Appendix B
Model Selection and Formulation

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

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Appendix B1
Operations Model Selection and Formulation

Newlands Project Planning Study
Special Report

Prepared by

Bureau of Reclamation
Mid-Pacific Region
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U.S. Department of the Interior
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Abbreviations and Acronyms

CWSD	Carson Valley Water Sub-Conservancy District
EIS	Environmental Impact Statement
LBAO	Lahontan Basin Area Office
NRCS	Natural Resource Conservation Service
OCAP	Operating Criteria and Procedures for the Newlands Reclamation Project
Reclamation	U.S. Department of the Interior, Bureau of Reclamation
Study	Newlands Project Planning Study
TROA	Truckee River Operating Agreement
TROM	Truckee River Operations Model
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geologic Survey
VBA	Visual Basic for Applications

Appendix B1 – Operations Model Selection and Formulation

Several models have been developed to describe the joint operations of the Truckee and Carson river basins. Each of the models developed has played an important role in furthering the understanding of the Truckee-Carson physical system, shaping the policies that govern water use and management for the two basins, and in planning for the future as needs and conditions change.

The selection of a water supply model for the Newlands Project Planning Study (Study) was guided by the following analytical criteria:

- Represent a full range of hydrology for the Truckee and Carson river basins
- Represent current operations of storage and conveyances on both the Truckee and Carson rivers, as administered under the 1997 Operating Criteria and Procedures for the Newlands Reclamation Project (OCAP)
- Assess how changes in the capacity of the Truckee Canal would affect water supply reliability for Newlands Project water rights holders
- Assess how the availability of alternative water supply sources, or changes in Newlands Project demands, or changes in operations would affect water supply reliability for Newlands Project water rights holders
- Summarize how various scenarios affect surface water supplies to various water users within the Carson and Truckee divisions, including irrigators, the Fallon-Paiute Shoshone, and Stillwater National Wildlife Refuge
- Facilitate comparisons between various actions and alternatives that could be applied for providing water supply reliability for the Newlands Project water rights holders

The following sections discuss the models that have been developed for the Truckee and Carson rivers, identify which models are candidates to meet the needs of the Study, and provide the rationale behind the selection of the Pre-TROA Planning Model as the platform for conducting water supply analysis for the Study.

Truckee-Carson Basins Water Supply Modeling Tools

The following section describes the most relevant tools that have been developed by the U.S. Department of the Interior, Bureau of Reclamation (Reclamation), and other stakeholders for studying water supply in the Truckee-Carson river basins.

Truckee River Operations Model (Actively Used Between 1975 and 2009)

Reclamation originally developed this monthly time-step operations model in a FORTRAN environment to help administer the OCAP, though it was later used to support the Preliminary Settlement Agreement in the Truckee Basin. This model was used as the basis for water supply assessments in the Truckee River Operating Agreement (TROA) Environmental Impact Statement (EIS). It represents TROA operations. This model is well known and widely accepted. Since the modeling to support the TROA EIS was completed, the model has essentially been idle. The documentation for the model is inadequate for future use. There are very few operators around who could make ready use of this model, and the available staff has limited capacity for engaging in model runs.

Truckee River Hydrology Model (1998)

U.S. Geologic Survey (USGS) developed this daily time-step flow routing model in the USGS Hydrologic Simulation Program, using a FORTRAN platform, in collaboration with the Reclamation. This model was later modified to include reservoir operations along the Truckee River. Reclamation abandoned this model shortly before TROA evaluations began due to its lack of flexibility, and incomplete representation of policy and hydrology in the two basins.

Carson River MODSIM Model (1991)

Carson Valley Water Sub-Conservancy District (CWSD) developed this monthly time-step model using the Colorado State University's MODSIM platform. This model simulates operations of the Carson River, above Lahontan Reservoir, and has been used by the CWSD to conduct a variety of studies on water use and water rights in the middle Carson River Basin. This model does not consider operations of the Newlands Project.

Truckee Canal Hydraulic Model (2008 – Current)

Reclamation's Sedimentation and River Hydraulics group of the Technical Services Center developed a hydraulic model of the Truckee Canal using the U.S. Army Corps of Engineers' HEC-RAS platform. The model simulates steady and unsteady flow conditions within the Truckee Canal, and has been used for risk and planning analyses conducted focusing on the Truckee Canal.

Short-Term Forecasting/Operations Model (2004 – Current)

Reclamation developed an hourly time-step forecasting and operations model using the Microsoft Excel/Visual Basic for Applications (VBA) platform. This model is used by Reclamation's Lahontan Basin Area Office (LBAO) and by

the Federal Watermaster to support operations of the Truckee and Carson basins over a 5- to 7-day horizon. This model uses real-time gage data from the USGS and Natural Resource Conservation Service (NRCS) to forecast flows in the Truckee and Carson rivers, and coordinate operations.

Mid-Term Forecasting/Operations Model (2006 – Current)

Reclamation developed a daily time-step forecasting and operations model using the Microsoft Excel/VBA platform. This model is used by LBAO exclusively for supporting the administration of the OCAP, including for forecasting flows, losses, and demands over a 6-week horizon for operation of Newlands Project facilities. This model uses input from gage locations to forecast flows, losses, and demands over the coming 30 to 45 days to set flow targets in the Truckee Canal.

