Newlands Project Planning Study
Special Report

Prepared by

Bureau of Reclamation
Mid-Pacific Region
Lahontan Basin Area Office

U.S. Department of the Interior
Bureau of Reclamation

April 2013

Contents

Tables

Figures

Appendices

Abbreviations and Acronyms

µg/l	micrograms per liter
2008 Final Risk Assessment	Truckee Canal Issue Evaluation Report of Findings: Final Risk Assessment
2011 Report of Findings	Truckee Canal Issue Evaluation Report of Findings
AB	Assembly Bill
APS	allowance for procurement strategies
BIA	U.S. Department of the Interior, Bureau of Indian Affairs
BLM	U.S. Department of the Interior, Bureau of Land Management
CCP	comprehensive conservation plan
cfs	cubic foot per second
CWA	Clean Water Act
CWSD	Carson Water Subconservancy District
DEC Review	Design, Estimating and Construction Review
Derby Dam	Derby Diversion Dam
DOD	U.S. Department of Defense
EA	Environmental Assessment
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
ESA	Endangered Species Act of 1966
GBLW	Great Basin Land and Water Trust
HDPE	High Density Polyethylene
I-80	Interstate 80
IDC	interest during construction
kV	kilovolt
kW	kilowatt
LCT	Lahontan cutthroat trout
LDPE	Low-Density Polyethylene
M&I	municipal and industrial
MAD	Maximum Allowable Diversion
MCL	maximum contaminant level
mgd	million gallons per day
msl	mean sea level
MW	megawatt

MWh	megawatt hour
NAS	Naval Air Station
NDEP	Nevada Department of Environmental Protection
NDOW	Nevada Department of Wildlife
NED	national economic development
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
NTU	nephelometric turbidity units
NVCRIS	Nevada Cultural Resource Information System
NWR	National Wildlife Refuge
O&M	operations and maintenance
OCAP	Operating Criteria and Procedures for the Newlands Project
P&G	Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies
Planning Model	Pre-TROA Planning Model
PM_{10}	particulate matter of 10 microns in aerometric diameter or less
ppm	parts per million
Project	Newlands Project
Reclamation	U.S. Department of the Interior, Bureau of Reclamation
RED	Regional Economic Development
RR	risk rating
SHPO	State Historic Preservation Office
STA	Truckee Canal station
Study	Newlands Project Planning Study
TCID	Truckee-Carson Irrigation District
TDS	total dissolved solids
TMDL	total maximum daily load
TMWA	Truckee Meadows Water Authority
TMWRF	Truckee Meadows Water Reclamation Facility
TROA	Truckee River Operating Agreement
TTSA	Tahoe-Truckee Sanitation Agency
UAMPS	Utah Associated Municipal Power Systems
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
USRS	U.S. Reclamation Service

WCWCD	Washoe County Water Conservation District
WQSA	Truckee River Water Quality Settlement Agreement

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Executive Summary

The Newlands Project Planning Study (Study) Special Report is a study conducted by the U.S. Department of the Interior, Bureau of Reclamation (Reclamation). The Study's intent is to formulate, develop, and evaluate a range of alternatives to deliver water to Newlands Project (Project) water rights holders while also reducing risk to local communities from operating the Project's Truckee Canal. The purpose of this Special Report is to describe that process and present Study findings.

Planning studies help identify and evaluate different ways to address a problem or issue in a manner that could be supported by decision makers, stakeholders, and Congress before funding more detailed studies or projects. Thus, the results of this Study may be used to inform decisions regarding the Newlands Project, including the extent of repairs to the Truckee Canal and its future operation; the report is informational only and is not intended to provide a specific recommended action. If Congress chooses to authorize and appropriate funds in the future for a feasibility study, construction, or other activities, this report would provide important context and guidance for undertaking those activities and any related environmental reviews.

Background

The Newlands Project is one of Reclamation's first irrigation projects and nearly as old as the agency itself. Reclamation began the Project in 1903 to provide irrigation water to the Lahontan Valley, near Fallon, Nevada, and to lands in the Truckee Basin near Fernley, Nevada.

In the early morning of January 5, 2008, a 50-foot portion of the Truckee Canal embankment failed about 12 miles downstream from Derby Dam, releasing water that inundated a residential development in the City of Fernley, flooding 590 properties. No fatalities occurred, but more than $1 billion in tort claims were filed against the Federal government, local governments, and the Truckee-Carson Irrigation District (TCID), and have now been consolidated into class-action lawsuits.

Although the damaged portion of the canal embankment was soon repaired, evaluations of the canal revealed a high potential for future failure. In response, Reclamation imposed restrictions on the water surface elevation allowed in the canal and the amount of water allowed to flow through the canal. The flow restrictions were reinforced by the Federal District Court for Nevada. If not lifted, these restrictions could complicate the long-term ability of Reclamation to provide Newlands Project water rights holders with reliable supplies.

Federal authorization for the Study was provided in the *Omnibus Appropriations Act of 2009* (Public Law 111-8, 123 Statute 609), which directed Reclamation to determine the actions necessary to rehabilitate the Truckee Canal so restrictions on its operation can be removed.

Existing and Future Conditions

The primary study area for this investigation consists of the Newlands Project boundaries, TCID service area in the Newlands Project, Churchill County, the City of Fernley in northern Lyon County, the Fallon Paiute-Shoshone Indian Reservation, the Stillwater National Wildlife Refuge (NWR), and the Carson Lake and Pasture. The extended study area encompasses the broader Carson River watershed, Truckee River watershed, and Dixie Valley. These areas encompass Lake Tahoe, Pyramid Lake, a number of cities and communities, as well as the majority of the Pyramid Lake Indian Reservation. Figure ES-1 shows both the primary and extended study areas.

This Study describes existing and likely future without-action conditions in the primary and extended study areas. The description of these conditions includes information available to the Study on infrastructure; physical, biological, cultural, socioeconomic environments; and water resources.

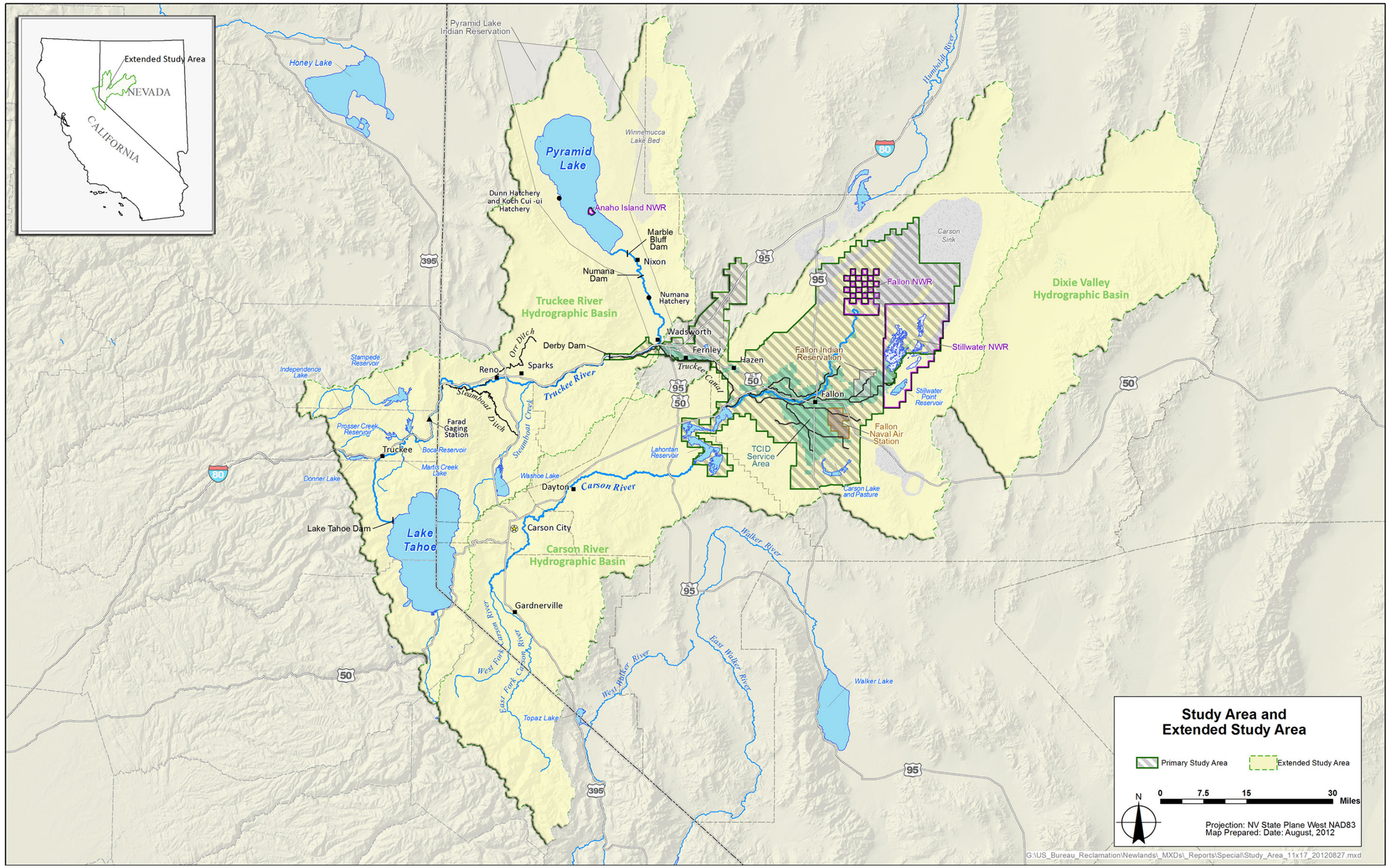

Figure ES-1. Study Areas for the Newlands Project Planning Study

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Problems, Needs, and Opportunities

Major water resources problems and needs for the Study pertain to the increasing competition for water rights in the Truckee and Carson river basins, increases in the likelihood and potential consequence of a Truckee Canal breach, and the reliability of Project water rights. Opportunities have been identified during the Study relative to Project efficiency and water quality and quantities on the Lower Truckee River.

Water Rights Related Needs

Reclamation and its local contractor, TCID, are obligated to serve Project water rights holders. However, the Project's changing makeup has complicated the delivery of water to its diverse blend of users. Over the last century, several factors, including urban growth in Fallon and Fernley and the decline of ecosystems in the primary and extended study areas, have increased competition for water in the Truckee and Carson river basins and reduced the proportion of Project water delivered for agricultural uses relative to other uses. While these changing demands are not considered a problem, serving Project water rights holders is an important need.

Truckee Canal Risk Related Problems and Needs

As evidenced by the 2008 breach, operating the Truckee Canal in its current condition to serve Project water rights holders presents large safety risks for residents and property, particularly in the Fernley area. The breach in 2008 was not the first structural failure of the Truckee Canal – eight other breaches occurred during the twentieth century. However, all of the previous breaches had occurred in rural areas or at a time when the property adjacent to the canal was uninhabited.

Since 2008, Reclamation has reviewed the risks of continuing to operate the Truckee Canal and has concluded that substantial improvements will be needed to allow the canal to safely convey as much water as it has historically. The facility's advanced age – around 110 years old – and structural issues make future breaches likely. Urbanization has increased the potential for a breach to cause damage, injuries, or deaths. The combination of failures with high likelihoods and with high consequences has led Reclamation to require extensive rehabilitation actions, especially for the urbanized portions of the Truckee Canal. In the meantime, while options for reducing risk are being formulated and discussed, Reclamation has restricted the flow stages of the Truckee Canal.

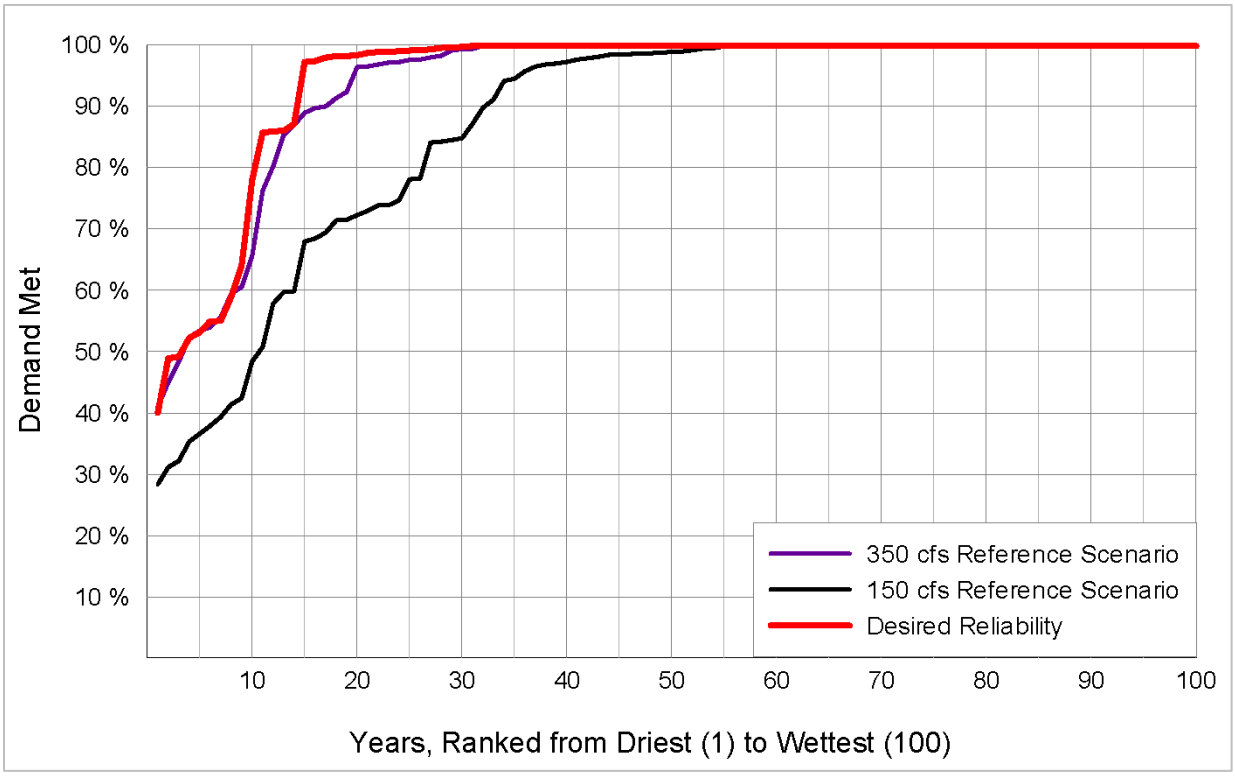
Water Supply Reliability Related Problems and Needs

Restrictions on flow through the Truckee Canal, aimed at addressing Reclamation concerns for safety and risk, could reduce Project water supply to levels below the conditions experienced by users before the 2008 Truckee Canal breach.

The potential for reduced Truckee Canal capacity to affect Project water supply is illustrated in Figure ES-2, which depicts 100 years of simulated water supply deliveries to Project water rights holders under different canal flow-stage scenarios, including:

- **Desired Reliability Scenario** – Represents the range of water supply conditions that Project water rights holders could have expected, had the 2008 canal breach not resulted in capacity restrictions.

- **150 cfs and 350 cfs Scenarios** – Illustrates the anticipated water supply conditions that Project water rights holders might experience in the future, with flow-stage restrictions on the Truckee Canal of 150 and 350 cfs. These two selected flow stages (350 and 150 cfs) bracket the range of recent and likely future without-action restrictions on the Truckee Canal, respectively.



Notes:
Simulations based on 100-year hydrology for the Truckee and Carson river basins, 1901–2000.
The Desired Reliability scenario considers the current Project demand; the other scenarios consider anticipated future demand, as discussed in Chapter 3 and Appendix C.
Key:
cfs = cubic feet per second

Figure ES-2. Potential for Restricted Truckee Canal Capacity to Affect Water Supply Reliability for the Newlands Project

Project Efficiency Related Opportunities

As Reclamation and others have long noted, many Project features and practices result in the inefficient use of Project water. For instance, the Project's aged conveyance structures, most of which are unlined, permit large amounts of water to seep into the ground before delivery. Conditions such as these present opportunities to improve the Project's efficiency by reducing delivery system losses, or otherwise improving the Project's ability to deliver more with its existing water supplies.

