334	60	704	112	190	200	261	613	1190	923	41	51	626	751	558	126	1370	1220	801	1010	---	0
30-Sep-2013	1728	568	56	732	131	190	200	257	433	1140	781	37	41	550	377	424	7	802	361	320	312	12	0
02-Oct-2013	1486	568	41	863	103	186	197	253	639	1150	772	33	24	491	312	163	4	633	286	173	224	---	0
04-Oct-2013	1231	395	39	771	91	117	122	253	472	1080	772	27	15	460	312	139	2	580	236	79	101	---	0
07-Oct-2013	1070	334	32	614	75	117	124	253	426	940	783	22	2	424	308	78	1	605	241	74	83	---	0
09-Oct-2013	956	310	29	578	73	71	94	253	176	858	782	24	2	436	200	62	1	235	243	98	92	---	0
11-Oct-2013	1001	290	49	614	100	71	164	249	242	934	781	32	6	442	267	35	1	241	221	63	64	---	0
15-Oct-2013	956	274	33	548	115	71	80	253	131	852	782	24	10	442	316	126	1	266	281	106	81	---	0
18-Oct-2013	902	191	38	533	100	120	132	253	76	769	2201	22	6	1950	2520	1190	1	1000	991	66	60	---	0
21-Oct-2013	762	174	35	442	86	120	126	253	68	656	2188	15	4	1920	2580	1270	1	1560	1230	1060	586	---	0
23-Oct-2013	737	154	33	428	75	120	126	200	210	692	1463	16	9	1300	1820	2090	1	1770	1440	1350	1150	---	0
25-Oct-2013	729	142	35	413	73	82	88	111	85	606	591	18	21	590	514	685	1	1450	1240	1530	766	0	0
28-Oct-2013	737	110	44	409	80	84	86	144	107	611	591	28	21	424	267	259	1	652	864	441	480	---	0
30-Oct-2013	754	90	45	380	73	87	86	189	30	615	591	27	10	384	260	195	1	623	764	298	292	0	0

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**APPENDIX B -  
REPORT OF 2013 FLOW ESTIMATES AND LONGITUDINAL LIMITS OF  
RUNNING WATER CONDITIONS IN THE MIDDLE RIO GRANDE**

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## River Eyes Report - 2013

Isleta Reach				Estimated Flow (cfs)	Flow Estimate	River Drying GIS Coordinates (UTM NAD 1983, Zone 13)			
Date	Time	Location*	Observation	Avg (Range)	Type	Top (N - E)		Bottom (N - E)	Comments
08-May-2013 <b>General Comments:</b>									
Flow in the main river channel is believed to be continuous throughout the Isleta Reach based on USGS internet postings. No field observations.									
	8:00	Rio Grande at Bosque Farms USGS gauge (RM 166.1)	Flow estimate	215.00 (215 - 215)	Measured	---	---	---	USGS flow estimate
10-May-2013 <b>General Comments:</b>									
Flow in the main river channel is believed to be continuous throughout the Isleta Reach based on USGS internet postings. No field observations.									
	8:00	Rio Grande at Bosque Farms USGS gauge (RM 166.1)	Flow estimate	206.00 (206 - 206)	Measured	---	---	---	USGS flow estimate
13-May-2013 <b>General Comments:</b>									
Flow in the main river channel is believed to be continuous throughout the Isleta Reach based on USGS internet postings. No field observations.									
	8:00	Rio Grande at Bosque Farms USGS gauge (RM 166.1)	Flow estimate	195.00 (195 - 195)	Measured	---	---	---	USGS flow estimate
15-May-2013 <b>General Comments:</b>									
Flow in the main river channel is believed to be continuous throughout the Isleta Reach based on USGS internet postings. No field observations.									
	8:00	Rio Grande at Bosque Farms USGS gauge (RM 166.1)	Flow estimate	203.00 (203 - 203)	Measured	---	---	---	USGS flow estimate