Below Lahontan Reservoir Model (1989 – 1995)

The U.S. Fish and Wildlife Service (USFWS), with assistance from The Nature Conservancy and the Environmental Defense Fund, developed a monthly model of operations within the Carson Division of the Newlands Project in a FORTRAN environment. This model has the ability to be linked with simulation of the Truckee River Operations Model (TROM). The Below Lahontan Reservoir model simulates hydrologic operations within the Carson Division canal network, and all of the irrigation, hydropower production, and losses throughout the canal network. Its intended use was to analyze strategies to efficiently acquire 125,000 acre-feet of Newlands Project water for Stillwater National Wildlife Refuge, and was the basis of water budgets in the USFWS Water Rights Acquisition Program, enacted by Public Law 101-618. This model is not readily available for use.

Carson Valley Operations Model (2008)

A Phase 1 study was conducted by the Idaho Water Resources Research Institute by Kurt Unger, under Professor John Tracy, using the academically popular systems simulation platform, STELLA. Unger's report on the model summarizes its formulation, the user interface developed for altering the model inputs and calculation parameters, and the methodology for obtaining results from various model runs. The report provides a hypothetical example for how the tool might be applied for testing changes in water supply management, and its conclusions focus on potential data development tasks that would improve the accuracy of the tool. The report does not reveal specific sensitivities of the Carson Valley to changing inputs or operating regimes.

Suite of Pre-TROA Models for Forecasting, Accounting, and Planning

Reclamation and the Federal Watermaster have collaboratively developed a suite of daily time-step models of the Truckee and Carson rivers using the RiverWare platform. Each of these models represents all significant Truckee Basin and Carson Basin (below the Fort Churchill gage) hydrology and accounting processes for water supply operations for the two basins. These models have been used for Reclamation operational and planning activities, and

are used by the Federal Watermaster to support accounting and operations activities. The suite of models is run monthly to produce the Truckee River Operations Forum public forecast that is presented at a public meeting and made available on the Web. It is consulted by all major basin stakeholders to support their operations and to provide an operational forecast for the entire basin.

TROA Implementation Model (2004 – Current)

This model simulates all basin operations and performs basin accounting under TROA. It shares essentially the same representation of the Carson and Truckee rivers as the planning models, but has been designed to accept user inputs to guide the decisions surrounding the storage, release, exchange, and delivery of water supplies. The model tracks flows, and forecasts operations (with user inputs) for up to 15 months in the future. This model is in the final stages of development and will be the primary tool used by the TROA Administrator to implement and administer TROA.

Pre-TROA Planning Model (2005 – Current)

This model simulates accounting, reservoir operations, and water deliveries according to all current basin policy, including the Truckee River Agreement, the Orr Ditch Decree, and the 1997 OCAP. The model is designed to simulate basin operations and accounting for 100 years or more.

TROA Planning Model (2009 – Current)

This model shares all of the features within the Pre-TROA Planning Model, but also includes operations of TROA. This model is being developed by a team of Truckee-Carson Basin stakeholders that was convened by Reclamation in 2009 for long-term policy and operations analysis under the anticipated implementation of TROA.

Model Selection

Two models from the above list meet most of the criteria for the Study: the TROM used for the TROA EIS linked with the Below Lahontan Model, and the Pre-TROA Planning Model. The following considerations led to the selection of the Pre-TROA Planning Model.

Model Usability and Public Acceptance

TROM was the basis for the TROA EIS, and has wide public acceptance as a result of that process. However, TROM would be difficult to apply to the Study because it has not continued to be used, was poorly documented, and the experts who can most readily apply the model cannot be relied upon for re-configuring the model to study alternatives, or even executing model runs with the existing representation.

Reclamation has more ready access to the Pre-TROA Planning Model, which began as a RiverWare Operations model, which had been used in the basin for

operations and short-term planning for more than 5 years. Over the past few years, the Pre-TROA Planning Model has received regular scrutiny from regional stakeholders in anticipation of its use for TROA implementation. As a result, Pre-TROA Planning Model will be much easier to re-configure for studying the Study alternatives, and likely has a more widely understood and accepted representation than TROM at this point.

Representation Detail

Many operations in the basin require a daily time-step to be modeled correctly. Pre-TROA Planning Model employs a daily time-step, whereas TROM operates on a monthly time-step. This additional resolution allows for appropriate representation of operations.

Representation of Water Users in the Carson Division

The Study requires details on water use by specific customer classes within the Truckee and Carson divisions.

TROM provides the only representation of the Carson Division through its integration with the Below Lahontan Model. However, neither TROM nor the Below Lahontan Model is readily accessible for use, and development of either cannot be accommodated within the desired time-frame of the Study.

The Pre-TROA Planning Model already distinguishes between deliveries among the Carson and Truckee divisions. It also tracks the demands of and deliveries to each of the major classifications of water right holders in the Newlands Project. The efficiency of the project is modeled for both the Truckee and Carson divisions and can be varied as can the acreage and duty class of each of the major groups of water right holders. The deliveries to the Carson Division can be tracked to provide a simplified, but adequate representation of water supplies available among the Truckee and Carson division water users. The approach for developing this representation is described in Appendix B3.