Lower Truckee River Related Opportunities

Conflict and litigation over surface water in the Truckee River Basin have been ongoing for more than 100 years, and the Newlands Project has been a frequent component of these disputes. Chief among these disputes is litigation stemming from reductions to Pyramid Lake elevations and fish species. A number of factors have reduced the cumulative inflows from the Truckee River to Pyramid Lake, thereby challenging the viability of these fisheries. Over time, Project diversions from the river at Derby Dam have become the focus of efforts to reverse declines in water levels at Pyramid Lake and water quality in the Lower Truckee River. The result of these efforts has been a significant reduction in Project diversions from the Truckee River, in comparison to historical practices.

Study Objectives

On the basis of specific direction in the Study's authorizing legislation, identified water resources problems and opportunities in the study areas, and other guidance, the following Study objectives were developed:

- Address Truckee Canal safety concerns in a manner that is consistent with Reclamation's preferred standards of safety for canals.

- Satisfy the exercise of future anticipated Project water rights in a manner equivalent to the level of service reliability Project users would have experienced historically, under current regulations and without restrictions on the Truckee Canal. Further, provide water rights reliability in a manner that maintains the viability of the Project, meaning that the Project's current ability to generate revenue and sustain itself is preserved.

Alternatives were formulated specifically to accomplish the Study objectives. To the extent possible, through pursuit of the Study objectives, alternatives also include features to help address the following opportunities:

- Improve the efficiency of Project water supply deliveries.

- Improve the water supply quantity and quality of the lower Truckee River.

Specific planning constraints, considerations, and criteria were also established to help guide the Investigation planning process.

Formulation and Evaluation of Alternatives

Once water resources problems, needs, and opportunities have been identified, and planning objectives, constraints, considerations, and criteria have been developed, the next major elements of the plan formulation process are identifying and screening management measures, and formulating alternatives to meet the Study objectives.

Screening Management Measures

A management measure is any structural or nonstructural action or feature that could address one or more planning objectives, consistent with other planning considerations, criteria, and constraints. At each step of the planning process, measures are reviewed, and in some cases reconsidered and incorporated into alternatives or eliminated from further consideration.

More than 50 measures were identified to address the Study objectives and opportunities, based upon previous studies, reports, public input, and meetings with stakeholders and agencies in the study area. The Study subjected all measures to a three-phased screening process that included:

- **Phase 1** – Removal of measures with seemingly intractable implementation hurdles, severe environmental effects that may outweigh safety or water supply benefits, or poor performance relative to magnitude of identified problems.

- **Phase 2** – Technical analysis of measures that passed Phase 1, but which had not been evaluated by previous studies or reports in sufficient detail for evaluating relative performance, and removal of poor performers from further consideration.

- **Phase 3** – Combination of measures into preliminary alternatives, and removal of measures that have lower performance relative to similar alternatives or compatibility problems.

Seven measures were retained for meeting the safety objective among five potential Truckee Canal conveyance capacities, and 11 additional measures were retained for meeting the water supply objective, including one measure that was retained in concept only. All measures retained for use in preliminary alternatives are listed in Table ES-1.

Table ES-1. Measures Addressing Study Objectives

Study Objective: Truckee Canal Safety[1,2]
Provide Safety at 600 cfs [1, 2]
High Density Polyethylene cutoff walls along the Truckee Canal
Provide Safety at 350 cfs [1, 2]
High Density Polyethylene cutoff walls along the Truckee Canal
Concrete/Geomembrane lining along the Truckee Canal
Provide Safety at 250 cfs [1, 2]
High Density Polyethylene cutoff walls along the Truckee Canal
Concrete/Geomembrane lining along the Truckee Canal
Provide Safety at 150 cfs [2]
Operate with Restricted Truckee Canal
Provide Safety at 0 cfs
Decommission the Truckee Canal
Study Objective: Water Supply
Develop Supplemental Sources of Water Supply
Treat and deliver City of Fernley Municipal Effluent
Import Groundwater Supplies from Dixie Valley
Construct Pipeline for Supplying Truckee Canal
Increase Delivery Efficiencies by Reducing Seepage Losses
Line Main Canals and Laterals in the Carson Division
Compact Soils of Main Canals and Laterals in the Carson Division
Concrete/Geomembrane Lining Along the Truckee Canal[1]
Compact soils of Truckee Canal
Reduce Dry-Year Agricultural Demand
Acquire and Permanently Retire Project Water Rights
Crop Insurance/Dry Year Fallowing
Partial Season Forbearance Agreements
Develop Upstream Truckee River Storage
Multi-Year Upstream Storage (*retained in concept only)*

Notes:

[1] Many measures retained for addressing Truckee Canal Safety Risks are distinguished by the type of improvements performed along the canal, but also include other structural refurbishments and non-structural activities that are consistent across all indicated measures.

[2] Aside from decommissioning the Truckee Canal, all measures retained for addressing Truckee Canal Safety Risks also have performance characteristics that help provide Newlands Project with Water Supply Reliability.

Refinement of Alternatives

As part of the measures screening process, 24 preliminary alternatives were developed for addressing the Study objectives. Figure ES-3 illustrates how measures from various subcategories were combined to achieve the water supply objective (illustrated as the Desired Reliability line). The preliminary alternatives are illustrated in ES-3 in the same sequence and order as they are described in Tables ES-2. Preliminary alternatives are labeled with a flow stage and letter (e.g. 350.a is the first preliminary alternative with a 350 cfs flow stage).

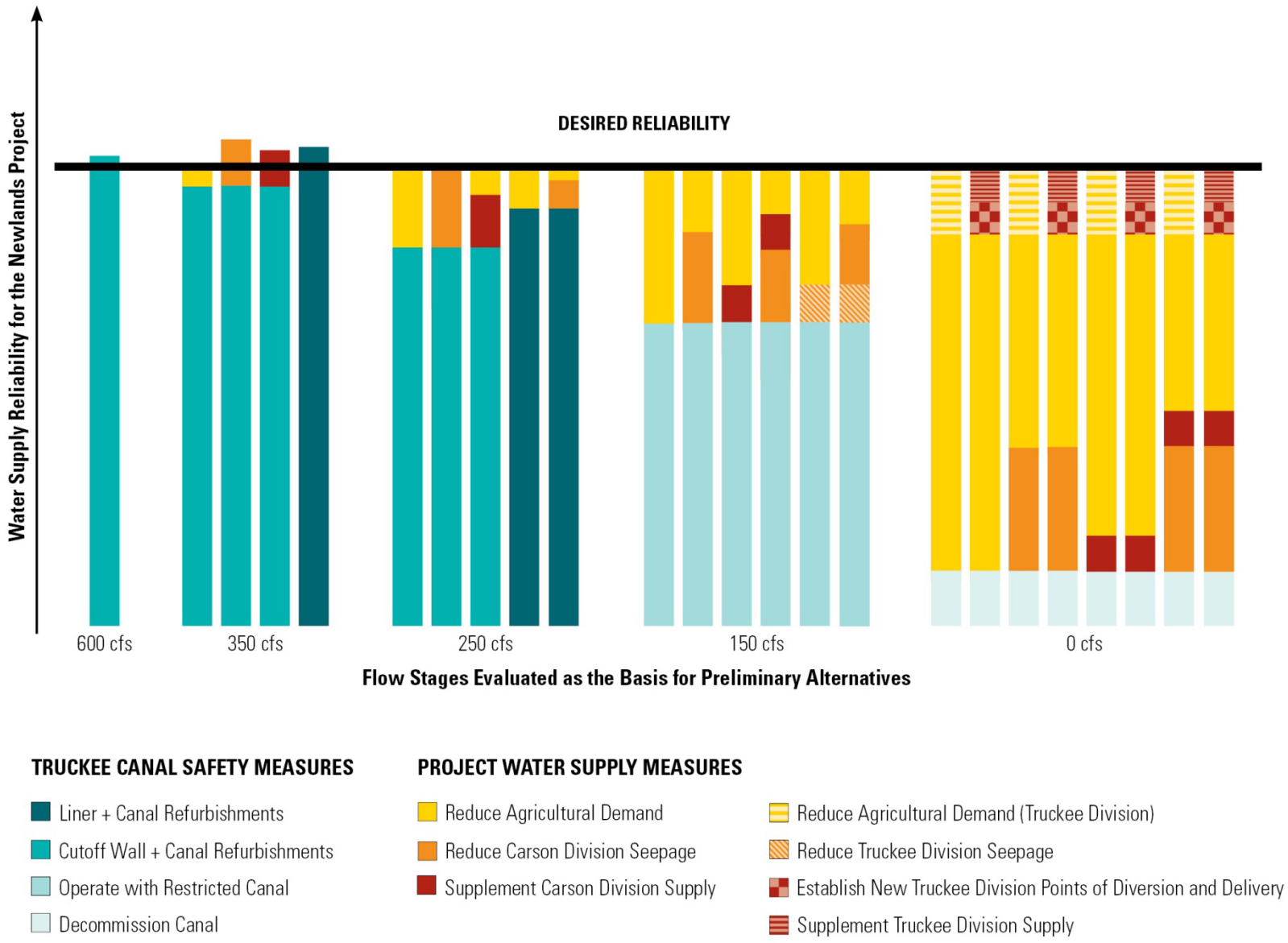


Figure ES-3. Summary of Preliminary Alternatives Assembled to Achieve Safety and Water Supply Reliability

Table ES-2. Summary of Preliminary Alternatives between Flow Stages of 600 cfs and 150 cfs

Truckee Canal Flow Stage		Measures Selected to Meet Objectives			Est. Annual Cost ($ Million)[1,2]	
		Safety	Water Supply			
			Primary Measure	Additional Measure(s)	Low	High
600 cfs		HDPE Cutoff Wall	None		$2.10	$2.10
350 cfs	a	HDPE Cutoff Wall	Reduce Agricultural Demand *(5 to 15%, 2 measures)*	None	$2.50	$3.90
	b		Reduce Carson Division Seepage *(2 measures)*	None	$2.60	$10.00
	c		Supplement Carson Division *(1 measure)*	None	$6.50	$13.00
	d	Concrete/ Geomembrane Liner	None		$2.80	$2.80
250 cfs	a	HDPE Cutoff Wall	Reduce Agricultural Demand *(20 to 25%, 2 measures)*	None	$3.70	$5.10
	b		Reduce Carson Division Seepage *(2 measures)*	None	$2.60	$10.00
	c		Supplement Carson Division Supply *(1 measure)*	ReduceAgriculturalDemand*(10to15%,2measures)*	$7.30	$15.00
	d	Concrete/ Geomembrane Liner	Reduce Agricultural Demand *(10 to 15%, 2 measures)*	None	$3.60	$5.20
	e		Reduce Carson Division Seepage *(2 measures)*	ReduceAgriculturalDemand*(0to10%,2measures)*	$3.30	$5.10

Table ES-2. Summary of Preliminary Alternatives between Flow Stages of 600 cfs and 150 cfs (contd.)

Truckee Canal Flow Stage		Measures Selected to Meet Objectives			Est. Annual Cost ($ Million)[1,2]	
		Safety	Water Supply			
			Primary Measure	Additional Measure(s)	Low	High
150 cfs	a	Maintain Flows at or Below Flow Stage	Reduce Agricultural Demand *(35 to 45%, 2 measures)*	None	$2.90	$5.30
	b		Reduce Carson Division Seepage *(2 measures)*	Reduce Agricultural Demand *(15 to 25%, 2 measures)*	$1.70	$11.00
	c		Supplement Carson Division Supply *(1 measure)*	Reduce Agricultural Demand *(25 to 35%, 2 measures)*	$6.40	$15.00
	d		Reduce Carson Division Seepage *(2 measures)*	Supplement Carson Division Supply*(1 measure)* ReduceAgriculturalDemand*(0to25%,2measures)*	$4.90	$22.00
	e		Reduce Truckee Division Seepage *(1 measure)*	Reduce Agricultural Demand *(25 to 40%, 2 measures)*	$2.20	$4.90
	f		Reduce Truckee Division Seepage *(1 measure)*	Reduce Carson Division Seepage *(2 measures)* ReduceAgriculturalDemand*(15to30%,2measures)*	$1.90	$12.00

Notes:

[1] Cost estimates have been formatted to indicate the annual cost of implementing each preliminary alternative, relative to the full range of costs developed for preliminary alternatives. Green represents lower costs (lowest being $1.7 million), red represents higher costs (highest being $22 million), and yellow represents mid-range costs.

[2] Annual costs include interest and amortization of the field cost based on the current Federal discount rate of 4 percent, over an assumed service life of the measures included (from 5 to 65 years depending on the specific measure). See Appendix E2 for additional information.

Key:

cfs = cubic feet per second

HDPE = High Density Polyethylene

Table ES-3. Components of 0 cfs Preliminary Alternatives by Division

Focus of Component		Measures to Meet the Water Supply Objective			Est. Annual Cost ($ Million)[1]	
		Primary Measure	Additional Measure(s)		Low	High
Carson Division	a	Reduce Agricultural Demand *(70 to 80%, 2 measures)*	None		$5.60	$10.00
Carson Division	b	Reduce Carson Division Seepage *(2 measures)*	Reduce Agricultural Demand *(60 to 70%, 2 measures)*		$5.20	$15.00
Carson Division	c	Supplement Carson Division Supply *(1 measure)*	Reduce Agricultural Demand *(60 to 70%, 2 measures)*		$9.10	$18.00
Carson Division	d	Reduce Carson Division Seepage *(2 measures*)	Supplement Carson Division Supply *(1 measure)*	Reduce Agricultural Demand *(50 to 60%, 2 measures)*	$8.80	$25.00
Truckee Division	y	Reduce Agricultural Demand *(100%, 1 measure)*	None		$1.00	$1.00
Truckee Division	z	Establish New Truckee Division Points of Diversion and Delivery *(1 measure)*	Supplement Truckee Division Supply *(2 measures)*		$8.40	$11.00

Note:

[1] Annual costs include interest and amortization of the field cost based on the current Federal discount rate of 4 percent, over an assumed service life of the measures included (from 5 to 65 years depending on the specific measure). See Appendix E2 for additional information.

Key:

cfs = cubic feet per second

Table ES-4. Summary of Preliminary Alternatives for a Flow Stage of 0 cfs

Truckee Canal Flow Stage		Measures Selected to Meet Objectives			Est. Annual Cost ($ Million)[1,2]	
		Safety	Water Supply			
			Components Selected		Low	High
0 cfs	ay	Decommission Truckee Canal	Carson Division 0.a	Truckee Division 0.y	$6.60	$11.00
	az			Truckee Division 0.z	$14.00	$21.00
	by		Carson Division 0.b	Truckee Division 0.y	$6.20	$16.00
	bz			Truckee Division 0.z	$13.60	$26.00
	cy		Carson Division 0.c	Truckee Division 0.y	$10.10	$19.00
	cz			Truckee Division 0.z	$17.50	$29.00
	dy		Carson Division 0.d	Truckee Division 0.y	$9.80	$26.00
	dz			Truckee Division 0.z	$17.20	$36.00

Notes:

[1] Cost estimates have been formatted to indicate the annual cost of implementing each preliminary alternative, relative to the full range of costs developed for preliminary alternatives. Green represents lower costs (lowest being $6.2 million), red represents higher costs (highest being $36 million), and yellow represents mid-range costs.

[2] Annual costs include interest and amortization of the field cost based on the current Federal discount rate of 4 percent, over an assumed service life of the measures included (from 5 to 65 years depending on the specific measure). See Appendix E2 for additional information.

Key:

cfs = cubic feet per second

Agency Review of Preliminary Alternatives and Screening Criteria

Once preliminary alternatives were developed, the Study team sought the review of agencies and tribes, which presented opportunities for these entities to:

- Understand how measures identified for consideration in the Study have been characterized and analyzed, and suggest revisions to the characterizations of particular measures used in preliminary alternatives.

- Contribute to the descriptions of the preliminary alternatives and identify the potential for benefits or negative impacts associated with each.