Isleta Reach				Estimated Flow (cfs)	Flow Estimate	River Drying GIS Coordinates (UTM NAD 1983, Zone 13)				
Date	Time	Location*	Observation	Avg (Range)	Type	Top (N - E)		Bottom (N - E)		Comments
17-May-2013	<b>General Comments:</b> Flow in the main river channel is believed to be continuous throughout the Isleta Reach based on USGS internet postings. No field observations.									
	8:00	Rio Grande at Bosque Farms USGS gauge (RM 166.1)	Flow estimate	212.00 (212 - 212)	Measured	---	---	---	---	USGS flow estimate
20-May-2013	<b>General Comments:</b> Flow in the main river channel is believed to be continuous throughout the Isleta Reach based on USGS internet postings. No field observations.									
	8:00	Rio Grande at Bosque Farms USGS gauge (RM 166.1)	Flow estimate	212.00 (212 - 212)	Measured	---	---	---	---	USGS flow estimate
22-May-2013	<b>General Comments:</b> Flow in the main river channel is believed to be continuous throughout the Isleta Reach based on USGS internet postings. No field observations.									
	8:00	Rio Grande at Bosque Farms USGS gauge (RM 166.1)	Flow estimate	221.00 (221 - 221)	Measured	---	---	---	---	USGS flow estimate
28-May-2013	<b>General Comments:</b> Flow in the main river channel is believed to be continuous throughout the Isleta Reach based on USGS internet postings. No field observations.									
	8:00	Rio Grande at Bosque Farms USGS gauge (RM 166.1)	Flow estimate	206.00 (206 - 206)	Measured	---	---	---	---	USGS flow estimate
31-May-2013	<b>General Comments:</b> Flow in the main river channel is believed to be continuous throughout the Isleta Reach based on USGS internet postings. No field observations.									
	8:00	Rio Grande at Bosque Farms USGS gauge (RM 166.1)	Flow estimate	209.00 (209 - 209)	Measured	---	---	---	---	USGS flow estimate

Isleta Reach				Estimated Flow (cfs)	Flow Estimate	River Drying GIS Coordinates (UTM NAD 1983, Zone 13)				
Date	Time	Location*	Observation	Avg (Range)	Type	Top (N - E)		Bottom (N - E)		Comments
03-Jun-2013	<b>General Comments:</b> Flow in the main river channel is believed to be continuous throughout the Isleta Reach based on USGS internet postings. No field observations.									
	8:00	Rio Grande at Bosque Farms USGS gauge (RM 166.1)	Flow estimate	227.00 (227 - 227)	Measured	---	---	---	---	USGS internet posted flow estimate
04-Jun-2013	<b>General Comments:</b> Flow in the main river channel is believed to be continuous throughout the Isleta Reach based on USGS internet postings. No field observations.									
	8:00	Rio Grande at Bosque Farms USGS gauge (RM 166.1)	Flow estimate	NA	Measured	---	---	---	---	USGS internet posted flow estimate
05-Jun-2013	<b>General Comments:</b> Flow in the main river channel is believed to be continuous throughout the Isleta Reach based on USGS internet postings. No field observations.									
	8:00	Rio Grande at Bosque Farms USGS gauge (RM 166.1)	Flow estimate	221.00 (221 - 221)	Measured	---	---	---	---	USGS internet posted flow estimate
06-Jun-2013	<b>General Comments:</b> Flow in the main river channel is believed to be continuous throughout the Isleta Reach based on USGS internet postings. No field observations.									
	8:00	Rio Grande at Bosque Farms USGS gauge (RM 166.1)	Flow estimate	221.00 (221 - 221)	Measured	---	---	---	---	USGS internet posted flow estimate
07-Jun-2013	<b>General Comments:</b> Flow in the main river channel is believed to be continuous throughout the Isleta Reach based on USGS internet postings. No field observations.									
	8:00	Rio Grande at Bosque Farms USGS gauge (RM 166.1)	Flow estimate	221.00 (221 - 221)	Measured	---	---	---	---	USGS internet posted flow estimate