Pre-TROA Planning Model Modifications

A series of modifications were made to the Pre-TROA Planning Model for the purpose of evaluating measures and alternatives for the Study. The following section describes these changes, including modifications to model structure, operating logic, and input values.

Modifications to the Existing Model Structure and Operating Logic

Power generation at Lahontan Dam and 26-Foot Drop Power Plant provide an important source of income for TCID, and is therefore important for the economic analyses performed on Study alternatives. Power generation had previously not been calculated by the Pre-TROA Planning Model. To calculate power generation, Lahontan Reservoir's designation within the RIVERWARE software was converted from a STORAGE RESERVOIR to a LEVEL POWER RESERVOIR. In

addition, an IN-STREAM POWER PLANT object was added downstream from Lahontan Reservoir to model the 26-Foot Drop Power Plant. A more thorough description of how this was performed is included in Appendix B3.

The Pre-TROA Planning Model calculates expected delivery efficiency based upon OCAP. The calculated efficiency value is used to determine daily releases from Lahontan Reservoir to meet Carson Division demands and losses. To accommodate the use of Carson Division delivery efficiency as a variable for the Study, the Carson Division delivery efficiency logic was altered to allow for a direct input of the delivery efficiency value. Truckee Division delivery efficiency was already designed to accept a direct input and required no modifications.

The Pre-TROA Planning Model calculates daily Carson Division demand based upon the total annual Carson Division demand and a monthly distribution pattern. The USFWS requested a unique monthly demand pattern be applied to their demands for this Study. For the Study the new monthly demand pattern is applied to the Stillwater National Wildlife Refuge annual demand while the existing monthly demand pattern is applied to all other Carson and Truckee Division demands.

Newlands Project Demands

The Study requires assessments of how alternatives affect a number of parties within the Carson Division, including Carson Division irrigators, the Paiute-Shoshone Tribe, and Stillwater National Wildlife Refuge. While the demand for these groups have been represented explicitly in the Pre-TROA Planning Model, a number of adjustments were necessary for developing the outputs necessary for assessing how Study alternatives affect these different parties.

Newlands Project Water User Categories

Within the model, Newlands Project demands for water are organized and tracked for water users listed in Table B1-1.

Table B1-1. Representation of Water User Categories in Pre-TROA Planning Model

Carson Division User Group	Slot Name
CD irrigated agriculture	CARSONDIVISIONWRANDIRRIG
CD municipal and industrial	CARSONDIVISIONWRANDIRRIG
CD Paiute-Shoshone irrigation project	FALLONINDIANRESERVATION
Paiute-Shoshone tribal wetlands	FALLONINDIANRESERVATIONWETLANDS
Stillwater National Wildlife Refuge	STILLWATERNATIONALWILDLIFEREFUGE
Carson Lake and Pasture	CARSONLAKEANDPASTURE
TD irrigated agriculture	TRUCKEEDIVISIONWRANDIRRIG
TD municipal and industrial	TRUCKEEDIVISIONMANDI
City of Fernley water	DERBYDAMDATA.DERBYBYPASSCOMPONENTS: FERNLEY C3
Pyramid Lake Paiute Tribe	DERBYDAMDATA.DERBYBYPASSCOMPONENTS: PLPT_C3

Key:
CD = Carson Division
TD = Truckee Division
TROA = Truckee River Operating Agreement

Annual demands for each water user category are calculated based upon user-input acreage values, and duties corresponding to specifications from the *Alpine* Decree. Each water user category represents demands for all water users within that category. Demands vary based upon the duty attributed to each acre. The four duty classifications are specified within the model as:

- Duty 1 representing Pasture, with 1.5 acre-feet per acre per year (feet)
- Duty 2 representing Wetlands with 2.99 feet
- Duty 3 representing Bottom Land irrigation with 3.5 feet
- Duty 4 representing Bench Land irrigation with 4.5 feet

Each water user category and their associated acreages are organized in a slot on the MHEDATA data object within the model.

As with preceding models of the Newlands Project, the monthly pattern of demands for each of the Project's water users has been taken from historical patterns of releases from Lahontan Reservoir. For the purposes of the Study, and at the recommendation of the US Fish and Wildlife Service (USFWS), the pattern of demand for Stillwater National Wildlife Refuge was modified to reflect a preference for higher deliveries in the spring, and lower deliveries in the late summer through the winter. This pattern is described in the Stillwater Comprehensive Conservation Plan (USFWS, 2002; Volume 2, Appendix G, Alternative E), and is depicted in Figure B1-1.