- Identify or clarify how screening criteria could be used in selecting and refining Study alternatives.

- Provide feedback on priorities for remaining analyses in the Study.

Inclusion of agencies in the review and assessment of the preliminary alternatives also promotes the Study's intent, which is the development of plans for meeting Study objectives that, ultimately, may be implemented by local, regional, State, and/or Federal partners.

Selection of Study Alternatives

Following the agency review of preliminary alternatives and selection criteria, the planning criteria from the *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies* (P&G) was further applied to screen down the preliminary alternatives and select among them for further analysis. These criteria include completeness, effectiveness, efficiency, and acceptability.

This step reduced the number of options available for consideration before proceeding with more detailed evaluation of alternatives. It further leverages the criteria that have been used in the identification of preliminary alternatives that are the most suitable for a more rigorous analysis. The following section discusses how the preliminary alternatives were viewed under each of the planning criteria.

Table ES-5 displays the results of the process to apply the criteria to the preliminary alternatives.

Table ES-5. Summary of Preliminary Alternatives Performance Against Criteria

Alt.	Completeness	Effectiveness	Efficiency	Acceptability	Retained for Further Consideration
600	High	High	High	Varies by Stakeholder and Agency	Yes
350.a	High	High-to-Medium	High-to-Medium	Medium	Yes
350.b	High	High-to-Medium	High-to-Medium		Yes
350.c	High	High-to-Medium	Low		
350.d	High	High-to-Medium	High-to-Medium		Yes
250.a	High	High-to-Medium	High-to-Medium	Medium-to-Low	Yes
250.b	High	High-to-Medium	High-to-Medium		Yes
250.c	High	High-to-Medium	Low		
250.d	High	High-to-Medium	High-to-Medium		Yes
250.e	High	High-to-Medium	Low		
150.a	Low	Low	High-to-Medium	Varies by Stakeholder and Agency	
150.b	Low	High-to-Medium	High-to-Medium		
150.c	Low	High-to-Medium	Low		
150.d	Low	High-to-Medium	Low		
150.e	Low	High-to-Medium	Low		
150.f	Low	High-to-Medium	Low		
0.ay	Low	Low	Low	Varies by Stakeholder and Agency	
0.az	Medium-to-Low	Low	Low		
0.by	Low	Low	Low		
0.bz	Medium-to-Low	Low	Low		
0.cy	Low	Low	Low		
0.cz	Medium-to-Low	Low	Low		
0.dy	Low	Low	Low		
0.dz	Medium-to-Low	Low	Low		

Key:
Alt. = Alternative Name

Scale

Lower Performance — Higher Performance

Alternatives Evaluations and Comparisons

Once the seven Study alternatives were selected, the following evaluations were performed for each: water supply operations modeling, hydropower generation modeling, preliminary environmental and regulatory review, engineering and cost estimates, and financial and preliminary benefits estimates.

Table ES-6 summarizes the features, performance, and evaluations for each Study alternative.

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Table ES-6. Summary of Study Alternatives

		Alternative 600	Alternative 350.a	Alternative 350.b	Alternative 350.d	Alternative 250.a	Alternative 250.b	Alternative 250.d	Without-Action Alternative	Desired Reliability Scenario
Major Features	Truckee Canal Flow Stage	600 cfs	350 cfs	350 cfs	350 cfs	250 cfs	250 cfs	250 cfs	150 cfs	900 cfs
	Truckee Canal HDPE Cutoff Wall or Lining	HDPE Cutoff Wall	HDPE Cutoff Wall	HDPE Cutoff Wall	Lining	HDPE Cutoff Wall	HDPE Cutoff Wall	Lining	-	NA
	Other Features	-	-	Lining 45 miles of Carson Division canals	-	Fallowing 25% in Dry Years	Lining 45 miles of Carson Division canals	Fallowing 10% in Dry Years	-	NA
Safety		Meets RR3	Meets RR3	Meets RR3	Meets RR3	Meets RR3	Meets RR3	Meets RR3	Uncertain[1]	NA
Average Annual Project Water Delivery[2] (percent)		96.5%	95.6%	97.3%	96.3%	95.7%	96.2%	95.5%	90.5%	94.6%
Average Annual Project Water Delivery by User Category	Ag/Irrigation (TAF)	118.3	117.2	119.2	118.0	112.4	118.0	115.4	111.2	NA
	M&I (TAF)	13.3	13.3	13.4	13.3	13.3	13.3	13.3	13.2	NA
	Lahontan Valley Wetlands[3] (TAF)	68.0	67.3	68.6	67.8	67.4	67.8	67.2	63.6	NA
Annual Cost[4] (millions)		$2.90	$2.90	$15.00	$4.20	$6.50	$15.00	$5.60	NA	NA
TCID Ability-to-Pay[5] (millions)		$7.30	$6.90	$7.40	$7.20	$6.90	$7.00	$6.90	$5.00	NA[6]
Hydropower Generation Revenue (millions)		$1.35	$1.35	$1.25	$1.35	$1.30	$1.25	$1.30	$1.20	-
Environmental and Other Effects	Avg. Annual Spill to Stillwater NWR from Lahontan Dam (TAF)[7]	12.6	12.1	14.3	13.2	11.6	13.9	12.7	11.0	12.5
	Carson Division Groundwater and Agricultural Drain Flows[8]	Significant change not anticipated	Significant change not anticipated	Reduced by lining Carson Division canals	Significant change not anticipated	Reduced by fallowing	Reduced by lining Carson Division canals	Reduced by fallowing	Reduced in comparison to current conditions	Similar to current conditions
	City of Fernley Demand Met[9] (percent)	115%	108%	108%	56%	105%	105%	56%	99%	121%
	Avg. Annual Flow to Pyramid Lake (TAF)	480	487	505	491	498	512	501	516	460[10]

Notes:

[1] The 150 cfs flow stage is believed to pose a lower risk to the Fernley area because the water elevation in the canal would be maintained at a level low enough to minimize the risk of destabilizing the canal embankment. However, this is not a solution specifically designed to reduce risk of operating the canal, and thus the degree to which it meets the Study's safety objective (RR3) is unknown.

[2] Long-term average annual percent of Newlands Project demand met.

[3] Includes deliveries to Carson Lake and Pasture, the Fallon Paiute-Shoshone Tribal wetlands, and Stillwater NWR.

[4] Annual costs include interest and amortization of the capital cost estimated over 50 years at the current federal discount rate of 4 percent. Costs also include annual operations and maintenance estimated at 0.2 percent of the field cost. For some alternatives with the dry-year fallowing, annual costs for the program were estimated at $100 per acre of land fallowing plus an administrative cost at 20 percent of the fee. For additional information, see Appendix E3.

[5] Ability to pay estimates represents potential maximum increases to charges that TCID could apply to their customers while maintaining farm profitability, and are not reasonable to use as the sole basis for capital investment decisions. Ability to pay has been estimated using Reclamation guidelines and relies substantially upon the 5-year average for crop prices, which are volatile and presently on the higher end of historical ranges. For example, if alfalfa prices fell from current levels ($155/ton) to levels experienced a decade ago ($125/ton), TCID ability to pay could be reduced by as much as $8.7 million per year. The estimated current ability of TCID to pay for projects and improvements beyond current obligations is $6.50 million per year. (See Appendix G.)

[6] Assessment of financial conditions was not conducted for the Desired Reliability scenario. This scenario was developed to estimate a historical water supply reliability under current regulations and does not represent a current or future ability to pay.

[7] Spills are not considered a Project delivery, but are included in the calculation of benefits to wetlands.

[8] Effects of alternatives on Carson Division groundwater and agricultural drain flows are not quantifiable, and are described in comparison to current conditions.

[9] The City of Fernley's municipal supply relies on groundwater available through incidental recharge from the Truckee Canal. While this is not a valid Project delivery, some alternatives would have the effect of reducing the availability of this groundwater. The demand met for the City of Fernley is noted as an environmental outcome. For additional information on how the Study evaluated the effects of Study alternatives on Fernley's ability to meet future demand, see Appendix B4.

[10] Because the Desired Reliability scenario is based upon current demands, which are greater than the future demands used for Study alternatives, the flow to Pyramid Lake will automatically be somewhat higher for the alternatives than for the Desired Reliability scenario.

Key:

Ag. = agricultural

Avg. = average

M&I = municipal and industrial

RR = risk rating

TAF = thousand acre-feet

TCID = Truckee Canal Irrigation District

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Comparison Based on Federal Planning Criteria

Table ES-7 compares the Study alternatives using the four P&G planning criteria: (1) completeness, (2) effectiveness, (3) efficiency, and (4) acceptability (WRC 1983).

Table ES-7. Summary of Alternatives Comparison Against Federal Planning Criteria

		600	350.a	350.b	350.d	250.a	250.b	250.d	Without-Action
Completeness		High	High	High	High	Medium-to-Low	High	High-to-Medium	Does not achieve Study objectives
Effectiveness		High	High	High	High	High-to-Medium	High	High	
Efficiency		High	High	Medium-to-Low	Medium	Medium	Medium-to-Low	Medium	
Acceptability	M&I Users	High	High	Medium	Low	High	Medium	Low	Low
	Wetlands Users	High	High	Medium	High	Medium-to-Low	Medium	High	Low
	Agricultural Users	High	High	High-to-Medium	High	Medium-to-Low	High	Medium	Low
	Truckee River WQSA Interests	Low	Medium-to-Low	Medium-to-Low	Medium	Medium	Medium	Medium	High

Key:
M&I = municipal and industrial
WQSA = Water Quality Settlement Agreement

Findings and Future Actions

Findings regarding Study alternatives, other aspects of the Project, and potential future actions are described below.

Key Findings

The research and analysis conducted to support the planning process uncovered a number of other findings that are likely to be important considerations for additional studies related to the Project or to any alternative going forward. The Study's key findings are summarized as follows:

- **Canal Repairs are Possible to Address Safety Concerns** – The repair of the Truckee Canal such that it meets the Federal safety performance level (RR3) has been found technically possible in previous studies (see Chapter 1).

- **Project Demand Will Remain Steady** – While the complexion of the Project continues to change through ongoing water rights retirement and transfer programs, the fulfillment of these programs will not substantially diminish the potential volume of future water demand by Project water rights holders (see Chapter 3 and Appendix C).

- **Without Action, Canal Safety Issues Will Continue to Worsen** – A continuing significant need exists to implement actions to provide safety for the Truckee Canal. Without significant investments to improve the canal, its condition is expected to gradually worsen (see Chapter 3).

- **Action is Necessary to Preserve Water Supply Reliability** – Without addressing safety issues on the Truckee Canal, more stringent restrictions to canal conveyance capacities may gradually be implemented as the canal's condition worsens. These restrictions will significantly reduce the reliability of Project water supplies (see Chapter 2 and 3).

- **Alternatives Exist for Meeting Both Study Objectives** – Seven Study alternatives have been identified to satisfy the Study's objectives of safety and water supply, and are recommended for further development (see Chapter 5). The development of these alternatives revealed many constraints and potential opportunities for meeting the Study objectives, including:

  - **The Truckee Canal is Fundamental to the Project** – Plans that included either: (1) decommissioning the Truckee Canal and Derby Dam, or (2) allowing the canal conveyance capacity to be reduced over time to 150 cfs as a result of insufficient progress toward Reclamation safety requirements; were eliminated as viable alternative plans because the resulting conditions require far more extensive and expensive programs to support Project water rights than refurbishing the canal. For example, decommissioning the canal requires that between 50 percent and 80 percent of the Project's agricultural water rights would need to be retired permanently to meet the necessary level of reliability for the Project's remaining users, and cost 3- to 18-times as much as the cheapest alternative (see Chapter 4 and Appendix D3).

  - **Upstream Storage Looks Promising** – The use of upstream storage on the Truckee River for Project water was not evaluated, but appears very promising as an option for achieving the water supply objective. Allowing for Project credit water to be stored in Truckee River reservoirs may be a low-cost option for making flow stages below 600 cfs viable, but require substantial discussion with stakeholders to frame operational conditions (see Chapter 4 and Appendix D6).

  - **OCAP Limits Enhancements to Lahontan Reservoir Storage** – The regulations in OCAP that limit diversions from the Truckee River relative to storage targets in Lahontan Reservoir also limit the value of developing additional storage in Lahontan Reservoir. For example, a larger Lahontan Reservoir does capture more water during wet conditions but, because of OCAP storage target limitations, higher carry-over storages result in lower Truckee River diversions instead of higher water supply availability for the Project (see Chapter 4 and Appendix D7).

  - **Enhancing Carson River Inflows to Lahontan Reservoir Would Yield Marginal Benefit** – Acquisition of water rights from lower segments of the Carson River was considered because these would be the easiest to transfer to the Project; however, these rights are the least secure and provide little assistance during dry years, when additional supplies are needed most. The *Alpine* Decree prevents the secure transfer of rights from upper segments to Lahontan Reservoir, but even if it were possible, OCAP storage targets would reduce Truckee River diversions instead of improving Project supplies (see Appendix D5).

- **Study Alternatives Present Complex Tradeoffs** – Each of the alternatives is expected to appeal to different stakeholders and potential cost-share partners in different ways. Selection of any alternative for implementation would also require balancing tradeoffs among broader, related issues within the region. For example:

  - **Higher Truckee River Flows Have Highest Cost** – Alternatives that increase flows to Pyramid Lake also have the highest costs. Conversely, the alternative with the lowest cost results in the lowest flow to Pyramid Lake (see Chapter 5).

  - **Some Alternatives Reduce Ancillary Supplies** – Alternatives that reduce diversions from the Truckee River also reduce spills from Lahontan Reservoir, which reduces the overall supply for the Lahontan Valley wetlands. Likewise, alternatives that include efficiency improvements may reduce regional groundwater resources (see Chapter 5 and Appendix F).

- **Reclamation is a Required Partner** – The implementation of any alternative to improve safety of the Truckee Canal and serve Project water rights will require leadership from Reclamation, due to the Federal government's: interest in serving water rights of Project users; interest in serving water rights to Tribes and Stillwater NWR; interest in operations that affect habitat for listed or special status species at Pyramid Lake; and, ownership of facilities requiring rehabilitation, such as the Truckee Canal.

- **Implementation will Require Partners and Proponents** – Benefits of alternatives affect more than one party, and include: public safety, water supply reliability, and the possibility of addressing other related regional issues. Further, it is uncertain whether any singular entity is capable of paying for the alternatives identified by the Study. Potential cost-share partners with Reclamation include:

  – **TCID** and the Project's water right holders, for their shared interest in maintaining Project water supply reliability;

  – **City of Fernley**, for their shared interest in improving the safety of the Truckee Canal along its corridor through the city; and

  – **Pyramid Lake Paiute Tribe**, for their potential interest in how various alternatives influence flows on the lower Truckee River and other related issues, such as endangered species recovery and recoupment.

Potential Next Steps for Implementing an Action

This Study identifies a range of alternatives for reducing risk from the Truckee Canal while providing for the reliable exercise of Project water rights in the future. Funding and legal authorization would need to be specified for any role that Reclamation plays in the implementation of a Study alternative. Depending on the project and the source of authorization, some level of environmental compliance review will also be required.

At this time, Reclamation does not have funding allocated for the implementation of Study alternatives. Additionally, it is likely that any funding made available for Reclamation participation or implementation of any Study alternative would require both cost-share partnership(s) and repayment for Federal participation.

Some Study alternatives could be implemented under existing Reclamation authorizations, while others would require a new congressional authorization. Specific features of Study alternatives affect the ability of Federal and non-Federal partners to fund, finance, and implement them.