Isleta Reach				Estimated Flow (cfs)	Flow Estimate	River Drying GIS Coordinates (UTM NAD 1983, Zone 13)				
Date	Time	Location*	Observation	Avg (Range)	Type	Top (N - E)		Bottom (N - E)		Comments
08-Jun-2013	<b>General Comments:</b> Flow in the main river channel is believed to be continuous throughout the Isleta Reach based on USGS internet postings. No field observations.									
	8:00	Rio Grande at Bosque Farms USGS gauge (RM 166.1)	Flow estimate	209.00 (209 - 209)	Measured	---	---	---	---	USGS internet posted flow estimate
09-Jun-2013	<b>General Comments:</b> Flow in the main river channel is believed to be continuous throughout the Isleta Reach based on USGS internet postings. No field observations.									
	8:00	Rio Grande at Bosque Farms USGS gauge (RM 166.1)	Flow estimate	203.00 (203 - 203)	Measured	---	---	---	---	USGS internet posted flow estimate
10-Jun-2013	<b>General Comments:</b> Flow in the main river channel is believed to be continuous throughout the Isleta Reach based on USGS internet postings. No field observations.									
	8:00	Rio Grande at Bosque Farms USGS gauge (RM 166.1)	Flow estimate	206.00 (206 - 206)	Measured	---	---	---	---	USGS internet posted flow estimate
11-Jun-2013	<b>General Comments:</b> Flow in the main river channel is believed to be continuous throughout the Isleta Reach based on USGS internet postings. No field observations.									
	8:00	Rio Grande at Bosque Farms USGS gauge (RM 166.1)	Flow estimate	157.00 (157 - 157)	Measured	---	---	---	---	USGS internet posted flow estimate

Isleta Reach				Estimated Flow (cfs)	Flow Estimate	River Drying GIS Coordinates (UTM NAD 1983, Zone 13)				
Date	Time	Location*	Observation	Avg (Range)	Type	Top (N - E)		Bottom (N - E)		Comments
12-Jun-2013 <b>General Comments:</b> Flow in the main river channel is believed to be continuous throughout the Isleta Reach based on USGS internet postings and field observations.										
	12:30	Rio Grande 0.8 miles upstream of Peralta Wasteway (RM 153.3)	Flow estimate	59.00 (59 - 59)	Measured	---	---	---	---	None
	6:30	Peralta Wasteway at Rio Grande (RM 152.5)	Flow estimate	0.00 (0 - 0)	Visual	---	---	---	---	None
13-Jun-2013 <b>General Comments:</b> Flow in the main river channel is believed to be continuous throughout the Isleta Reach based on USGS internet postings and field observations from the previous afternoon. No field observations this date.										
	8:00	Rio Grande at Bosque Farms USGS gauge (RM 166.1)	Flow estimate	138.00 (138 - 138)	Measured	---	---	---	---	USGS internet posted flow estimate
14-Jun-2013 <b>General Comments:</b> Flow in the main river channel is believed to be continuous throughout the Isleta Reach based on USGS internet postings and field observations.										
	4:30	Rio Grande 0.8 miles upstream of Peralta Wasteway (RM 153.3)	Flow estimate	40.00 (40 - 40)	Measured	---	---	---	---	None
	4:00	Peralta Wasteway at Rio Grande (RM 152.5)	Flow estimate	0.00 (0 - 0)	Visual	---	---	---	---	None
	5:30	Rio Grande 2.3 miles upstream of US 60 (RM 133)	Flow estimate	35.00 (35 - 35)	Visual	---	---	---	---	None