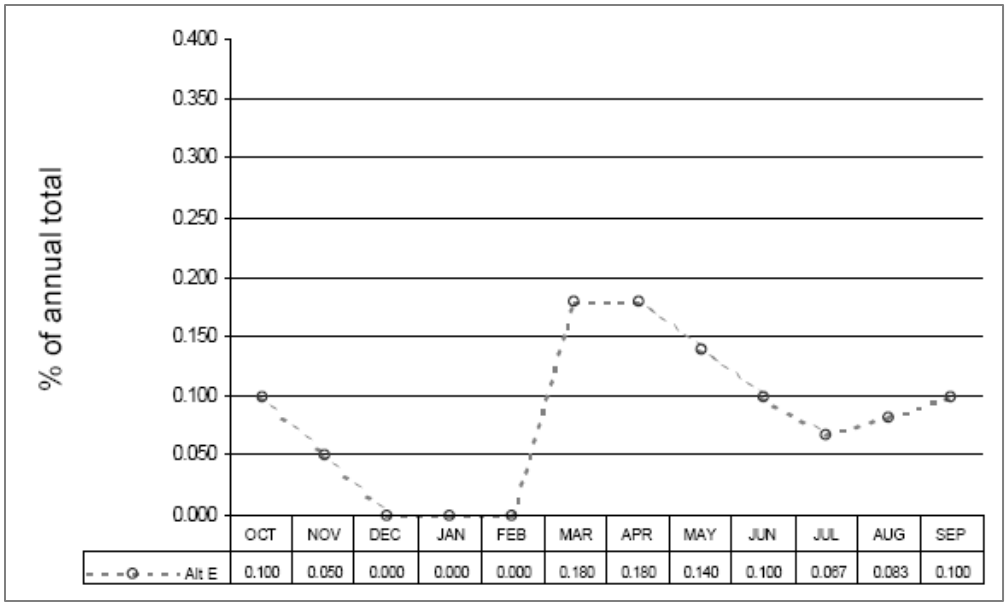

Figure B1-1. Pattern of Demand Used for Modeling Deliveries from Lahontan Reservoir for Stillwater National Wildlife Refuge

Within the Truckee Division, some water rights have been transferred to water users that receive their right on the Truckee River, downstream from Derby Dam. These rights are represented in the model flows to Pyramid Lake. In addition, urban demands in the Truckee Division belonging to the City of Fernley are anticipated to be fully exercised. However, the location for diversion for the city is unknown. For the purposes of this Study, it is assumed that the city exercises its rights at Derby Dam instead of explicitly representing a diversion along either the Truckee Canal or directly from the Truckee River. Two slots exist for these operations, and demands for these rights are calculated as the irrigated acreage times the duty level. These volumes are then converted to a flow and distributed over 120 days, from July 1 through October 28. The bypass values are set as user-input in the model under the slot, DERBYDAMDATA.DERBYBYPASSCOMPONENTS: with column headings FERNLEY C3 for water rights owned by the city, and PLPT_C3 for the Claim 3 rights owned by the Pyramid Lake Paiute Tribe. This method requires some amount of post-processing of model results to determine the volume of water delivered to the City of Fernley, which is described in Appendix B4.

Newlands Project Delivery Efficiency

The delivery efficiency factor for the both the Carson and Truckee divisions was calculated using the Appendix A to Part 418 of the OCAP, Calculation of Efficiency Equation. The calculation is based upon the total irrigated acreage and maximum headgate entitlement of the entire Newlands Project, both the Carson and Truckee divisions. The delivery efficiency factor was calculated to be 0.65. This value was entered on the slots,

LAHONTANDATA.USERINPUTCDEFFICIENCYFACTOR and TRUCKEECANALDIVDATA.USERINPUTTDEFFICIENCYFACTOR.

Newlands Project Incentive Credit Water

The Pre-TROA Planning model allows for the establishment of Newlands Project Incentive Credit (or Debit) water in Lahontan Reservoir. This number depends upon the yearly actions of TCID and its customers, and is therefore difficult to predict with accuracy. For purposes of this study, the amount of annual Incentive Credit Water earned was set to 0 acre-feet for the duration of the model run. This was done by entering "0 AF" onto the slot, INCENTIVECREDITDATA.CALCULATEDANNUALICW.

References

U.S. Federal District Court. 1980. Alpine Decree, Findings of Fact, Conclusions of Law, Tabulation and Administrative Provisions. *United States of America v. Alpine Land & Reservoir Company*, a Corporation, et al., Civil No. D-183 BRT [Bruce R. Thompson], Final Decree, United States Federal District Court for the District of Nevada. October 28.

U.S. Department of the Interior, Fish and Wildlife Service (USFWS). 2002. Stillwater National Wildlife Refuge Complex Comprehensive Conservation Plan and Boundary Revision: Final Environmental Impact Statement. Fish and Wildlife Service, Region 1. May.

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Appendix B2
Revised 100-year Hydrology

Newlands Project Planning Study
Special Report

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Abbreviations and Acronyms

cfs	cubic feet per second
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
Study	Newlands Project Planning Study
OCAP	Operating Criteria and Procedures for the Newlands Project
Project	Newlands Project
TAF	thousand acre-feet
TROA	Truckee River Operating Agreement
USGS	U.S. Geological Survey

Appendix B2 – Revised 100-Year Hydrology

The use of models has become a standard approach for testing water supply reliability in the Truckee and Carson basins. One such model, the Pre-Truckee River Operating Agreement (TROA) Planning Model (see Appendix B1) was selected for assessing water supply reliability for the Newlands Project Planning Study (Study). The hydrology inputs for water supply models play a significant role in analysis of water supply. These data effectively set expectations for average water supply, and the range, frequency, and magnitude of deviations from that average condition, all of which provide the setting in which infrastructure must be operated to balance supplies and demands throughout the Truckee and Carson basins.