Considerations for Future Study

Based on the public comments on the Draft Special Report that Reclamation received in February 2013, stakeholders and the public have identified a number of considerations for future studies focused on refining or implementing any Study alternative. These comments, which appear in Appendix H (Public Participation and Outreach Report), suggest the following activities be in future studies:

- Develop information to provide greater detail regarding the effects of alternatives on:
  - Specific water quality objectives in the Truckee River (WRWC 2013).
  - Regional air quality (Churchill County 2013; City of Fernley 2013).
  - Recreation at Lahontan Reservoir (CWSD 2013; Churchill County 2013; TCID 2013).
  - Habitat and vegetation at Lahontan Reservoir (Churchill County 2013).
  - Wildlife at Lahontan Valley wetlands (Churchill County 2013).
  - Groundwater and agricultural return flows within the Carson Division (CWSD 2013; Churchill County 2013; TCID 2013).
  - Water supply reliability for the City of Fernley (TCID 2013; City of Fernley 2013) and the cost of resolving the city's potential future shortages (City of Fernley 2013).
  - Regional partners' financial conditions and ability to pay (CWSD 2013; Churchill County 2013; City of Fernley 2013).
- Identify the requirements of consultation in regards to CWA and other regulations with the USACE, USFWS, tribes, and other agencies for implementation of alternatives (NDEP 2013; Pyramid Lake Paiute Tribe 2013).
- Provide further consideration for the assumptions surrounding the appropriate extent of water rights that will need to be met in the future for the Newlands Project (Pyramid Lake Paiute Tribe 2013).
- Explore the suitability and possibility of upstream Truckee River credit storage for the Project, in coordination with appropriate regional stakeholders (CWSD 2013; Churchill County 2013; TCID 2013).
- Provide a cost-allocation recommendation that appropriately characterizes the relative benefits received by implementing alternative plans, and each beneficiary's ability to pay (CWSD 2013).
- Determine the economic benefits of increased flows in the Truckee River and to Pyramid Lake (WRWC 2013).

- Evaluate the potential effects of climate changes on hydrology in the Carson River Basin (CWSD 2013).

Chapter 1
Introduction

The Newlands Project Planning Study (Study) Special Report is a study conducted by the U.S. Department of the Interior, Bureau of Reclamation (Reclamation), to develop and evaluate alternatives for serving Newlands Project (Project) water rights reliably and safely. This report is authorized by the *Omnibus Appropriations Act of 2009* (Public Law 111-8, 123 Statute 609), which directed Reclamation to determine the actions necessary to rehabilitate the Truckee Canal so restrictions on its operation can be removed.

Since 1903, the Newlands Project has provided irrigation water to lands in the Lahontan Valley near Fallon, Nevada (the Carson Division), and to lands along the Truckee Canal near Fernley and Hazen, Nevada (the Truckee Division). Water for the Newlands Project is diverted from the Truckee River into the Truckee Canal at Derby Diversion Dam (Derby Dam), which is approximately 20 miles downstream from Reno, Nevada, and approximately 30 miles upstream from the river's terminus at Pyramid Lake. The Truckee Canal conveys Project water 32 miles east and south for irrigation in the Truckee Division and for delivery to Lahontan Reservoir, which also collects inflow from the Carson River and provides water supplies to the Carson Division. The Truckee Canal is the sole source of Project water within the Truckee Division, and has performed a critical role for the Carson Division by augmenting inflows from the Carson River and tempering the year-to-year variability in water supplies that might occur on the Carson River in isolation.

At approximately 4:16 a.m. on January 5, 2008, the Truckee Canal breached, resulting in the flooding of 590 properties in the City of Fernley. Canal operations were halted immediately until the breach was sealed and engineers had identified options for resuming operations safely. Although the damaged portion of the canal embankment was soon repaired, evaluations of the canal revealed a high potential for future failure. In response, Reclamation imposed restrictions on the water surface elevation allowed in the canal and the amount of water allowed to flow through the canal. The flow restrictions were reinforced by the Federal District Court for Nevada. If not lifted, these restrictions could complicate the long-term ability of Reclamation to provide Newlands Project water rights holders with reliable supplies.

The Newlands Project has experienced several changes over the past century that were unanticipated at its inception, including shifts in water uses and increased environmental requirements. In recent decades, many Truckee Division rights have been dedicated to the City of Fernley or sold out of the Project to augment inflows to Pyramid Lake. Within the Carson Division, a

significant portion of water rights has been acquired for local wetland rehabilitation. In addition, the Project has also become an important component of regional energy development, and hydropower generation is now a central source of revenue to pay for Project costs.

Purpose, Scope, and Organization of Special Report

The Study's intent is to formulate, develop, and evaluate a range of alternatives to deliver water to Newlands Project water rights holders while also reducing risk to local communities from operating the Project's Truckee Canal. The purpose of this Special Report is to describe that process and present Study findings. This Special Report makes no determinations regarding the current condition of the Truckee Canal.

This Special Report presents a set of alternatives for meeting the Study's objectives; each alternative includes a set of repairs to restore a specified capacity for the Truckee Canal and one or more "measures" to ensure that Newlands Project water rights holders will continue to receive reliable water deliveries long term. The range of measures evaluated include securing alternative water sources for serving Project water rights holders, changing Project operations, or other actions that would improve supply or manage demand. To support evaluating a range of alternatives to provide water supply reliability for the Newlands Project, this report also documents the current and future water needs in the Project area, and potential accomplishments, costs, benefits, and environmental considerations of the alternatives developed.

Planning studies help identify and evaluate different ways to address a problem or issue in a manner that could be supported by decision makers, stakeholders, and Congress before funding more detailed studies or projects. Thus, the results of this Study may be used to inform decisions regarding the Newlands Project, including the extent of repairs to the Truckee Canal and its future operation; the report is informational only and is not intended to provide a specific recommended action. If Congress chooses to authorize and appropriate funds in the future for a feasibility study, construction, or other activities, this report would provide important context and guidance for undertaking those activities and any related environmental reviews.

This report contains seven chapters that summarize the work and findings from the Study, including the following after this introduction in Chapter 1:

Chapter 2 describes the plan formulation process, including Study objectives, planning conditions and constraints, and criteria used to help guide the Study and alternatives development.

Chapter 3 identifies current and likely future water resources and related conditions in the study area.

Chapter 4 summarizes the measures that may be combined to form alternatives and describes the development of preliminary alternatives.

Chapter 5 contains summaries of each final alternative, including features and accomplishments, as well as initial costs, benefits, and preliminary environmental considerations; describes related evaluation methods; and notes implementation considerations.

Chapter 6 compares the alternatives against the planning criteria; summarizes the alternatives comparisons and major findings; and suggests how this report may be used as a resource in the future.

Chapter 7 lists sources used to compile this report.

Chapter 8 acknowledges the Study Team and other organizations and individuals who contributed to the Study process.

Study Authorization and Guidance

Congress provided Federal authorization for the Study in Public Law 111-8, 123 Statute 609, enacted in March 2009. This act authorized Reclamation to perform the Study and a risk analysis of the Truckee Canal, as follows:

> *Lahontan Basin Project, Nevada – Within the funds provided, $2,500,000 is to perform an exploration/risk analysis of the Canal, which breached in January 2008 flooding Fernley, Nevada. The analysis will determine the full extent of rehabilitation needed for the canal to resume flows above 350 cubic feet per second.*

As the authorization requires, Reclamation has already conducted a number of studies to determine the extent of the risk associated with operating the Truckee Canal, and to investigate possibilities to rehabilitate the structure or take other corrective actions to reduce this risk at a range of different canal capacities, including 600 cubic feet per second (cfs), 350 cfs, 250 cfs, and 0 cfs. This Study is a companion effort to that work and will use the range of canal rehabilitation options Reclamation has already identified as building blocks for formulating Study alternatives to achieve a desired level of reliability for the Newlands Project. A review of the engineering studies Reclamation has already conducted appears in this chapter, and a discussion of how the related information and conclusions fit into this Study's planning process appears in Chapter 2, "Plan Formulation Process," and Chapter 4, "Measures and Preliminary Alternatives."

In contrast to some Federal planning studies, the intent of this Study is not necessarily to culminate in actions by the Federal government. The future of the Truckee Canal is of interest to a diverse set of agencies and stakeholders, and

the alternatives formulated and evaluated in the Study may include elements that could call for participation by a broad range of partners.

Other guidance for the Study's alternatives formulation process includes the *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies* (P&G) (WRC 1983). Although the P&G provide a valuable framework for development, evaluation, and comparison of alternatives that are feasible for Federal action, strict adherence may preclude the consideration of actions that are not federally feasible but are otherwise feasible and preferable for local or regional actions; thus, the P&G is used as general planning guidance only, and strict adherence is not appropriate for this type of study.

Study Area

The primary study area for this investigation consists of the Newlands Project boundaries, Truckee-Carson Irrigation District (TCID) service area in the Newlands Project, Churchill County, the City of Fernley in northern Lyon County, the Fallon Paiute-Shoshone Indian Reservation, the Stillwater National Wildlife Refuge (NWR), and the Carson Lake and Pasture, as shown in Figure 1-1. Most of the primary study area is in Churchill County, Nevada, among Lahontan Reservoir, Stillwater NWR, and Carson Lake and Pasture. The remaining portion of the primary study area is in Lyon, Washoe, and Storey counties around the Truckee River below Derby Dam, and surrounding Fernley, the Truckee Canal, and Lahontan Reservoir. A portion of the Truckee Canal near Wadsworth crosses the southernmost portion of the Pyramid Lake Indian Reservation.

Although the primary study area encompasses the lands and facilities of the Newlands Project, some alternatives may involve lands, users, and political entities outside the primary study area boundaries. Thus, the extended study area is considered to encompass the broader Carson River watershed, Truckee River watershed, and Dixie Valley. These areas encompass Lake Tahoe, Pyramid Lake, a number of cities and communities, as well as the majority of the Pyramid Lake Indian Reservation. For the sake of brevity, this report occasionally uses the general term "study area(s)" in titles and headings to broadly refer to both study areas.

These geographic areas are described in greater detail in Chapter 3, "Study Area Conditions."

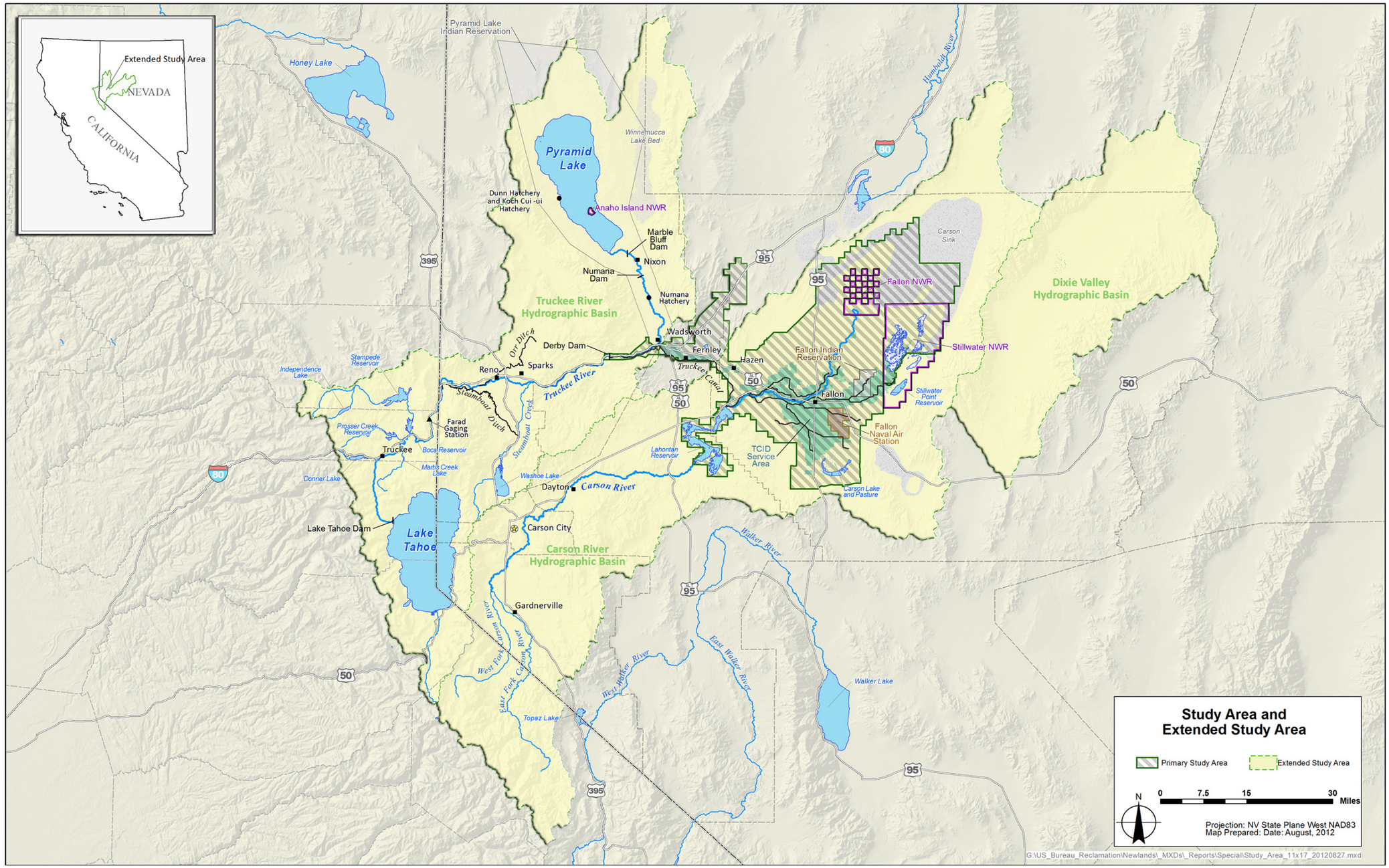

Figure 1-1. Study Areas for the Newlands Project Planning Study

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Background

The Newlands Project is one of Reclamation's first irrigation projects and nearly as old as the agency itself. Reclamation began the Project in 1903 to provide irrigation water to the Lahontan Valley, near Fallon, Nevada, and to lands in the Truckee Basin near Fernley, Nevada. These areas of the Project are known as the Carson Division and Truckee Division, respectively.

The Newlands Project covers lands in the west-central Nevada counties of Churchill, Lyon, Storey, and Washoe. Currently, Project facilities consist of two reservoirs (Lake Tahoe and Lahontan), three storage dams (Tahoe, Lahontan, and Sheckler), two diversion dams (Derby and Carson), one hydroelectric power plant, and hundreds of miles of canals and laterals, along with numerous checks and other hydraulic features throughout. Reclamation owns the principal Project facilities, but two additional power-generation structures were financed locally and are owned by the Project's local operator, TCID.

Project water comes from the Carson River and also from the Truckee River. The Carson Division is served by both rivers, while the Truckee Division is entirely served by the Truckee River. Lahontan Dam collects inflow from the Carson River to be used by the Carson Division. Derby Dam, located on the Truckee River approximately 20 miles downstream from Reno, diverts water into the Truckee Canal to serve the Truckee Division. If the projected supply at Lahontan Reservoir is unlikely to meet the needs of water rights holders in the Carson Division, the Truckee Canal also delivers water to the reservoir for use by the Carson Division. The Carson River and Truckee River terminate in the Carson Sink and Pyramid Lake, respectively.

Uses of Project Water

Currently, the Project delivers water to about 57,000 acres of actively irrigated agricultural land – 2,000 acres and 55,000 in the Truckee and Carson divisions, respectively – with alfalfa as the region's primary crop. Average annual rainfall in the area is approximately 5 inches, which is considerably less than the average annual evaporation of 4 feet, and local farmers rely heavily on Project water for irrigation.

In addition to irrigation, the Project serves water rights for wetlands at the Stillwater NWR, Carson Lake and Pasture, and the Fallon Paiute-Shoshone Indian Reservation. Drainage from Project canals also serves as a source of water for wetlands, and in years with wet hydrological conditions, excess flows spilled or released from Lahontan Dam reach Stillwater NWR and Carson Lake and Pasture. The Project is also authorized for municipal and industrial (M&I) use, although has not yet delivered for this purpose. The Project only supplies surface water, although agriculture and Project operations support incidental groundwater recharge in the basins.