Isleta Reach				Estimated Flow (cfs)	Flow Estimate	River Drying GIS Coordinates (UTM NAD 1983, Zone 13)				
Date	Time	Location*	Observation	Avg (Range)	Type	Top (N - E)	Bottom (N - E)			Comments
15-Jun-2013 <b>General Comments:</b>										
Flow in the main river channel is believed to be continuous throughout the Isleta Reach based on USGS internet postings and field observations.										
4:15		Rio Grande 0.8 miles upstream of Peralta Wasteway (RM 153.3)	Flow estimate	30.00 (30 - 30)	Measured	---	---	---	---	None
4:00		Peralta Wasteway at Rio Grande (RM 152.5)	Flow estimate	0.00 (0 - 0)	Visual	---	---	---	---	None
5:15		Rio Grande 2.3 miles upstream of US 60 (RM 133)	Flow estimate	30.00 (30 - 30)	Visual	---	---	---	---	None
16-Jun-2013 <b>General Comments:</b>										
Flow in the main river channel is believed to be continuous throughout the Isleta Reach based on USGS internet postings and field observations.										
4:20		Rio Grande 0.8 miles upstream of Peralta Wasteway (RM 153.3)	Flow estimate	30.00 (30 - 30)	Measured	---	---	---	---	None
4:00		Peralta Wasteway at Rio Grande (RM 152.5)	Flow estimate	17.50 (15 - 20)	Visual	---	---	---	---	None
5:15		Rio Grande 2.3 miles upstream of US 60 (RM 133)	Flow estimate	30.00 (30 - 30)	Measured	---	---	---	---	None
17-Jun-2013 <b>General Comments:</b>										
Flow in the main river channel is believed to be continuous throughout the Isleta Reach based on USGS internet postings and field observations.										
2:30		Rio Grande 1.2 miles upstream of Peralta Wasteway (RM 153.7)	Flow estimate	27.50 (25 - 30)	Measured	---	---	---	---	None
2:15		Peralta Wasteway at Rio Grande (RM 152.5)	Flow estimate	0.00 (0 - 0)	Visual	---	---	---	---	None
5:15		Rio Grande at Abeytas Heading (3.3 miles upstream of Hwy 60) (RM 134.3)	Flow estimate	17.50 (15 - 20)	Measured	---	---	---	---	None



Isleta Reach				Estimated Flow (cfs)	Flow Estimate	River Drying GIS Coordinates (UTM NAD 1983, Zone 13)				
Date	Time	Location*	Observation	Avg (Range)	Type	Top (N - E)	Bottom (N - E)			Comments
18-Jun-2013 <b>General Comments:</b>										
Flow in the main river channel is believed to be continuous throughout the Isleta Reach based on USGS internet postings and field observations.										
2:17		Rio Grande 1.2 miles upstream of Peralta Wasteway (RM 153.7)	Flow estimate	17.50 (15 - 20)	Measured	---	---	---	---	None
1:57		Peralta Wasteway at Rio Grande (RM 152.5)	Discharge estimate	0.00 (0 - 0)	Visual	---	---	---	---	None
3:30		Rio Grande at Abeytas Heading (RM 134.3)	Flow estimate	12.50 (10 - 15)	Measured	---	---	---	---	None
19-Jun-2013 <b>General Comments:</b>										
Flow in the main river channel is believed to be continuous throughout the Isleta Reach based on USGS internet postings and field observations.										
2:30		Rio Grande 1.2 miles upstream of Peralta Wasteway (RM 153.7)	Flow estimate	10.00 (10 - 10)	Measured	---	---	---	---	None
2:00		Peralta Wasteway at Rio Grande (RM 152.5)	Flow estimate	0.00 (0 - 0)	Visual	---	---	---	---	None
3:35		Rio Grande at Abeytas Heading (RM 134.3)	Flow estimate	10.00 (10 - 10)	Measured	---	---	---	---	None