Up to the time of this study, a monthly hydrology data set called TCDATFIL has been the universally applied representation of the historic monthly volumes at the key locations within the basin, and has been applied to several planning and decision-making processes, including the TROA Environmental Impact Statement (EIS)/Environmental Impact Report (EIR).

As a part of the Pre-TROA Planning Model development effort, a consortium of parties including Reclamation, the Pyramid Lake Paiute Tribe, Truckee Meadows Water Authority, and the states of California and Nevada invested in the development of a 100-year historic hydrology data set to improve the resolution of water supply modeling studies. The data set consists of 100 years of daily flows at all of the major input nodes for the Pre-TROA Planning Model, from October 1, 1900, to 2000. The revised daily hydrology (hereafter, Daily Hydrology) was derived from TCDATFIL through a process of disaggregating monthly into daily flows. The Daily Hydrology presents several improvements over TCDATFIL, including resolution on daily streamflow variability that is important for calculating diversions at Derby Dam.

Despite its potential improvements, the Daily Hydrology has not yet been applied in studies. The following sections outline several evaluations of the Daily Hydrology for its fitness in the Pre-TROA Planning Model. These tests included verification that the sum of daily volumes matched the TCDATFIL monthly volumes, and assurance that the pattern of synthesized daily flows is consistent with hydrologic records at key locations (particularly Derby Dam).

The findings below confirm that the Daily Hydrology is appropriate for use in the Study.

NOTE TO READER: The Study considered use of a 30-year period in anticipation that computation times for 100-year analyses would be prohibitive for screening analyses. These computational limitations were overcome over the course of the Study, and the full 100-year period was used for screening

analysis. An evaluation was performed to support selection of the 30-year screening period, which has been removed from this appendix. At request, Reclamation can provide interested parties with the administrative draft version of this analysis and the associated write-up.

Confirmation of Daily Hydrology

Two evaluations were performed to confirm the applicability of the Daily Hydrology. The first evaluation compared the aggregated monthly flow volumes to the monthly data in TCDATFIL. Concern has been expressed in previous efforts to extend hydrologic time series that did not agree with the monthly pattern of flows in TCDATFIL, and this confirmation was an important step in accepting the Daily Hydrology.

The second evaluation confirmed that the day-to-day fluctuation in flows within the Daily Hydrology qualitatively matched the frequency and magnitude of storm events that are available from the daily record, and that the hydrologic components of those events (rate of rise, duration of recession limb, and base flow rates) also matched expectations. The requirement to use daily flows in the Newlands planning analysis, as opposed to monthly flows, is driven by the sensitivity of Derby Dam diversions to daily fluctuations. Assuring that the hydrologic elements of the synthesized daily hydrology developed for the Daily Hydrology matched expectations under the historic hydrology was an important consideration in its selection for use in the Study.

Volumetric Mass Balance Check

In planning analyses, such as those needed for this Study, the most significant characteristic of the selected hydrology data set is the total volume of water that it introduces to the system over the period of analysis. While important in some regards, the daily distribution of this volume within a month is not as important as the total aggregate volume of water that is input to the system in a given month at each location. As such, it is important to first demonstrate that the Daily Hydrology matches the TCDATFIL data set in the monthly volumes of inflow at each location where inflow is represented.

It was determined that in all cases the Daily Hydrology aggregated to monthly volumes matched the TCDATFIL monthly volumes to a very high degree of accuracy. For each month in the 100-year data sets, the total volumes matched to within .0015 percent. This very slight discrepancy was identified as the result of rounding errors, and the use of a unit conversion factor that was only accurate to the fourth decimal in the analysis. As such, the actual variation between the new daily values and the TCDATFIL monthly volumes is even less, as differences between the conversion factor (cubic feet per second (cfs) to acre-feet) used to create the Daily Hydrology time series and this analysis introduced some portion of this small difference.

A simple quantification of the difference between the two 100-year data sets was conducted and the results are shown below in Table B2-1. The difference between the two data sets at three key locations (the Fort Churchill Gage on the Carson River, the Truckee Basin above Farad, and the Lake Tahoe net inflow) was calculated both in the total volume difference over the entire 100-year time frame, and in an average deviation per day in cfs. For each location the difference calculated between the two data sets is significantly less than other known sources of uncertainty associated with this hydrology, such as errors in the gage record.

Table B2-1. Comparison of Volumes Between TCDATFIL and Daily Hydrology

Inflow Node	Total Volume Difference (acre-feet)	Average Monthly Flow Difference (cfs)
Lahontan Reservoir Inflow	433	.36
Lake Tahoe Net Inflow	261	.22
Truckee Basin Inflows	603	.50

Key:
cfs = cubic foot per second

It is clear that the Daily Hydrology data is volumetrically identical to the TCDATFIL data set for all 100 years. It can be concluded then that, given the acceptability of the TCDATFIL data set for past modeling efforts in the Truckee and Carson river basins, the Daily Hydrology is acceptable for use in the Study.