While hydropower generation is not a consumptive use of Project water, it is an important component of operations and supports the Project financially, contributing around one-third of TCID's operating revenue (Reclamation 2005). TCID has built transmission lines to convey power generated by facilities at Lahontan Dam to the communities of Fallon, Fernley, Wadsworth, Hazen, and Stillwater; the Fallon Reservation and Colony; and most of the less-populated areas of the Project (Reclamation 2011f). However, these customers are served by Sierra Pacific Power Company (now known as NV Energy), with whom TCID has a long-term lease for power distribution (NV Energy 1999). TCID also has a second lease with Utah Associated Municipal Power Systems (UAMPS) for power produced at the 26-Foot Drop Powerplant. UAMPS is responsible for integrating electrical resources for the City of Fernley. The lease term initially began in 2005 and extends through 2014.

Operations

In 1926, Reclamation contractually turned the Project over to TCID for operations and maintenance (O&M). Members in the district own their water rights individually, which is one of the Newlands Project's distinguishing characteristics relative to other Reclamation projects in the West.

The original contract between Reclamation and TCID was terminated in 1984. Temporary contracts were used until 1996, when a new contract was signed. Under the contract with Reclamation, TCID management has the fiduciary responsibility to operate and maintain the Newlands Project's facilities without cost to the Federal government. O&M fees and assessments charged to water users are the source of revenue to cover the district's expected expenses and to maintain reserves for contingencies.

Use of the Term "Flow Stage" in this Report: The capacity restrictions placed on the Truckee Canal are often expressed in terms of a flow rate (e.g., 350 cubic feet per second, or cfs). These capacity restrictions, however, are actually based on the assumed water surface elevation, or stage, in the canal at a given flow rate. Changing conditions in the canal, such as growth of the invasive aquatic weed milfoil, will change the flow-stage relationship such that lower flows are possible at the previously specified stage restrictions. However, the stage restrictions identified will not be altered to allow for the flow rates that were previously possible without milfoil. For clarity and accuracy, this report uses the term "flow stage" in conjunction with the expression of cfs to emphasize that the flow rate restrictions being discussed for the Truckee Canal are also based on the elevation of the water in the canal. Further information about flow stages is found in Appendix A, "Flow-Stage Relationships for the Truckee Canal."

Several regulatory requirements and agreements also affect operation of the Newlands Project, including the Truckee River Agreement, *Orr Ditch* Decree, *Alpine* Decree, Operating Criteria and Procedures for the Newlands Project (OCAP), and water rights settlement acts. Many of these and their implications

will be described in greater detail later in this chapter and elsewhere in this Special Report.

Truckee Canal Breach

In the early morning of January 5, 2008, a 50-foot portion of the Truckee Canal embankment failed about 12 miles downstream from Derby Dam, releasing water that inundated a residential development in the City of Fernley, flooding 590 properties. No fatalities occurred, but more than $1 billion in tort claims were filed against the Federal government, local governments, and TCID, and have now been consolidated into class-action lawsuits.

As a result of the incident, Reclamation and TCID temporarily halted canal operations. Inspections revealed numerous stability issues, such as rodent burrows, vegetation, and other problems, along many areas of the canal embankment. Based on these findings and concerns about the canal's immediate and long-term structural integrity, water elevations within the canal are currently restricted to elevations corresponding to unchecked flows (flow stages) of 350cfs (see sidebar). This is significantly less than the canal's more recent maximum operating capacity of 900 cfs, and may result in Carson Division water rights holders experiencing increasing shortages in service of their water rights.

Related Studies and Programs in the Study Area

This section of the Special Report provides context for the Study and identifies previously developed information that provided inputs to the planning process. Given the Newlands Project's long history in the Federal Reclamation program and the decades of intense conflict surrounding management of northern Nevada's rivers and lakes, a multitude of entities are now involved in studying or managing resources in the study area. Additionally, legal arrangements, negotiated settlements, and other documents also shape the Project's current form and function.

Projects and Programs

Numerous activities of various Federal, State, and local agencies and organizations in the study area are pertinent or related to the Newlands Project and this Study. Such projects and programs are listed alphabetically and described below. Parenthetical notes identify the lead and/or supporting agencies or organizations for each.

Carson Lake and Pasture (NDOW, Reclamation)

Since the 1990s, the Nevada Department of Wildlife (NDOW) has purchased Newlands Project water rights for delivery to Carson Lake and Pasture – approximately 10,800 acres of wetlands that Reclamation is in the process of transferring to NDOW. NDOW holds water rights for the property and manages

it cooperatively with Greenhead Hunting Club through TCID's Carson Lake Pasture Advisory Committee (Lahontan Audubon Society 2001).

Donner Lake (TMWA, TCID)

Truckee Meadows Water Authority (TMWA), the municipal water provider in the Reno-Sparks area, and TCID jointly hold rights for up to 9,500 acre-feet of water stored at Donner Lake (Reclamation 2011f).

Conveying this water for Project use through Federal facilities, such as the Truckee Canal, requires TCID to obtain a Warren Act contract with Reclamation. Under certain conditions, Public Law 101-618 authorizes the use of private water, such as from Donner Lake, to supply Lahontan Valley wetlands without a Warren Act contract. However, this would likely require an agreement among Reclamation, TCID, and U.S. Fish and Wildlife Service (USFWS); deliveries through the Truckee Canal would still be subject to OCAP limits; and USFWS would need to obtain some manner of ownership or control of the water for wetlands use, and would also need to assume costs of delivery.

NAS Fallon (U.S. Navy)

The U.S. Department of Defense (DOD) maintains a large presence throughout Nevada; the Navy is one of the largest employers within the study area and also benefits from Newlands Project water.

Naval Air Station (NAS) Fallon is located within the boundaries of the Newlands Project southeast of Fallon, north of Carson Lake and Pasture. It began as an Army Air Corps airstrip established in the early days of World War II to launch missions against Japan if a strike against the West Coast occurred. It now serves as a comprehensive tactical warfare training center (CNIC 2011). NAS Fallon holds Newlands Project water rights that are used to irrigate crops in an agricultural buffer zone surrounding the facility and also to benefit Lahontan Valley wetlands.

Newlands Project (Reclamation, TCID)

The Newlands Project provides water for irrigation in the Lahontan Valley in northwest Nevada. Construction began in 1903 for the Truckee Canal and Derby Dam, some of the primary water supply features of the Newlands Project. Other facilities built as part of the Newlands Project include Lahontan Dam, Lahontan Powerplant, Carson Diversion Dam and canals, laterals, and drains for irrigation deliveries to around 55,000 acres annually (see Appendix C, "Projected Future Water Rights and Demands for the Newlands Project"). Lake Tahoe Dam, which controls releases from the lake into the Truckee River, is also considered a facility of the Newlands Project.

Since January 1, 1927, TCID has operated and maintained the Newlands Project under contract with Reclamation.

The Newlands Project contains two divisions:

- Truckee Division lands are primarily in and around Fernley, Nevada, a growing city in Lyon County about 30 miles east of Reno. The division also includes the Hazen and Swingle Bench areas in Churchill County. The Truckee Division contains less than 5 percent of the Project's total acreage, and is supplied exclusively by water diverted at Derby Dam from the Truckee River into the Truckee Canal.

- The Carson Division contains the bulk of Project lands, in and around the City of Fallon, Nevada, about 65 miles east of Reno. Water users of the Carson Division include farmers, the Fallon Paiute-Shoshone Tribe, the Stillwater NWR, and other wetlands. Irrigation water for the division is released from Lahontan Reservoir, located on the Carson River and at the terminus of the Truckee Canal.

Although the Newlands Project's reliance on Truckee River supplies has declined with the enactment of several operational requirements and implementation of various efficiency measures, the Truckee Canal continues to play a significant role in supplying Project water. The Truckee Division receives 100 percent of its water supplies from the Truckee Canal. Before the 2008 Truckee Canal breach, the Carson Division received a long-term average of 25 percent of its water supplies from the Truckee Canal; however, in some of the driest years, the Carson Division received as much as 75 percent of its supplies from Truckee River diversions.

Newlands Project Water Rights Retirement Programs (CWSD, GBLW)

Two programs have been established to resolve administrative and judicial disputes brought by the Pyramid Lake Paiute Tribe involving 9,429 water-righted acres in the Newlands Project by acquiring and permanently retiring water rights associated with 6,500 Project acres.

- **AB 380 Program (CWSD)** – From 2000 to 2006, the Carson Water Subconservancy District (CWSD) administered the first Newlands Project Water Rights Retirement Fund and purchasing program established by passage of Nevada's Assembly Bill (AB) 380 in 1998. The program was successful in purchasing and retiring 4,623.54 acres and their appurtenant water rights in the Truckee and Carson divisions from willing sellers (CWSD 2001, Reclamation 2010). The purchases were funded by Reclamation ($6.087 million), State of Nevada ($3.3 million), Truckee Meadows Water Authority and Sierra Pacific Power Company ($3.44 million), and Carson-Truckee Water Conservation District ($100,000) (Reclamation 2010). Although the AB 380 program expired on June 30, 2006, its goals continue through the Water Rights Compensation Program.

- **Water Rights Compensation Program (GBLW)** – Once the AB 380 program expired, Congress established a new Newlands Project Water Rights Fund to acquire the remaining water rights necessary to meet the 6,500-acre retirement target. Reclamation, the Pyramid Lake Paiute Tribe, and the State of Nevada are the three parties to the program and fund, which are administered by Great Basin Land and Water (GBLW). Congress has directed Reclamation to contribute $10 million to a fund supporting this program and Newlands Project water rights retirement programs in the future (Reclamation 2010). As of June 2012, 66 acres have been acquired by the program.

Stillwater NWR (USFWS)

Northeast of Fallon in the Lahontan Valley, USFWS manages 77,000 acres of land as Stillwater NWR. The refuge was established in 1949 and is part of the Stillwater NWR Complex. USFWS manages the wetlands to approximate the area's natural biological diversity to benefit breeding and migrating waterfowl, shorebirds, and other water birds and wintering waterfowl (USFWS 2002). Currently, USFWS is the single largest user of Newlands Project water, for the purposes of managing the refuge's wetlands.

Truckee Storage Project (Reclamation, WCWCD)

The Truckee Storage Project includes Boca Dam and Reservoir, located near the mouth of the Little Truckee River downstream from Stampede Dam in California. The project was constructed in 1939 and has the capacity to store up to 40,850 acre-feet. It provides a supplemental water source for approximately 29,000 acres of farmland in the Truckee Meadows area surrounding Reno and Sparks, Nevada. Boca Reservoir is operated in conjunction with Lake Tahoe Dam to regulate Truckee River flows to meet the needs of downstream users of Truckee River water, such as Truckee Meadows users (including Reno-Sparks and irrigators), the Newlands Project, and the Pyramid Lake Indian Reservation. The Washoe County Water Conservation District (WCWCD) operates and maintains Boca Dam under contract with Reclamation (Reclamation 2011g).

Washoe Project (Reclamation, USFWS)

The Washoe Project, authorized in 1956, includes Stampede Dam, Reservoir, and Power Plant on the Little Truckee River; Prosser Creek Dam and Reservoir; Marble Bluff Dam; and Pyramid Lake Fishway. Stampede and Prosser Creek dams conserve runoff and regulate flow into the Truckee River. The project is used for flood protection, fish and wildlife benefits, M&I purposes, and recreation. (Reclamation 2011h). All of the project's facilities are located in California and are operated by Reclamation, except for Pyramid Lake Fishway and Marble Bluff Dam, which are located on the Truckee River in Nevada and operated by USFWS. Since 1983, Stampede Reservoir has also been dedicated to storing water for the benefit of fisheries along the Truckee River and at Pyramid Lake (Reclamation 2011h). Since 1994, TMWA has had the opportunity to store water in Stampede Reservoir through an interim storage contract with Reclamation for up to 14,000 acre-feet. OCAP contains a

provision that allows for storing Newlands Project Credit Water in Stampede Reservoir under certain conditions.

Original plans for the project included additional facilities, including Watasheamu Dam and Reservoir on the east fork of the upper Carson River, to develop and deliver supplemental water to irrigators for nearly 44,000 acres above Lahontan Dam (Reclamation 1991). The *Fallon Paiute Shoshone Tribal Settlement Act of 1990* and *Truckee-Carson-Pyramid Lake Water Rights Settlement Act of 1990* (Public Law 101-618) revoked the authorization to construct these facilities (Reclamation 2011h).

Water Rights Acquisition Program for Lahontan Valley Wetlands (USFWS, BIA, State of Nevada)

USFWS conducts a water rights acquisition program for the Stillwater NWR and other designated Lahontan Valley wetland areas. The program was initiated with the passage of Public Law 101-618. Specifically, Subsection 206(a) of Public Law 101-618 directs the Secretary of the Interior to acquire enough water and water rights, in conjunction with the State of Nevada and other parties, to sustain a long-term average of 25,000 acres of primary wetland habitat in the Lahontan Valley at Stillwater NWR, Carson Lake and Pasture, and the Fallon Paiute-Shoshone Indian Reservation wetlands (USFWS 1996a).

The goal of the program is to acquire enough water to provide the wetlands with approximately 125,000 acre-feet annually – the estimated amount needed to support 25,000 acres of wetland habitat – by using irrigation drain water and releases from Lahontan Reservoir, acquiring 75,000 acre-feet of Carson Division water rights, acquiring middle Carson River water rights, leasing Carson Division water rights, obtaining water conserved at NAS Fallon, and pumping groundwater (USFWS 1996a). The program is a "willing-seller" purchasing program; water-righted land is only purchased from sellers who approach USFWS to initiate a sale.

As of December 2012, more than 43,200 acre-feet of water rights in the Carson Division had been acquired for Lahontan Valley wetlands, including 32,500 acre-feet by USFWS, 8,900 acre-feet by the State of Nevada and the Nevada Waterfowl Association, and 1,800 acre-feet by the U.S. Department of the Interior, Bureau of Indian Affairs (BIA). In addition, USFWS receives about 3,700 acre-feet of treated effluent from NAS Fallon, Churchill County and the City of Fallon (Richard Grimes, USFWS, personal communication, December 21, 2012).

Water Rights Conservation Program/Water Quality Settlement Agreement (GBLW, Reno, Sparks, Washoe County)

The Truckee River Water Quality Settlement Agreement (WQSA) signed in 1996 by Reno, Sparks, Washoe County, U.S. Department of the Interior, U.S. Department of Justice, U.S. Environmental Protection Agency, Nevada Department of Conservation and Natural Resources, and the Pyramid Lake

Paiute Tribe established a Truckee River water rights purchasing program and fund administered by GBLW (Reclamation et al. 2008).

Under the program, GBLW, on behalf of the Pyramid Lake Paiute Tribe, has purchased about 4,400 acre-feet of water rights from the Truckee River and in the Truckee Division of the Newlands Project (GBLW 2011). These purchased rights remain as Truckee River flows to improve the quantity and quality of water at Pyramid Lake. Congress has directed Reclamation to contribute $10 million to a fund supporting this program and Newlands Project water rights retirement programs in the future (Reclamation 2010).

Previous Studies and Reports

Among the sources the Study used to inform the planning process are many Federal documents and local reports, all described and summarized below. This list is not exhaustive, and the set of additional documents consulted in detail appear in Chapter 7, "References." The information is organized alphabetically by agency name, and the year each report or Study was produced is shown in parentheses.

Churchill County

In recognition of community growth and the changing nature of the availability of Newlands Project water, Churchill County has been investigating a range of options that might be available to meet the community's demand for water in future years.

Churchill County Water Resources Plan (2003) This plan investigated sources to meet community needs through 2025 and 2050 (Churchill County 2003). Those sources include local groundwater resources in Lahontan Valley and groundwater in nearby Dixie Valley. For each of the sources identified, the plan described the type of treatment required to make the water suitable for use by the community, as well as any associated costs. Capital costs ranged from $120.09 million (Historic Lahontan Valley Groundwater) to $236.07 million (Recharge, Storage, and Recovery); annual O&M costs ranged from $10.84 million (Lahontan Reservoir) to $15.57 million (Recharge, Storage, and Recovery).

The county circulated the draft plan among dozens of public agencies and groups for review, and these reviewers rated the above alternatives as follows from "most favorable" to "least favorable": Dixie Valley; Lahontan Reservoir; Recharge, Storage, and Recovery; Conjunctive Use; Induction Wells; and Historical Lahontan Valley Groundwater. Ultimately, the plan recommended continuing to use historical groundwater; obtaining additional supplies through water rights required for new municipal development; and continuing to investigate the feasibility of the alternatives above (Churchill County 2000).