Isleta Reach				Estimated Flow (cfs)	Flow Estimate	River Drying GIS Coordinates (UTM NAD 1983, Zone 13)				
Date	Time	Location*	Observation	Avg (Range)	Type	Top (N - E)	Bottom (N - E)			Comments
20-Jun-2013 <b>General Comments:</b>										
Flow in the main river channel is believed to be continuous throughout the Isleta Reach based on USGS internet postings and field observations.										
	4:30	Rio Grande 1.1 miles upstream of Peralta Wasteway (RM 153.6)	Flow estimate	7.50 (5 - 10)	Measured	---	---	---	---	None
	4:15	Peralta Wasteway at Rio Grande (RM 152.5)	Flow estimate	0.00 (0 - 0)	Visual	---	---	---	---	None
	7:30	Rio Grande 1.8 miles downstream of Peralta Wasteway (RM 150.7)	Flow estimate	7.50 (5 - 10)	Measured	---	---	---	---	None
	5:00	Rio Grande just upstream of Sabinal Drain outfall (RM 137.9)	Flow estimate	14.00 (14 - 14)	Measured	---	---	---	---	None
	5:15	Sabinal Drain outfall (just upstream of the Rio Grande (RM 137.87)	Flow estimate	1.30 (1.3 - 1.3)	Measured	---	---	---	---	None
	8:10	Rio Grande at Abeytas Heading (RM 134.3)	Flow estimate	4.00 (3 - 5)	Visual	---	---	---	---	None
21-Jun-2013 <b>General Comments:</b>										
Flow in the main river channel is believed to be continuous throughout the Isleta Reach based on USGS internet postings and field observations. Flow is less than 0.5 cfs between RM 154 and RM 152.5 (i.e., a 1.5 mile segment upstream of Peralta Wasteway) and is expected to dry this day.										
	5:45	Rio Grande 1.5 miles upstream of Peralta Wasteway (RM 154)	Flow estimate	0.37 (0.25 - 0.49)	Visual	---	---	---	---	None
	4:40	Peralta Wasteway at Rio Grande (RM 152.5)	Flow estimate	0.00 (0 - 0)	Visual	---	---	---	---	None
	3:45	Rio Grande at Abeytas Heading (RM 134.3)	Flow estimate	5.00 (5 - 5)	Visual	---	---	---	---	None



Isleta Reach			Estimated Flow (cfs)	Flow Estimate	River Drying GIS Coordinates (UTM NAD 1983, Zone 13)				
Date	Time	Location*	Observation	Avg (Range)	Type	Top (N - E)		Bottom (N - E)	Comments
22-Jun-2013 <b>General Comments:</b> The river is dry or reduced to isolated pools over a 4.12 mile segment in the Isleta Reach.									
River is reduced to isolated pools over a 3.7-mile segment in the vicinity of Peralta-Los Chaves Wasteways, extending south from a point approximately 0.7 miles downstream of Los Chavez Wasteway (RM 156.0) to a point 0.2 miles downstream of Peralta Main Wasteway (RM 152.3). Total miles of discontinuous flow in this segment is 3.70 miles. This entire segment is "new drying."									
A second segment of river is reduced to isolated pools between Hwy 346 and Hwy 60. Top of drying in this segment is 6.45 miles downstream of Hwy 346 (RM 134.35). Bottom of drying in this segment is 3.33 miles upstream of Hwy 60 (RM 133.93). Total miles of discontinuous flow in this segment is 0.42 miles. This entire segment is "new drying."									
Total number of river miles reduced to isolated pools in the Isleta Reach, including the two dry segments, is 4.12 miles. Aside from these two segments, the flow in the main river channel is continuous in the Isleta Reach.									
4:15		Rio Grande 0.7 miles downstream of Los Chavez Wasteway (RM 156)	Top of river drying	0.00 (0 - 0)	Visual	3844961	340588	---	None
3:15		Peralta Wasteway at Rio Grande (RM 152.5)	Flow estimate	0.00 (0 - 0)	Visual	---	---	---	None
4:55		Rio Grande 0.2 miles downstream of Peralta Wasteway (RM 152.3)	Bottom of river drying	0.00 (0 - 0)	Visual	---	---	3839867 340293	None
6:00		Rio Grande at Hwy 346 (RM 140.8)	Flow estimate	6.00 (5 - 7)	Visual	---	---	---	None
8:00		Rio Grande just upstream of Sabinal Drain outfall (RM 138)	Flow estimate	6.00 (5 - 7)	Visual	---	---	---	None
6:40		Rio Grande 6.45 miles downstream of Hwy 346 (RM 134.35)	Top of river drying	0.00 (0 - 0)	Visual	3815510	334360	---	None
7:15		Rio Grande 3.33 miles upstream of Hwy 60 (RM 133.93)	Bottom of river drying	0.00 (0 - 0)	Visual	---	---	3814977 334648	None