Daily Disaggregation Analysis

The second analysis of the Daily Hydrology was to determine if the daily disaggregation methodology generated a daily hydrology that demonstrates a daily variability that is consistent with gage data in the basin. This is an important characteristic of the data set to verify because the operations within the Truckee-Carson basin reservoirs are coordinated. Several operations in the basin, including compliance with the Floriston Rate and the diversions through the Truckee Canal, are highly dependent on the daily flow levels and are more accurate if actual hydrologic patterns are used, as opposed to averaging monthly flows or other simplified methods that ignore recorded daily and weekly variability.

Both data sets include inflows to eight Truckee-Carson basin reservoirs, including Lake Tahoe, and the total accretions (the sum of unregulated inflows and losses) in the Truckee River Basin above the Farad Gage. Specifically, these locations are:

1. Lake Tahoe Net Inflow.

2. Donner Reservoir Inflow.

3. Prosser Reservoir Inflow.
4. Martis Creek Inflow.
5. Independence Lake Inflow.
6. Stampede Reservoir Inflow.
7. Boca Reservoir Local Inflow (hydrologic inflow minus the Stampede Reservoir releases).
8. Lahontan Reservoir Inflow.
9. Total Unregulated Truckee Inflow above Farad (Sidewater).
10. Carson River at Fort Churchill.

Full natural inflows for these locations do not exist as a data set for any of these locations, and therefore the time series of inflows for each location relies heavily upon hydrologic analysis. In some cases, when daily data were not available at a particular location, daily data from similar neighboring gaged watersheds were sampled to introduce the anticipated variability at the ungaged location. The question posed was whether flows generated by this method would qualitatively demonstrate the same distribution characteristics within each month as the gaged flows in the basins' record show.

To analyze the acceptability of the daily disaggregation, the daily flows April through July 1993 were compared to see how the daily variations of two gages in the basin compare to the daily variations in the unregulated locations in the Daily Hydrology time series for the same time period. Gage data for three U.S. Geological Survey (USGS) gages were obtained for the following locations:

- "Truckee R Nr Truckee CA" (USGS 10338000)
- "Donner C A Donner Lk Nr Truckee CA" (USGS 10338500)
- "Donner C At Hwy 89 Nr Truckee CA" (USGS 10338700)

These gages and this period of time were selected because the flows at these points in the basin during the spring runoff consist primarily of unregulated inflows and observations exist in the gage record for this time period for all three gages. The "Donner C At Hwy 89 Nr Truckee CA" gage flows do include releases from Donner Lake which are regulated and were therefore subtracted out of the values for this analysis. The flows measured by the Truckee R Nr Truckee CA gage also include the upstream releases from Tahoe. During the selected time period, the releases from Tahoe were very small, all being below the Tahoe minimum release of 70 cfs. Because the Tahoe release was such a

small percentage of the total flow at the "Truckee R Nr Truckee CA," it was ignored in the subsequent steps.

Next, the average flow for the April – July period was calculated for the Truckee River Gage, the Donner Creek Gage (minus the Donner Lake releases), and the Daily Hydrology time series for the "Sidewater" time series that describes ungaged Truckee River accretions in the Pre-TROA Planning Model. The time series were then normalized by the April – July average flow value for each of the three hydrographs. All three normalized time series were plotted to allow for a visual assessment of the reasonability of the disaggregation (see Figure B2-1).