City of Fernley

The City of Fernley has grown through the transition of agricultural lands into residential developments. With these transitions, the underlying water rights have been dedicated to the City of Fernley, which manages the rights for service to the development. The City currently does not receive surface water deliveries from the Truckee Canal, but relies on pumping and treating local groundwater supplies that are dependent on incidental seepage from the Truckee Canal. The City has only recently exercised its surface water rights by leasing them to the Pyramid Lake Paiute Tribe to remain as instream Truckee River flows, but has not exercised them for direct use within Fernley. Under a 2009 settlement agreement among the City of Fernley, the Pyramid Lake Paiute Tribe, U.S. Department of Justice, and Reclamation, Fernley would need to satisfy a number of permitting and other requirements to exercise its surface water rights using Federal facilities such as the Truckee Canal.

During the late 1990s and early 2000s, Fernley experienced a period of rapid urban growth, but this growth rate has since receded to pre-1990 levels. Responding to that period of growth, and the following recession, has created several infrastructure planning and financing challenges for the City. The City is revisiting long-term growth projections and related water infrastructure plans.

Water Master Plan (2008) In 2006, the City of Fernley served approximately 7,000 customers and was experiencing maximum demands of approximately 10 million gallons per day (mgd); the city anticipates a need for 30 mgd of water treatment capacity by 2025 (City of Fernley 2008a). The plan noted that, while the water supply infrastructure was in fair condition, production and storage capacity were challenged in meeting peak daily demands. The plan proposed $64 million in capital improvements, nearly half of which would develop additional groundwater pumping capacity, and a third of which would be used to upgrade the existing treatment plant to accept surface water supplies.

Reclamation

As the owner of the Newlands Project, Reclamation has studied the Project's operations and facilities extensively. A number of recent reports also focus on problems with the Truckee Canal and how to address the public safety risks it poses.

Newlands Project Efficiency Study (1994) At the direction of Public Law 101-618, Reclamation undertook a study to investigate the feasibility of improving the Newlands Project's conveyance efficiency to an average level of 75 percent or greater by 2002.

Reclamation evaluated current and potential performance and reported on various groups of measures, including efficiency measures (metering, canal lining, reservoir diking, reuse, land acquisition, and automation), diversion reductions (land retirement, recoupment, other users on the Truckee and Carson rivers), and measures identified or pursued by other programs (USFWS Water

Conservation Plan and Water Rights Acquisition Program, and measures suggested by the 1988 OCAP). The study also addressed the likely effects of efficiency measures on local groundwater conditions and wetlands in the Carson River Basin.

Following the independent discussion and review of each individual measure, the most cost-effective measures were assembled into two alternatives: a least-cost alternative (estimated cost of $63 million in 1994 dollars) and a structural alternative (estimated cost of $127 million in 1994 dollars). Both alternatives achieved 75 percent Project efficiency. Funding for the two alternatives was identified as a challenge, and neither alternative was implemented.

In addition to authorizing the *Newlands Project Efficiency Study* (Reclamation 1994), Public Law 101-618 included central elements intended to promote enhancement and recovery of endangered and threatened fish species at Pyramid Lake; protect the health of wetlands in the Lahontan Valley; encourage solutions for competition over Truckee River water; enact settlements for the Fallon Paiute-Shoshone and Pyramid Lake Paiute Tribe over water-related issues; and settle California-Nevada interstate water apportionment.

Newlands Project Economic Viability Study (2005) Increasing urbanization and demand for water for environmental uses have resulted in a decrease in agricultural land uses within the Newlands Project. The changes in land and water use impact TCID's operations and the water supply available to support agriculture and hydropower production. As more land and water are converted to nonagricultural uses, there is concern that the revenue required to maintain service to the land remaining in production will exceed the ability to pay for some farm types and diminish the ability of TCID to meet O&M maintenance obligations. To address these concerns, Reclamation completed an economic/financial analysis to assess the viability of the Newlands Project under a variety of water supply and water transfer scenarios (Reclamation 2005). The analysis applied three economic models to determine district viability and a fourth model to estimate regional effects from changes in land and water use:

- **Agricultural Production Model** – A representative farm-based optimization model was developed to estimate changes in farm-level payment capacity with changes in agricultural water supplies. The representative farms were selected to represent the variety of farm types within the Newlands Project. Noncommercial agriculture ("hobby farms") was excluded from consideration in the model.

- **Hydropower Production Model** – Changes in water supply under the scenarios were used to estimate changes in hydropower production and revenues at district-owned facilities.

- **District Financial Model** – TCID financial statements were used to develop a financial model to determine ability to pay at the district level. Ability to pay was defined as the financial capability of the district to meet Reclamation repayment obligations. Output from the Agricultural Production Model and Hydropower Production Model provided key inputs to the financial model.

The study considered nine scenarios with varying assumptions regarding water supply reliability and volume of water transfers from agriculture to alternative uses. Estimated district-level ability to pay ranged from minus (-) $4.6 million to $2.5 million annually. The two "combination" alternatives that considered both changes in water supply reliability and water transfers to alternative uses estimated district-level ability to pay between $657,000 and $892,000 annually.

Special Technical Embankment Examination (2008) Following the breach of the Truckee Canal in 2008, the canal was taken out of operation and Reclamation initiated several studies, including: a detailed inspection of the canal to describe its condition (Special Technical Embankment Examination, Reclamation 2008a), an independent forensic review of the factors likely leading to the breach (Investigative Evaluation Report, Reclamation 2008b), and a risk assessment (*Truckee Canal Issue Evaluation Report of Findings: Final Risk Assessment* (2008 Final Risk Assessment), Reclamation 2008c).

The findings of the embankment examination were released in January 2008 and reported evidence of high rodent activity as well as a large number of trees and other woody vegetation growing on or near the canal embankment. Both rodent activities and vegetation can promote seepage paths through the embankment. While the investigation did not identify specific locations where obvious and immediate failures would occur if canal operations were allowed to resume, the quantity of issues that posed a potential for future failure was described as "high," and Reclamation recommended that flows in the canal be restricted until a prioritized list of repairs could be made and implemented.

Truckee Canal Failure on 5 January 2008: Investigative Evaluation Report (2008) The Investigative Evaluation Report summarized the findings of the independent forensic examination of the factors most likely leading to the canal breach (Reclamation 2008b). The report included geological surveys, assessments of historical performance, interviews with TCID and Reclamation staff, hydrologic analyses, and descriptions of a range of potential failure modes (such as failure caused by internal erosive forces, seismicity, and sabotage).

The Investigative Evaluation Report concluded that the most likely cause was piping triggered by the combination of high ramping rates and water flow on January 4 and January 5, and the presence of animal burrows that provided seepage paths through the embankment; together, these conditions promoted embankment erosion that resulted in a breach.

Truckee Canal Issue Evaluation Report of Findings: Final Risk Assessment (2008) The Reclamation risk analysis considered the likelihood of another canal breach at various flow levels. The 2008 Final Risk Assessment (Reclamation 2008c) describes several actions for resuming flows in the Truckee Canal and for assessing the short- and long-term actions needed (including repairs and changes to O&M procedures) to allow the canal to safely resume operations. Operations were considered at a variety of flow levels between zero and full reinstatement of the canal.

The assessment's main conclusions included:

- Recommendation for restricting flow in the urbanized portions of the Truckee Canal (near Fernley) to elevations that correspond to a flow-stage of 150 cfs. The report also provided several recommendations for structural and operational fixes that would be needed to increase canal flows to 150 cfs, including installation of a temporary lining along the bottom and north bank of the canal, through urbanized portions of the canal.

- Recommendation for further study of the risks posed by various flow levels for describing the long-term requirements for resuming flows through the entire length of the canal.

Truckee Canal Issue Evaluation: Design, Cost Estimating, and Construction Review (2008) Reclamation conducted a Design, Estimating and Construction Review (DEC Review), which included a review of recent reports, findings, and recommendations as well as a field investigation by senior Reclamation staff (Reclamation 2008d).

The DEC Review broadly agreed with most of the findings and recommendations made in the previous Reclamation reports. However, the review suggested that a flow restriction of 150 cfs was overly conservative for short-term operations and that short-term requirements for bringing the canal into service should be limited to operational limitations on flow, response planning, increased monitoring, and other procedural measures. The DEC Review suggested that limiting interim (1 to 5 years) canal flows to a flow-stage of 350 cfs should provide appropriate short-term operational constraints for risk reduction on the Truckee Canal, commensurate with the identified risk for canal failure.

At the recommendation of the DEC Review, Reclamation's Regional Engineer set short-term flow restrictions through the urbanized portions of the canal to elevations corresponding to an unchecked flow of 350 cfs.

Truckee Canal Permanent Repair Special Study (2009) At the recommendation of the 2008 Final Risk Assessment and DEC Review, Reclamation developed cost estimates for a range of permanent repair

alternatives for the Truckee Canal (Reclamation 2009b). These evaluations, which were funded by the passage of Public Law 111-8, were structured around three different canal capacities or operations. Each evaluation reported on expectations for total cost (including field, design, contingency and indirect costs):

- Estimating the costs to restore Truckee Canal flows within the City of Fernley (Fernley Reach) to safely convey a flow stage of 500 cfs. The estimated cost was $65.5 million.

- Estimating the costs to restore Truckee Canal flows to safely convey a flow stage of 500 cfs for the entire length of the canal. The estimated cost was $89.6 million.

Separate estimates of water supply reliability were assembled for each proposal considered under a third investigation described below.

- Evaluating additional ways of delivering water to the Carson Division without using the Truckee Canal or water from the Truckee River. The following measures were considered in combination with abandoning the Truckee Canal:

  – Raise Lahontan Dam to capture additional inflow from the Carson River. The estimated cost was $155 million. Increased storage at Lahontan Reservoir was found to be incapable of replacing water supply reliability from the Truckee Canal, and this alternative would need to be combined with other measures to be successful. It was noted that this program would reduce incidental spills, which currently benefit the Stillwater NWR.

  – Install a groundwater pumping system and conveyance piping. The estimated cost was $200 million. The study noted that the most optimistic estimates for water supply available from Dixie Valley groundwater imports were less than half of the volume required to replace the water supply reliability of the Truckee Canal, and this alternative would need to be combined with other measures to be successful.

  – Improve the efficiency of the Carson Division canal system. The estimated cost was between $45.2 and $128 million. The study noted that the benefits of increasing efficiency would not replace the water supply reliability of the Truckee Canal, and this alternative would need to be combined with other measures to be successful.

  – Retire water rights from the Carson Division to decrease the irrigation needs to existing supply from Lahontan Reservoir. The

estimated cost for this was $100 million. The study noted that this alternative would require retiring over 40 percent of the current irrigated lands in the Newlands Project, and that the feasibility of retiring that much land was questionable.

– Implement water conservation improvements in the Carson Division to decrease the irrigation needs to existing supply from Lahontan Reservoir. No costs were developed for this proposal because the estimated water supply reliability for the alternative, compared with other alternatives, was judged to be insufficient.

Truckee Canal Issue Evaluation Report of Findings (2011) At the recommendation of the 2008 Final Risk Assessment and DEC Review, Reclamation developed a series of updated risk assessments for the three reaches of the Truckee Canal (Derby, Fernley, and Lahontan reaches) at water surface elevations corresponding to canal flows of 250, 350, and 600 cfs. The findings of these evaluations (Reclamation 2011a, b, c) are summarized in the April 2011 document, *Truckee Canal Issue Evaluation Report of Findings: Summary of Final Baseline Risk Estimates and Evaluation of Risk Reduction for Proposed Corrective Action Alternatives* (2011 Report of Findings) (Reclamation 2011d).

The 2011 Report of Findings summarized baseline risks for operating the Truckee Canal, and identified measures for reducing various risks to an acceptable level. Risks to the canal were categorized by failure mode (the general descriptors for the manner in which canal failures occur). The report described alternatives for responding to the following failure modes: static internal erosion failures, ice and debris jam failures, hydrologic overtopping failures, liquefaction failures, and seismic failures.

Three potential designs were described for reducing the risk of internal erosion failure: a low-density polyethylene geomembrane/concrete lining within the canal prism, a cement-bentonite cutoff wall within the canal embankment, or a high-density polyethylene cutoff wall within the canal embankment. The report noted that the required extent of internal erosion protection depended upon the desired level of risk, but could include modifications of the entire 12 miles of the Fernley Reach, 4 miles in the Lahontan Reach and 2 miles in the Derby Reach.

Designs for reducing the risk of ice and debris jam failures, and hydrologic overtopping failures included cross drainage structures in the Derby Reach, new check structures and wasteways in the Fernley Reach, adding a new check structure at the beginning of the Fernley Reach, and raising the canal banks in the Lahontan Reach.

Only one 200-foot section of the Truckee Canal, in the Lahontan Reach near turnout TC-12, was found to require excavation and recompaction to reduce the risk of liquefaction failure.

The report evaluated seismic risks at 10,000- and 1,000-year return frequencies and concluded that structural alternatives to reduce seismicity risks were not likely to be economically feasible; however, prudent actions, such as the construction of wasteways and check structures at strategic locations to divert or control flows upstream from a seismic breach, could mitigate the risk and would likely save lives in the event of an earthquake. The report noted that actions considered for internal erosion failures would also reduce risks for more frequent (1,000-year) seismic risks.

Corrective Action Study Alternatives and Appraisal Level Cost Estimates (2011) Parallel with the development of the 2011 Report of Findings, Reclamation formulated specific alternatives for mitigating the risks of operating the Truckee Canal (Reclamation 2011e). Designs were assembled for a matrix of options defined by three categories of functionality: canal section, reach capacity, and risk reduction achieved. Canal sections included the Derby, Fernley, and Lahontan reaches. Reach capacities included water surface elevations corresponding to canal flows of 250, 350, and 600 cfs, respectively. Risk reduction achieved was categorized by three risk rating (RR) levels:

- **Risk Rating 1 (RR1)** – "Long-Term Risk Reduction Likely Appropriate" or higher. Reducing this level of risk addresses problems judged to have the highest likelihood of causing the canal embankment to fail, or which would present the greatest hazard to life and property should failure occur. Addressing problems at RR1 is a part of reducing risk at all risk levels.

- **Risk Rating 2 (RR2)** – "Long-Term Risk Reduction Action May Be Appropriate" and higher (includes RR1). Reducing this level of risk includes actions to reduce risk at RR1 and, additionally, addresses problems judged to have a slightly lower likelihood of causing the canal embankment to fail.

- **Risk Rating 3 (RR3)** – "Long-Term Action May Be Necessary to Maintain Agency Credibility" and higher (includes RR2). Reducing this level of risk includes actions to reduce risk at RR2 and, additionally, addresses problems that have a very high likelihood of causing the canal embankment to fail, but would result in the lower-hazard consequences.

To estimate costs, the study focused on implementing the structural alternatives proposed by the 2011 Report of Findings. Total estimated costs vary by the options selected, but range between $30 million and $50 million. Decommissioning the Truckee Canal was estimated to cost approximately $10

million. These cost estimates were developed for construction only; none include costs related to environmental permitting or mitigation.

USFWS

As the single largest user of Newlands Project water, USFWS functions as both a Project landowner and as a steward of the Lahontan Valley wetlands.

Stillwater NWR Complex Comprehensive Conservation Plan and Boundary Revision (2002) USFWS is implementing a comprehensive conservation plan (CCP) for the Stillwater NWR Complex, which includes the Stillwater NWR, Fallon NWR, and Anaho Island NWR (USFWS 2002). The plan provides a 15-year strategy for managing wildlife, habitat, and public uses at the Stillwater NWR under the direction established by Public Law101-618 and for managing the increased volume of water to be acquired from the Carson Division and delivered to the refuge under the Lahontan Valley Wetlands Water Rights Acquisition Program.

The CCP outlines habitat objectives that focus on providing a range of habitat conditions in the marshes, with an emphasis on breeding habitat, as well as restoring and protecting riparian, wet meadow, and sensitive upland areas such as the dunes. Water management goals are intended to mimic the natural seasonal pattern of inflow to minimize nest flooding to provide fall and winter habitat for waterfowl and waterfowl hunting.