Isleta Reach			Estimated Flow (cfs)	Flow Estimate	River Drying GIS Coordinates (UTM NAD 1983, Zone 13)					
Date	Time	Location*	Observation	Avg (Range)	Type	Top (N - E)		Bottom (N - E)		Comments
23-Jun-2013	<b>General Comments:</b> The river is dry or reduced to isolated pools over a 6.13 mile segment in the Isleta Reach.  River is reduced to isolated pools over a 4.15-mile segment in the vicinity of Peralta-Los Chaves Wasteways, extending south from a point approximately 0.55 miles downstream of Los Chavez Wasteway (RM 156.15) to a point 0.5 mile downstream of Peralta Main Wasteway (RM 152.0). Some 0.45 miles of river in this segment is considered "new drying." A second segment of river is reduced to isolated pools between Hwy 346 and Hwy 60. Top of drying in this segment is 5.5 miles downstream of Hwy 346 (RM 135.3). Bottom of drying in this segment is 2.72 miles upstream of Hwy 60 (RM 133.32). Total miles of discontinuous flow in this segment is 1.98 miles. In this segment, there is 1.56 miles of river considered "new drying." Total number of river miles reduced to isolated pools in the Isleta Reach, including the two dry segments, is 6.13 miles. Aside from these two segments, the flow in the main river channel is continuous in the Isleta Reach.									
	4:15	Rio Grande 0.55 miles downstream of Los Chavez Wasteway (RM 156.15)	Top of river drying	0.00 (0 - 0)	Visual	3845276	340373	---	---	None
	3:15	Peralta Wasteway at Rio Grande (RM 152.5)	Flow estimate	0.00 (0 - 0)	Visual	---	---	---	---	None
	5:30	Rio Grande 0.5 mile downstream of Peralta Wasteway (RM 152)	Bottom of river drying	0.00 (0 - 0)	Visual	---	---	3839483	340383	None
	6:20	Rio Grande at Hwy 346 (RM 140.8)	Flow estimate	6.00 (5 - 7)	Visual	---	---	---	---	None
	7:00	Rio Grande 5.5 miles downstream of Hwy 346 (RM 135.3)	Top of river drying	0.00 (0 - 0)	Visual	3816965	381696	---	---	None
	7:40	Rio Grande 2.72 miles upstream of Hwy 60 (RM 133.32)	Bottom of river drying	0.00 (0 - 0)	Visual	---	---	3814039	334737	None

Isleta Reach			Estimated Flow (cfs)	Flow Estimate	River Drying GIS Coordinates (UTM NAD 1983, Zone 13)				
Date	Time	Location*	Observation	Avg (Range)	Type	Top (N - E)		Bottom (N - E)	Comments
24-Jun-2013	<b>General Comments:</b> The river is dry or reduced to isolated pools over a 6.44 mile segment in the Isleta Reach.  River is reduced to isolated pools over a 4.22-mile segment in the vicinity of Peralta-Los Chaves Wasteways, extending south from a point approximately 0.48 miles downstream of Los Chavez Wasteway (RM 156.22) to a point 0.5 mile downstream of Peralta Main Wasteway (RM 152.0). Total miles of discontinuous flow in this segment is 4.22 miles. Some 0.07 miles of river is considered "new drying." A second segment of river is reduced to isolated pools between Hwy 346 and Hwy 60. Top of drying in this segment is 5.4 miles downstream of Hwy 346 (RM 135.38). Bottom of drying in this segment is 2.56 miles upstream of Hwy 60 (RM 133.16). Total miles of discontinuous flow in this segment is 2.22 miles. In this segment, there is 0.20 miles of river considered "new drying." Total number of river miles reduced to isolated pools in the Isleta Reach, including the two dry segments, is 6.44 miles. Total "new drying" since yesterday is 0.27 miles. Aside from these two segments, the flow in the main river channel is continuous in the Isleta Reach.								
	3:15	Rio Grande 0.48 miles downstream of Los Chavez Wasteway (RM 156.22)	Top of river drying	0.00 (0 - 0)	Visual	3845377	340324	---	None
	4:15	Peralta Wasteway at Rio Grande (RM 152.5)	Flow estimate	0.00 (0 - 0)	Visual	---	---	---	None
	4:30	Rio Grande 0.5 mile downstream of Peralta Wasteway (RM 152)	Bottom of river drying	0.00 (0 - 0)	Visual	---	---	3839483 340383	None
	5:30	Rio Grande at Hwy 346 (RM 140.8)	Flow estimate	4.00 (3 - 5)	Visual	---	---	---	None
	6:00	Rio Grande 5.4 miles downstream of Hwy 346 (RM 135.38)	Top of river drying	0.00 (0 - 0)	Visual	3817115	334566	---	None
	6:20	Rio Grande 2.56 miles upstream of Hwy 60 (RM 133.16)	Bottom of river drying	0.00 (0 - 0)	Visual	---	---	3813835 334587	None