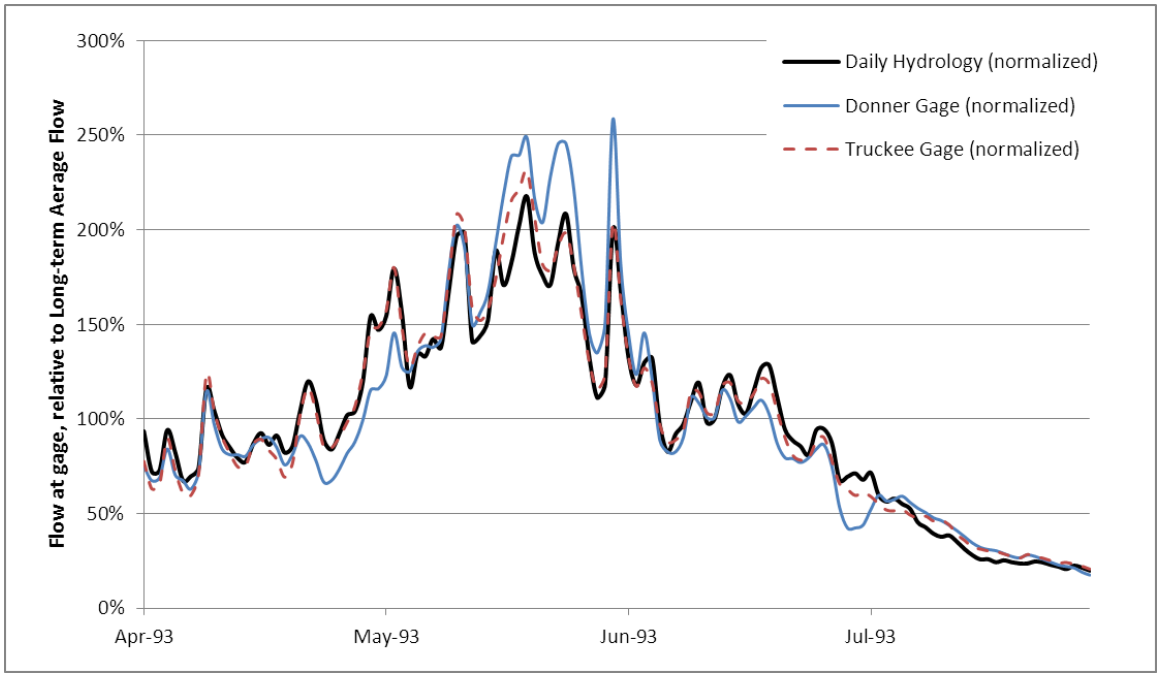

Figure B2-1. Comparison of Normalized Flow Between (a) Daily Hydrology and Two USGS Gage Records on the Truckee River

By visual inspection of the plot, it can be seen that the disaggregation method employed to develop the daily data did accurately reflect the daily variability in the basin that would be expected to be somewhat consistent (but not identical) at this location. It can be concluded that the daily variability exhibited by the Daily Hydrology data is a good representation of the daily variability in the basin.

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Appendix B3
Newlands Project Hydropower Generation

Newlands Project Planning Study
Special Report

Prepared by

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Bureau of Reclamation

April 2013

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cfs	cubic feet per second
kW	kilowatt
MW	megawatts
MWh	megawatt-hour
Project	Newlands Project
RiverWare	Truckee-Carson RiverWare Planning Model
Study	Newlands Project Planning Study
TCID	Truckee-Carson Irrigation District
TROA	Truckee River Operating Agreement

Appendix B3 – Newlands Project Hydropower Generation

Hydropower production is not one of the primary purposes of the Newlands Project (Project). Hydropower generation is accomplished in an incidental manner, meaning that the production of hydropower does not influence the timing and volume of hydropower-generating flows within the Project. However, the power generated by Truckee-Carson Irrigation District (TCID) is sold through purchase agreements, and the sale of this power represents a significant portion of TCID income. For this reason, the generation of power by Project operations is an important component of alternatives evaluated for the Newlands Project Planning Study (Study).

Hydropower is generated by releases from Lahontan Reservoir and from flows below Lahontan Reservoir routed through the V Canal within the Carson Division. Two hydropower plants capitalize on releases from Lahontan Reservoir, and are referred to as the "Old" and "New" power plants. The Old Lahontan Plant was built in 1911[1] and has a maximum capacity of 1.92[2] megawatts (MW). The New Lahontan Plant was built in 1982 and is owned by TCID. These two plants are operated conjunctively, with the intended result of maximizing power output across the range of Lahontan Reservoir elevations (heads) and the flow rates.

Hydropower on the V Canal is generated at the 26-Foot Drop Power Plant, which was built by TCID in 1918.[3] Generation at the 26-Foot Drop Power Plant relies on flows routed to TCID customers who receive water from the V Canal. Typically, 70 percent of all releases from Lahontan Dam are routed through the V Canal (Personal Conversation, Jeff Rieker, Reclamation, 2011).

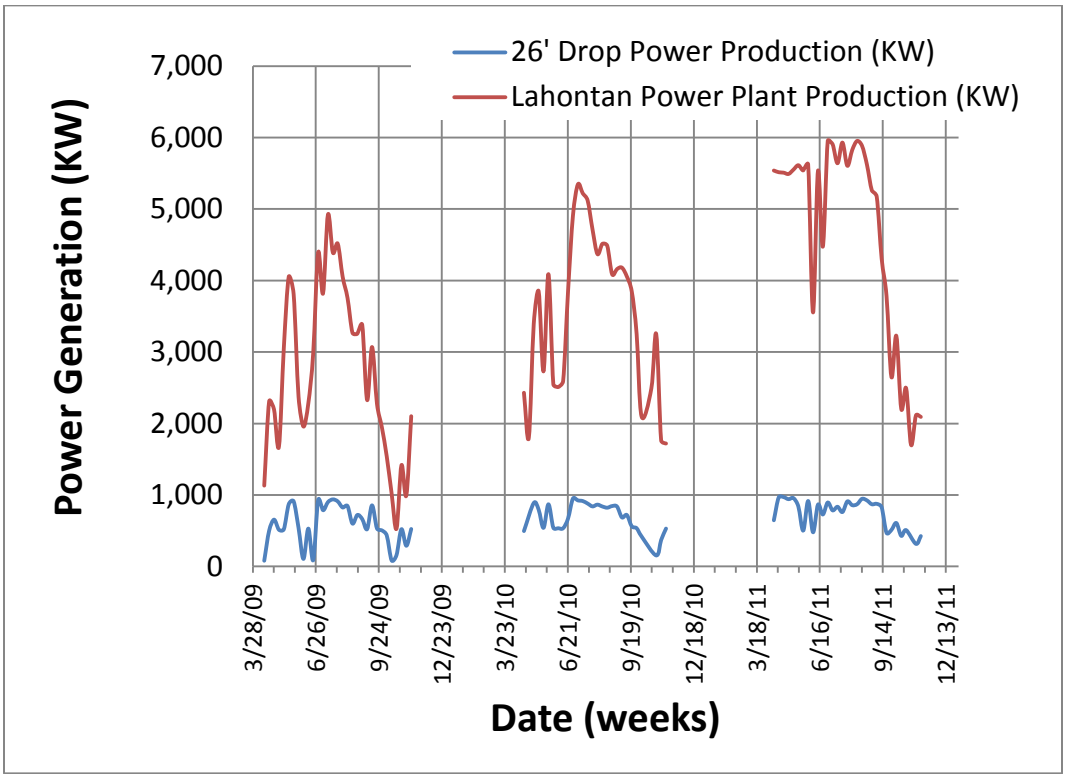
The following document describes the approach developed for characterizing hydropower generation resulting from Project operations.