In addition to maintaining hunting as an integral part of the visitor services program, the CCP provides for enhanced opportunities for a balance of wildlife-dependent public uses such as environmental education and interpretation, and wildlife observation and photography. The CCP also increased the cultural resources management program at the Stillwater NWR Complex.

Banking on Nature (2007) USFWS estimated the economic benefit provided by national wildlife refuges to local communities (USFWS 2007a). The analysis does not specifically address the economic benefits associated with the Stillwater NWR. However, the economic benefits generated by refuges lend support to public expenditures incurred to maintain refuges and enhance their functionality, such as the Water Rights Acquisition Program that purchases water rights from agricultural users in the Carson Division to improve wetland habitat at the Stillwater NWR.

The study's analysis focused on the benefits derived from visits to wildlife refuges and the increased expenditures within the local communities associated with the visits. The two primary data sources for the analysis included the *National Survey of Fishing, Hunting, and Wildlife-Associated Recreation* (USFWS 2007b) and the *Refuge Annual Performance Plan* (USFWS 2006). These data sources provided information regarding the level and pattern of refuge-based visitation, typical expenditures by category (such as food, hotel, fuel), and type of visitor (such as wildlife viewer, hunter, fisher). The

information was applied to a regional input-output model to estimate the positive economic effects associated with the recreational opportunities provided by NWRs throughout the United States. Results indicated the economic importance of wildlife refuges. In total, the report estimated that more than $1.7 billion is spent annually in support of wildlife-related activities at refuges, and the refuge system supports nearly 27,000 jobs nationally.

Court Decrees, Agreements, and Operational Rules

The Carson and Truckee basins have longstanding cultural, environmental, and other values, and since the mid-nineteenth century have also been used as a source of water for agricultural, industrial and municipal purposes. Plans and infrastructure built for managing the Carson and Truckee rivers basins were executed in a period where values were different than they are today. The arid climate of northern Nevada, combined with the sensitivity of the various desired uses for water, has resulted in fierce competition for both basins' limited resources.

Several frameworks have been put in place to help manage water use in the Truckee and Carson river basins. Listed chronologically, these are described below with their enactment dates noted in parentheses.

Truckee River Agreement (1935) The Truckee River Agreement, signed in 1935 by Reclamation, TCID, Sierra Pacific Power Company (now TMWA), and other local Truckee River water users represented by WCWCD, established how the Truckee River would be managed to serve users downstream from Lake Tahoe Dam. In doing so, it also confirmed the agreed-upon rates of flow required in the river when it crosses the California/Nevada state line.

Rates of flow identified in the agreement are slightly modified versions of rates (called "Floriston rates") established in prior agreements regarding management of the Truckee River, such as the 1915 *Truckee River General Electric* Decree. Depending on the time of year and water elevation at Lake Tahoe, the average (mean) flow in the Truckee River at the U.S. Geological Survey (USGS) gaging station near Farad, California, must remain at a minimum rate that varies between 300 and 500 cfs. If these rates are not met by the Truckee River's natural flow, Reclamation must release additional water from reservoirs, such as Lake Tahoe Dam and Boca Dam, until the rates are achieved.

Orr Ditch Decree (1944) The *Orr Ditch* Decree quantified individual Truckee River water rights in Nevada. It established amount, places, types of use, and priorities of the various rights, including those of the Pyramid Lake Paiute Tribe (Claims 1 and 2) and the Federal government on behalf of the Newlands Project (Claim 3). The U.S. District Court Federal Water Master in Reno, Nevada, enforces the terms of the decree.

Alpine Decree (1980) The *Alpine* Decree documented Carson River water rights in California and Nevada, and is the primary means by which the river and its reservoirs are operated, also overseen by the Federal Water Master.

The decree divided the Carson River into eight segments to be operated independently when water levels in the river were lower than usual and junior rights holders might not be served; as Section 8, the Newlands Project uses water that cannot be stored or used legally upstream.

For the Newlands Project, the *Alpine* Decree defined the annual net consumptive use of surface water for irrigation at 2.99 acre-feet, a water duty of 4.5 acre-feet per acre for bench lands, and a 3.5 acre-feet per acre duty for bottom lands. Although the decree established water duties for bench and bottom lands, it did not identify which lands received these classifications (DWP 1999). For lands above Lahontan Reservoir, the decree established water duties of 4.5 acre-feet per acre for bottom-lands, 6 acre-feet per acre diverted for alluvial fan lands, and 9 acre-feet per acre for bench lands; consumptive use for irrigation was set at 2.5 acre-feet.

OCAP (1997) In 1997, Reclamation issued the most recent version of the Newlands Project OCAP, which is intended to protect service of Project water rights; regulate diversions from the Truckee River to only the amount needed to serve Project water rights; and maximize the Project's use of Carson River supplies. OCAP sets diversions based on annual estimates of irrigated acreage and dictates other components of how TCID must operate and maintain the Project.

The 1997 OCAP incorporated numerous considerations and criteria that address conditions that have been developing throughout the study area since 1967. In February 1967, Pyramid Lake reached its lowest elevation in recent history (3,783.9 feet mean sea level). Shortly thereafter, the Pyramid Lake cui-ui fish species was identified as in danger of extinction under the Federal Endangered Species Act of 1966 (ESA). In response to these factors, Reclamation issued the first Newlands Project OCAP to limit and reduce the reliance of the Newlands Project on Truckee River diversions. In 1973, following the U.S. District Court finding of excessive Project diversions of Truckee River waters for the Newlands Project (*Pyramid Lake Paiute Tribe of Indians v. Rogers C.B. Morton, et al.*), OCAP was modified to reduce diversions from the Truckee River from 406,000 acre-feet (established in 1926 in agreements between TCID and Reclamation) to 350,000 acre-feet. The OCAP terms were subsequently updated at various times throughout the 1980s, and again in 1997 by Reclamation, resulting in further reductions to Project diversions of Truckee River water to its current amount in the range of 285,000 – 300,000 acre-feet.

TROA (2008) The Truckee River Operating Agreement (TROA) is a negotiated agreement for operation of federal reservoirs on the Truckee River upstream from Reno. Signatories to TROA include the U.S. Department of the

Interior, U.S. Department of Justice, Pyramid Lake Paiute Tribe, TMWA, and states of California and Nevada (Reclamation et al. 2008). The agreement is intended to assure coordination of the operation of those reservoirs for the purposes of storage, release, and exchange of water. TROA provides storage space which will increase municipal drought supplies, benefit instream flows for threatened and endangered fish species of Pyramid Lake and water quality purposes, and enhance reservoir levels for recreational use. In short, it provided flexibility to TROA parties and others for how reservoirs are operated to meet the needs of various – and sometimes competing – users of the Truckee River's water. Once TROA is implemented, it may result in Truckee River water users exercising their rights more efficiently throughout the basin. Section 205(a) of Public Law101-618 directed the Secretary for the Interior to negotiate the agreement, but also required that TROA ensure that water is stored in and released from Truckee River reservoirs to satisfy the exercise of Orr Ditch decree water rights.

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Chapter 2
Plan Formulation Process

This chapter describes the process for formulating and evaluating alternatives, consistent with the Study authorization, purpose, and objectives. The process relies upon characterizations of major water resources problems, needs, and opportunities in the primary study area and, if appropriate, extended study area, which provide the framework for plan formulation and help refine planning objectives for the Study. The process for developing alternatives for the Study parallels the general process for Federal water resources studies and projects, and involves iterative steps, consistent with the P&G (WRC 1983), as directed by the Study's authorization in Public Law 111-8 and pertinent Federal, State, and local laws and policies. The results of the plan formulation steps are documented in this Special Report, as follows:

- Defining water resources problems, needs, and opportunities to be addressed that are relevant to Federal, State, and local interests (Chapter 2).
- Developing planning objectives, constraints, considerations, and criteria (Chapter 2).
- Compiling, forecasting, and analyzing existing and likely future resources conditions in the study areas, and their relation to identified problems and opportunities (Chapter 3).
- Identifying potential management measures and combining them to form preliminary alternatives to meet the Study objectives given the planning constraints and other requirements (Chapter 4).
- Refining alternatives and evaluating their effects (Chapter 5).

Water Resources and Related Problems, Needs, and Opportunities

"Problems" and "needs" are conditions in which something needs to be repaired, changed, or addressed. "Opportunities" are prospects to create desirable future conditions – to make something better – through the planning process. This section describes water resources problems, needs, and opportunities identified in the primary study area. These were identified both in the Study's authorization and through stakeholder input regarding the existing

and likely future water resources and other related issues in the primary and extended study areas.

Newlands Project Problems and Needs

The Truckee Canal breach in 2008, the canal's structural and safety issues, and the related water supply reliability concerns are the most discrete problems that led to development of this Study. However, the Project's broader cultural and institutional context is also shaped by a number of problems and issues that have persistently challenged operations.

Water Rights Problems and Needs

Reclamation and its local contractor, TCID, are obligated to serve Project water rights holders who intend to exercise their rights. However, the Project's changing makeup has complicated the delivery of water to its diverse blend of users. While these changing demands are not considered a problem, serving Project water rights holders is an important need that will be considered as the Study alternatives are formulated.

As originally envisioned, the Project would irrigate hundreds of thousands of acres dedicated to agricultural production. Soon after the Project began, the challenges of farming in an arid climate adjusted the perceived potential for irrigated land within the Project down from over 250,000 acres to fewer than 100,000 acres. Over the last century, several factors, including urban growth in Fallon and Fernley and the decline of ecosystems in the primary and extended study areas, have increased competition for water in the Truckee and Carson river basins and reduced the proportion of Project water delivered for agricultural uses relative to other uses. While Reclamation is committed to serving Project water rights holders, such trends present significant difficulties, as the examples below demonstrate.

- Federal, State, and locally funded programs have started acquiring and/or retiring Truckee River and Carson River water rights previously included in the Project. This has restricted the Project's operating flexibility and affected its ability to generate revenue.

- Many of the rights remaining in the Project are being transferred to nonagricultural users or are being retired. Truckee Division rights are increasingly dedicated to M&I uses or acquired for ecosystem restoration in the Truckee River; Carson Division rights are being acquired for wildlife refuge restoration; and rights throughout the Project are being retired to resolve administrative and judicial proceedings. These conversions have changed demand and delivery patterns, which increases operating complexity.

- As Project water rights are transferred within the basin to serve nonagricultural uses or outside of the basin to remain as in-stream flows, swaths of land previously under cultivation are laid fallow. As

once-continuous stretches of agricultural land are broken up, delivering water to Project farmers who wish to continue crop production can become extremely difficult, expensive, and inefficient.

Truckee Canal Risk-Related Problems and Needs

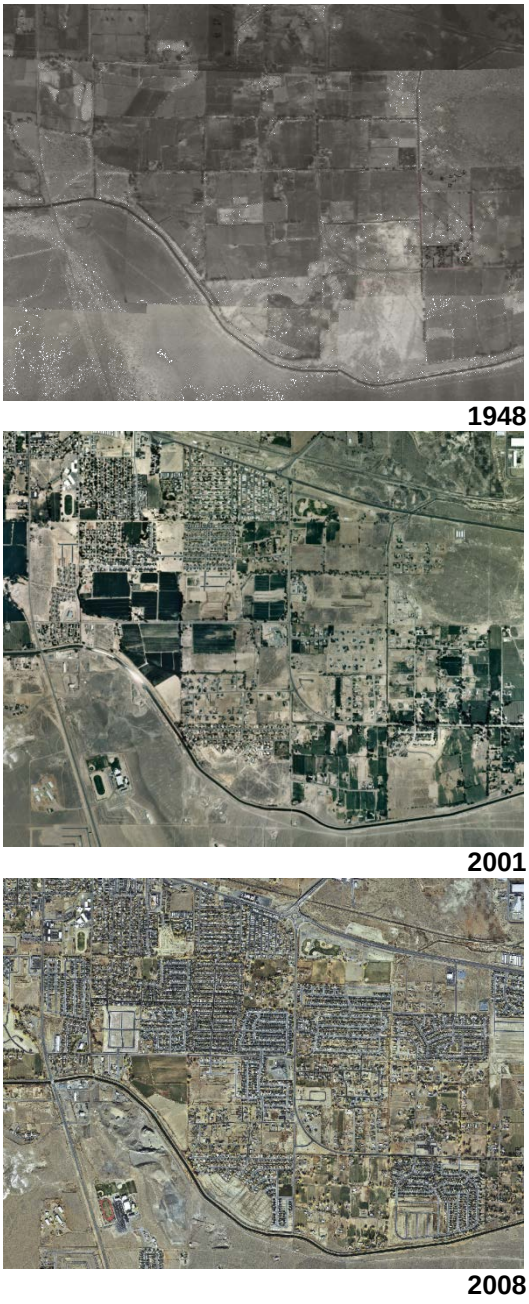


Figure 2-1. Residential Growth in the Fernley Area: 1948, 2001, and 2008

As evidenced by the 2008 breach, operating the Truckee Canal in its current condition to serve Project water rights holders presents large safety risks for residents and property, particularly in the Fernley area. The breach in 2008 was not the first structural failure of the Truckee Canal – eight other breaches occurred during the twentieth century. However, all of the previous breaches had occurred in rural areas (Reclamation 2008a) or at a time when the property adjacent to the canal was uninhabited. In 1996, the time of the second most recent breach, the population of Fernley was less than half of its current 12,000 residents. The rapid rate of urbanization along the Truckee Canal is highlighted by aerial photography in Figure 2-1, which shows the development of residential and commercial properties, in some cases, up to the toe of the Truckee Canal embankments.

In the months following the 2008 breach, Reclamation conducted examinations and forensic inspections to identify the factors leading to the embankment failure. These investigations identified a variety of factors that contributed to the failure, including rodent burrows and structural issues, and revealed that the same factors would continue to pose a safety risk unless actions were taken to improve the canal.

Since 2008, Reclamation has reviewed the risks of continuing to operate the Truckee Canal and has concluded that substantial improvements will be needed to allow the canal to safely convey as much water as it has historically. The facility's advanced age – around 110 years old – and structural issues make future breaches likely (Reclamation 2011d). Urbanization has increased the potential for a breach to cause damage, injuries, or deaths. Reclamation has weighed the high likelihood and increased consequences of a breach, and found the resulting risk to be unacceptable for a Federal facility (Reclamation 2008c, d). The combination of failures with high likelihoods and with high consequences has led Reclamation to require

extensive rehabilitation actions, especially for the urbanized portions of the Truckee Canal (Reclamation 2011e). In the meantime, while options for reducing risk are being formulated and discussed, Reclamation has restricted the flow stages of the Truckee Canal.

Water Supply Reliability Problems and Needs

Restrictions on flow through the Truckee Canal, aimed at addressing Reclamation concerns for safety and risk, could reduce Project water supply to levels below the conditions experienced by users before the 2008 Truckee Canal breach.

Following the breach, Reclamation limited flows in the canal's Fernley Reach, which includes the portion where the canal embankment failed. These limitations first restricted flow stages in the canal to 150 cfs, but were relaxed to 350 cfs by the end of 2008. In the ensuing years since the breach the Project has not experienced significant shortages due to a combination of hydrologic conditions that temporarily reduced the Carson Division's reliance on diversions from the Truckee River. However, these recent hydrologic conditions have not diminished the Project's long-term reliance on the Truckee River. Consequently, Truckee Canal capacity limitations that restrict flows to less than 350 cfs could increase the magnitude and/or frequency of Project water supply shortages in the future.