Isleta Reach			Estimated Flow (cfs)	Flow Estimate	River Drying GIS Coordinates (UTM NAD 1983, Zone 13)				
Date	Time	Location*	Observation	Avg (Range)	Type	Top (N - E)	Bottom (N - E)		Comments
25-Jun-2013		<b>General Comments:</b> The river is dry or reduced to isolated pools over a 6.51 mile segment in the Isleta Reach. River is reduced to isolated pools over a 4.27-mile segment in the vicinity of Peralta-Los Chaves Wasteways, extending south from a point approximately 0.40 miles downstream of Los Chavez Wasteway (RM 156.27) to a point 0.5 mile downstream of Peralta Main Wasteway (RM 152.0). Total miles of discontinuous flow in this segment is 4.27 miles. Some 0.05 miles of river is considered "new drying." A second segment of river is reduced to isolated pools between Hwy 346 and Hwy 60. Top of drying in this segment is 5.4 miles downstream of Hwy 346 (RM 135.4). Bottom of drying in this segment is 2.56 miles upstream of Hwy 60 (RM 133.16). Total miles of discontinuous flow in this segment is 2.24 miles. In this segment, there is no "new drying." Total number of river miles reduced to isolated pools in the Isleta Reach, including the two dry segments, is 6.51 miles. Total "new drying" since yesterday is 0.05 miles. Aside from these two segments, the flow in the main river channel is continuous in the Isleta Reach.							
	2:17	Rio Grande 0.40 miles downstream of Los Chavez Wasteway (RM 156.27)	Top of river drying	0.00 (0 - 0)	Visual	3845460	340291	---	None
	4:15	Peralta Wasteway at Rio Grande (RM 152.5)	Flow estimate	0.00 (0 - 0)	Visual	---	---	---	None
	4:26	Rio Grande 0.5 mile downstream of Peralta Wasteway (RM 152)	Bottom of river drying	0.00 (0 - 0)	Visual	---	---	3839433 340399	None
	6:30	Rio Grande 5.4 miles downstream of Hwy 346 (RM 135.34)	Top of river drying	0.00 (0 - 0)	Visual	3817064	334547	---	None
	6:45	Rio Grande 2.56 miles upstream of Hwy 60 (RM 133.16)	Bottom of river drying	0.00 (0 - 0)	Visual	---	---	3813803 334565	None