The potential for reduced Truckee Canal capacity to affect Project water supply is illustrated in Figure 2-2, which depicts 100 years of simulated water supply deliveries to Project water rights holders under different canal flow-stage scenarios, including:

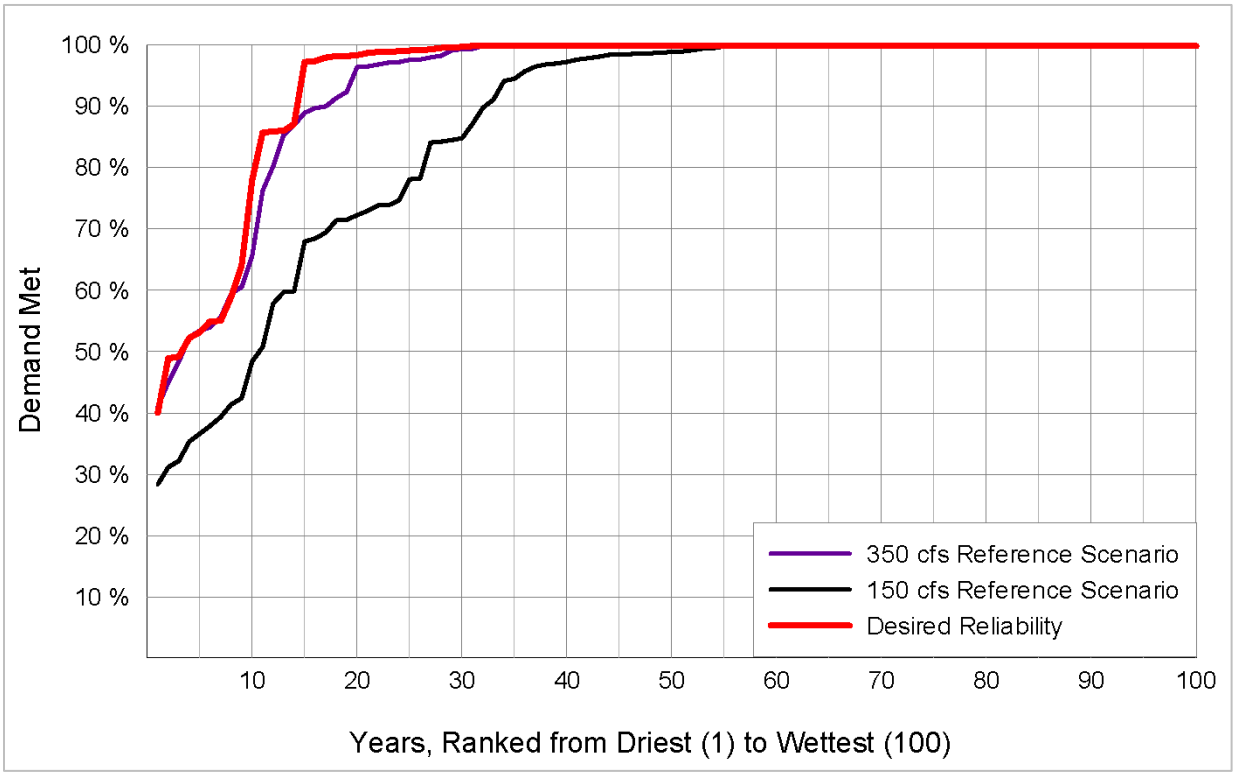
- **Desired Reliability Scenario** – Represents the range of water supply conditions that Project water rights holders could have expected, had the 2008 canal breach not resulted in capacity restrictions. This scenario is based upon the current potential for water demand (225,461 acre-feet), existing regulatory conditions, including OCAP; and the Truckee Canal's more recent maximum operating capacity of 900 cfs (from Derby Dam to Lahontan Reservoir).

  The Study's estimate of the current potential for water demand is based upon an assessment of potentially active water rights, which include rights that have not been identified for retirement. This assessment is described in Appendix C (Projected Future Water Rights and Demands for the Newlands Project).

- **150 cfs and 350 cfs Scenarios** – Illustrates the anticipated water supply conditions that Project water rights holders might experience in the future, with flow-stage restrictions on the Truckee Canal of 150 and 350 cfs. These scenarios are based upon potential future conditions, as described in Chapter 3 (Study Area Conditions). The two selected flow

stages (350 and 150 cfs) bracket the range of recent and likely future without-action restrictions on the Truckee Canal, respectively.

Both scenarios are based upon the ability of the Project to meet an anticipated future potential for water demand (216,332 acre-feet). The Study's estimate of the future potential for water demand is based upon an assessment of potentially active water rights that have not been retired, and includes anticipated completion of several water rights transfer and retirement programs. The assessment of future demand is described in greater detail in Appendix C (Projected Future Water Rights and Demands for the Newlands Project).



Notes:
Simulations based on 100-year hydrology for the Truckee and Carson river basins, 1901–2000.
The Desired Reliability scenario considers the current Project demand; the other scenarios consider anticipated future demand, as discussed in Chapter 3 and Appendix C.
Key:
cfs = cubic feet per second

Figure 2-2. Potential for Restricted Truckee Canal Capacity to Affect Water Supply Reliability for the Newlands Project

Figure 2-2 illustrates the performance of the 350 and 150 scenarios, relative to the Desired Reliability. As mentioned earlier, both 350 and 150 cfs scenarios operate within the same 100-year period of hydrologic conditions, with the same future conditions, but with different canal capacities. Each line represents water supply conditions across the 100 years, ranked from driest to wettest; for

any given year of the 100 evaluated, the figure shows the proportion of overall Project water rights that would have been satisfied.

Under the Desired Reliability, Project water rights holders receive at least 95 percent of their demand in 86 of the 100 years evaluated.[1] For driest year, Project water rights holders receive 40 percent of their water rights.

Under the 350 cfs scenario, Project water rights holders receive at least 95 percent of their demand in 80 of the 100 years evaluated; in the driest of year, Project water rights holders receive 40 percent of their demand. The largest difference in deliveries between the Desired Reliability and 350 cfs scenarios is approximately 10 percent of the annual demand.

Under the 150 cfs scenario, Project water rights holders receive at least 95 percent of their demand in 70 of the 100 years evaluated; in the driest of year, Project water rights holders receive 28 percent of their demand. The largest difference in deliveries between the Desired Reliability and 150 cfs scenarios is approximately 40 percent of the annual demand.

Appendix C to this report describes the current and future levels of demand formulated for use in these scenarios. Appendix D1 to this report describes the methodology used to develop an understanding of potential water supply across a range of potential future Truckee Canal capacity scenarios.

Opportunities

Whereas the problems and needs identified above must be addressed directly through development of the Study alternatives, the opportunities described below are other conditions that could also be improved through the planning process as a secondary outcome.

Project Efficiency

As Reclamation and others have long noted, many Project features and practices result in the inefficient use of Project water. For instance, the Project's aged conveyance structures, most of which are unlined, permit large amounts of water to seep into the ground before delivery. Among other consequences, this requires water to be diverted from the Truckee River not only to meet Project demands, but also to account for the water that is lost to seepage in the Truckee Canal. Similarly, seepage from the network of canals in the Carson Division means that more water must be released from Lahontan Reservoir than farmers and other users actually need; this water recharges groundwater basins, which does not directly benefit the Project. Conditions such as these present opportunities to improve the Project's efficiency by reducing delivery system

[1] The frequency with which the Project experiences a shortage (less than 95 percent of demand met) under the Desired Reliability differs from the frequency reported in the TROA Environmental Impact Statement (EIS)/Environmental Impact Report (EIR). This is due primarily to the different approach this Study takes to calculate Project demand, which is not based solely on historical irrigated acreage within the Project. See Appendix C for an explanation of the Study's assumptions and analysis to estimate Project demand.

losses, or otherwise improving the Project's ability to deliver more with its existing water supplies.

Water Quality and Quantity in the Lower Truckee River

Conflict and litigation over surface water in the Truckee River Basin have been ongoing for more than 100 years, and the Newlands Project has been a frequent party to these disputes. Chief among these disputes is litigation stemming from reductions to Pyramid Lake elevations and fish species. The Pyramid Lake Paiute Tribe considers the lake to be sacred, and the lake's indigenous fish species, cui-ui and Lahontan cutthroat trout, have a similar cultural importance. A number of factors have reduced the cumulative inflows from the Truckee River to Pyramid Lake, thereby challenging the viability of these fisheries. Over time, Project diversions from the river at Derby Dam have become the focus of efforts to reverse declines in water levels at Pyramid Lake and water quality in the Lower Truckee River. The result of these efforts has been a significant reduction in Project diversions from the Truckee River, in comparison to historical practices.

Additionally, the Truckee Canal's extremely high rate of seepage requires that the Project must divert more Truckee River water than Project users need to serve Project water rights. These losses have been exacerbated by the maintenance of high stages in the canal during periods of low use, such as during the winter when crops are idle and the only demands are for stock water.

Planning Objectives

This section discusses the objectives that will help direct the Study's planning process. Objectives help clarify the identified problems, needs, and opportunities; narrow the focus of Study efforts; and represent the basis for identifying and screening measures and formulating alternatives.

Study Objectives

Objectives for the Study were developed based on specific direction in the Study's authorizing legislation, identified water resources problems and opportunities in the study areas, and other guidance. Alternatives will be formulated to achieve the following Study objectives.

Address Truckee Canal Safety Concerns ("Safety Objective")

To meet the Study's safety objective, alternatives must include one or more elements to allow the Truckee Canal to be operated in a manner that is safe for the surrounding communities. Alternatives must do so in a manner that is consistent with Reclamation's preferred standards of safety for the canal, which address risks at the RR3 level (Reclamation 2011d, e). RR3 is described in greater detail in Chapters 1 and 3.

All Study alternatives will include corrective actions that Reclamation has already identified to meet the safety objective. Through a series of engineering studies noted in Chapters 1 and 3, Reclamation produced several design options and other actions to reduce risk from operating the Truckee Canal. The intent of this Study is not to improve upon or to replace these recommendations. Instead, this Study will incorporate them as part of comprehensive alternatives that also seek to resolve water supply problems.

Satisfy the Exercise of Newlands Project Water Rights ("Water Supply Objective")

Meeting the Study's water supply objective has two components: reliability and viability.

Reliability The Study's water supply objective requires providing water supply reliability to Project water rights holders, or mitigating water supply conditions that are less than reliable.

The Study interprets "reliability" to mean a condition that is approximately equivalent to the level of service Project users would have experienced from 1901 through 2000 if (1) the current OCAP regulations were in place, (2) the Project water rights in place today were held constant over the full period of study, (3) all holders of potentially active Project water rights fully exercised these rights, and (4) the Truckee Canal was operating without flow-stage capacity restrictions. These conditions are represented by the Desired Reliability scenario (Figure 2-2). Reliability under this scenario is summarized as follows and in Appendix D1:

- Over the full 100-year period of study, Project water rights holders would have received annually, on average, 95 percent of their water rights.
- In the driest 10 out of 100 years, Project rights holders would have received an average of about 50 percent of their water right, and as little as 40 percent in the driest year.
- In the second driest 10 out of 100 years, Project rights holders would have received an average of about 90 percent of their water rights.
- In the wettest 80 out of 100 years, Project rights holders would have received at least 98 percent of their water rights.

Viability The Study's water supply objective also requires that alternatives must maintain the viability of the Project. For the purposes of the Study, this means that alternatives should preserve the Project's current ability to generate revenue for ongoing O&M, in order to sustain itself.

National Planning Objectives

The P&G (WRC 1983) defines the Federal water resources planning objective as follows:

> *"The Federal objective of water and related resources Project planning is to contribute to national economic development consistent with protecting the Nation's environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements…Contributions to national economic development (NED) are increases in the net value of the national output of goods and services, expressed in monetary units. Contributions to NED are direct net benefits that accrue in the planning area and the rest of the nation."*

As further refined in the Water Resources Development Act of 2007 (Public Law 110-114), the National Water Resources Planning Policy is for all Federal water resources investments to reflect national priorities, encourage economic development, and protect the environment by:

- Seeking to maximize sustainable economic development
- Seeking to avoid the unwise use of floodplains and flood-prone areas and minimizing adverse impacts and vulnerabilities in any case in which a floodplain or flood-prone area must be used
- Protecting and restoring the functions of natural systems and mitigating any unavoidable damage to natural systems

Although this Study has not been conducted solely with Federal interests in mind, the overarching Federal objective defined above provides useful guidance for developing alternatives that would address Federal priorities. Meeting this objective would be crucial for any alternative to garner Federal participation in cost-sharing.

Planning Constraints and Considerations

The following section describes the planning constraints, criteria, and other considerations for identifying planning measures and for formulating and evaluating alternatives.

Constraints

Constraints identify the basic concerns or issues specific to the Study that will shape the range of actions and measures the Study considers. Some planning constraints are rigid, such as congressional direction, current applicable laws and policies, and physical conditions. Other planning constraints, such as

agency regulations and policies, are less stringent but are still influential in guiding the Study. Noted below are the preliminary constraints for the Study.

Study Authorization

In 2009, Congress authorized and appropriated funding for an investigation of opportunities to repair the Truckee Canal to the full extent needed to restore Newlands Project deliveries above 350 cfs (Public Law 111-8, 123 Statute 609). Thus, the alternatives must be developed to address the future use or nonuse of the Truckee Canal.

Laws, Regulations, and Policies

Numerous laws, regulations, executive orders, and policies may need to be considered, including: the P&G, National Environmental Policy Act (NEPA), Fish and Wildlife Coordination Act, Clean Air Act, Clean Water Act (CWA), National Historic Preservation Act, and ESA, among others.

Truckee River Agreement

The Truckee River Agreement signed in 1935 establishes how the Truckee River will be managed to serve its water users. It directs Reclamation to operate Lake Tahoe Dam so that as far as practicable the lake elevation will not exceed an elevation of 6,229.1 feet.

Limits on Truckee River Diversions

The 1997 OCAP and all previous versions since 1973 required that all Truckee River water in excess of valid Project water be delivered to Pyramid Lake. Additionally, it requires that Carson River water be the primary source for the Project and the Truckee River be a supplementary source to leave as much water as possible in the Truckee River for flows to Pyramid Lake.

Limits on Use of Upstream Truckee River Storage

Few opportunities exist currently for the Project to store water on the Truckee River. A 1982 court ruling limited the use of Washoe Project water in Stampede Reservoir on the Little Truckee River for flows to Pyramid Lake for endangered species. Although TROA will expand opportunities for many Truckee River water users to benefit from upstream storage, TCID and Project water rights holders are not signatories to the agreement. Additionally, based on recent court rulings, there may also be limitations on use of storage at Donner Lake – the rights to which are partially owned by TCID – to supplement Project water.

Other Considerations

The following considerations were identified to guide the formulation, evaluation, and comparison of alternatives.

- Alternatives should address the identified planning objectives.
- Alternatives should preserve the character of water rights as established under Federal court decrees.

- Alternatives should seek to avoid adverse impacts on environmental resources.

- Alternatives should seek to avoid adverse impacts to present or historical cultural resources.

- Alternatives will be based on a range of safe Truckee Canal flow stages.

- Initial reliability analysis, refinement of alternatives, and final alternatives are to be evaluated on a 100-year hydrologic period of record.

- Costs for alternatives are intended to be a basis for planning purposes only and are either preliminary- or appraisal-level, and represent field or total construction costs. Where available, existing estimates are used and reflect the most current pricing at the time of the estimate.

- Alternatives should have a high certainty of achieving the intended benefit and not significantly depend on speculative long-term actions for success.

- Alternatives should consider the purposes, operations, and limitations of existing projects and programs, and be formulated to not adversely impact those projects and programs.

- Alternatives should be formulated to neither preclude nor enhance development and implementation of TROA or other water resources programs and projects in the Truckee and Carson river basins.

Criteria for Formulating, Considering, and Evaluating Alternatives

The Federal planning process in the P&G includes four specific criteria for consideration in formulating and evaluating alternatives: (1) completeness, (2) effectiveness, (3) efficiency, and (4) acceptability (WRC 1983).

Completeness is a determination of whether an alternative includes all elements necessary to realize its effects, and accounts for the degree that the alternative's intended benefits depend on the actions of others. Effectiveness is the extent to which an alternative alleviates problems and achieves identified objectives. Efficiency is the measure of how efficiently an alternative alleviates identified problems while realizing the objectives. Acceptability is the workability and viability of an alternative with respect to its potential acceptance by the range of entities with vested interests in the Project's future, including other Federal agencies, State and local governments, public interest groups, and individuals.

These criteria and how they apply in helping to compare comprehensive alternatives are described in chapters 4 and 6.

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