Isleta Reach			Estimated Flow (cfs)	Flow Estimate	River Drying GIS Coordinates (UTM NAD 1983, Zone 13)			
Date	Time	Location*	Observation	Avg (Range)	Type	Top (N - E)	Bottom (N - E)	Comments
26-Jun-2013	<b>General Comments:</b> The river is dry or reduced to isolated pools over a 6.44 mile segment in the Isleta Reach.  River is reduced to isolated pools over a 4.27-mile segment in the vicinity of Peralta-Los Chaves Wasteways, extending south from a point approximately 0.40 miles downstream of Los Chavez Wasteway (RM 156.27) to a point 0.5 mile downstream of Peralta Main Wasteway (RM 152.0). Total miles of discontinuous flow in this segment is 4.27 miles. There has been no "new drying" in this segment since yesterday. A second segment of river is reduced to isolated pools between Hwy 346 and Hwy 60. Top of drying in this segment is 5.47 miles downstream of Hwy 346 (RM 135.33). Bottom of drying in this segment is 2.56 miles upstream of Hwy 60 (RM 133.16). Total miles of discontinuous flow in this segment is 2.17 miles. In this segment, there is no "new drying." Some 0.07 miles of river rewet in this river segment since yesterday. Total number of river miles reduced to isolated pools in the Isleta Reach, including the two dry segments, is 6.44 miles. There has been no "new drying" since yesterday. Some 0.07 miles of river rewet since yesterday. Aside from these two segments, the flow in the main river channel is continuous in the Isleta Reach.							
	2:20	Rio Grande 0.40 miles downstream of Los Chavez Wasteway (RM 156.27)	Top of river drying	0.00 (0 - 0)	Visual	3845472	340290	--- --- None
	3:30	Peralta Wasteway at Rio Grande (RM 152.5)	Flow estimate	0.00 (0 - 0)	Visual	---	---	--- --- None
	3:29	Rio Grande 0.5 mile downstream of Peralta Wasteway (RM 152)	Bottom of river drying	0.00 (0 - 0)	Visual	---	---	3839429 340406 None
	4:35	Rio Grande 5.47 miles downstream of Hwy 346 (RM 135.33)	Top of river drying	0.00 (0 - 0)	Visual	3817042	334524	--- --- Some 0.07 miles of river rewet since yesterday.
	4:48	Rio Grande 2.56 miles upstream of Hwy 60 (RM 133.16)	Bottom of river drying	0.00 (0 - 0)	Visual	---	---	3813804 334569 None



Isleta Reach			Estimated Flow (cfs)	Flow Estimate	River Drying GIS Coordinates (UTM NAD 1983, Zone 13)					
Date	Time	Location*	Observation	Avg (Range)	Type	Top (N - E)	Bottom (N - E)	Comments		
27-Jun-2013	<b>General Comments:</b> The river is dry or reduced to isolated pools over a 6.73 mile segment in the Isleta Reach.  River is reduced to isolated pools over a 4.38-mile segment in the vicinity of Peralta-Los Chaves Wasteways, extending south from a point approximately 0.29 miles downstream of Los Chavez Wasteway (RM 156.38) to a point 0.5 mile downstream of Peralta Main Wasteway (RM 152.0). Total miles of discontinuous flow in this segment is 4.38 miles. Some 0.11 miles of river represent "new drying" at the "top of river drying". A second segment of river is reduced to isolated pools between Hwy 346 and Hwy 60. Top of drying in this segment is 5.5 miles downstream of Hwy 346 (RM 135.33). Bottom of drying in this segment is 2.35 miles upstream of Hwy 60 (RM 133.16). Total miles of discontinuous flow in this segment is 2.35 miles. Some 0.03 miles of river rewet since yesterday at the "top of river drying". Some 0.21 miles of river represent "new drying" at the "bottom of river drying". Total number of river miles reduced to isolated pools in the Isleta Reach, including the two dry segments, is 6.73 miles. There has been 0.32 of "new drying". Some 0.03 miles of river rewet since yesterday. Aside from these two segments, the flow in the main river channel is continuous in the Isleta Reach									
	3:10	Rio Grande 0.29 miles downstream of Los Chavez Wasteway (RM 156.38)	Top of river drying	0.00 (0 - 0)	Visual	3845639	340285	---	---	Some 0.11 miles of river represent "new drying" at the "top of river drying"
	2:50	Peralta Wasteway at Rio Grande (RM 152.5)	Flow estimate	0.00 (0 - 0)	Visual	---	---	---	---	None
	3:54	Rio Grande 0.5 mile downstream of Peralta Wasteway (RM 152)	Bottom of river drying	0.00 (0 - 0)	Visual	---	---	3839429	340406	None
	4:50	Rio Grande 5.5 miles downstream of Hwy 346 (RM 135.3)	Top of river drying	0.00 (0 - 0)	Visual	3816997	334502	---	---	Some 0.03 miles of river rewet since yesterday at the "top of river drying".
	5:10	Rio Grande 2.35 miles upstream of Hwy 60 (RM 132.95)	Bottom of river drying	0.00 (0 - 0)	Visual	---	---	3813532	334404	Some 0.21 miles of river represent "new drying" at the "bottom of river drying"