Methods

Data were obtained from TCID in two documents. The first was titled "T.C.I.D Hydroelectric Information". It gave weekly flow and power data for the months of April through November for years 2009, 2010, and 2011. The second was titled, "Hydro Revenues". It detailed the revenue provided by the power generation facilities for the years of 2008, 2009, and 2010. In the "T.C.I.D

[1] http://www.cr.nps.gov/nr/travel/ReclamationDamsAndWaterProjects/Lahontan_Dam_and_Power_Station.html The plant was used to construct the reservoir which was finished in 1915.
[2] http://water.nv.gov/mapping/chronologies/carson/part3.cfm
[3] http://water.nv.gov/mapping/chronologies/carson/part3.cfm

Hydroelectric Information" data for each year, weekly data were provided for the water surface elevation of Lahontan Reservoir in feet, flow rate below Lahontan Reservoir in cubic feet per second (cfs), the New Plant power output in kilowatts (kW), the Old Plant power output in kW, and the 26-Foot Drop Powerplant Power output in kW. "Hydro Revenues" reported monthly energy output in megawatt-hours (MWh) for the Old Plant, the New Plant, and the 26-Foot Drop Power Plant. Figure B3-1 graphically displays the power generation data provided by TCID.

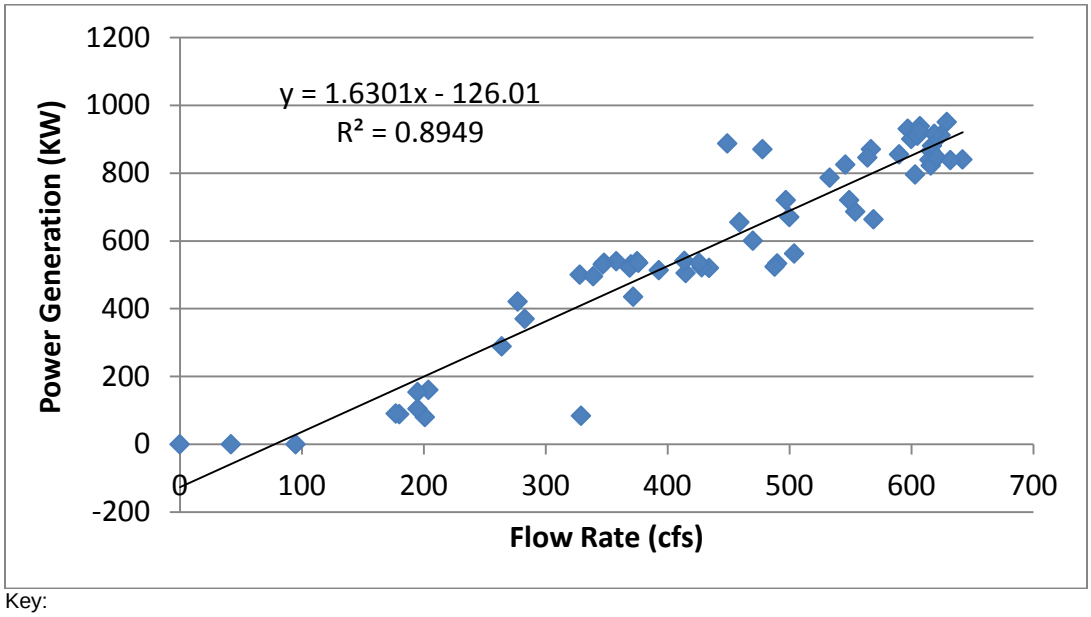


Key:
KW = kilowatt

Figure B3-1. Power Generation for Lahontan Reservoir and the 26-Foot Drop Inline Powerplants in 2009, 2010, and 2011

In the Truckee-Carson RiverWare Planning Model (RiverWare), the 26-Foot Drop Powerplant is modeled as an inline power plant in a reach object below the reservoir. The 26-Foot-Drop Powerplant is configured with a maximum flow through its turbine of 700 cfs. The 26-Foot Drop Powerplant depends on flows through the V Canal to generate power. RiverWare does not represent the explicit management of flows among the various canals below Lahontan Reservoir. To estimate flows through the 26-Foot Drop Power Plant for calculating generation, it was assumed that 70 percent of the outflow from Lahontan Reservoir was diverted through the V Canal. The Old and New powerplants at Lahontan are treated as one power generation plant in the reservoir object representing Lahontan Reservoir.

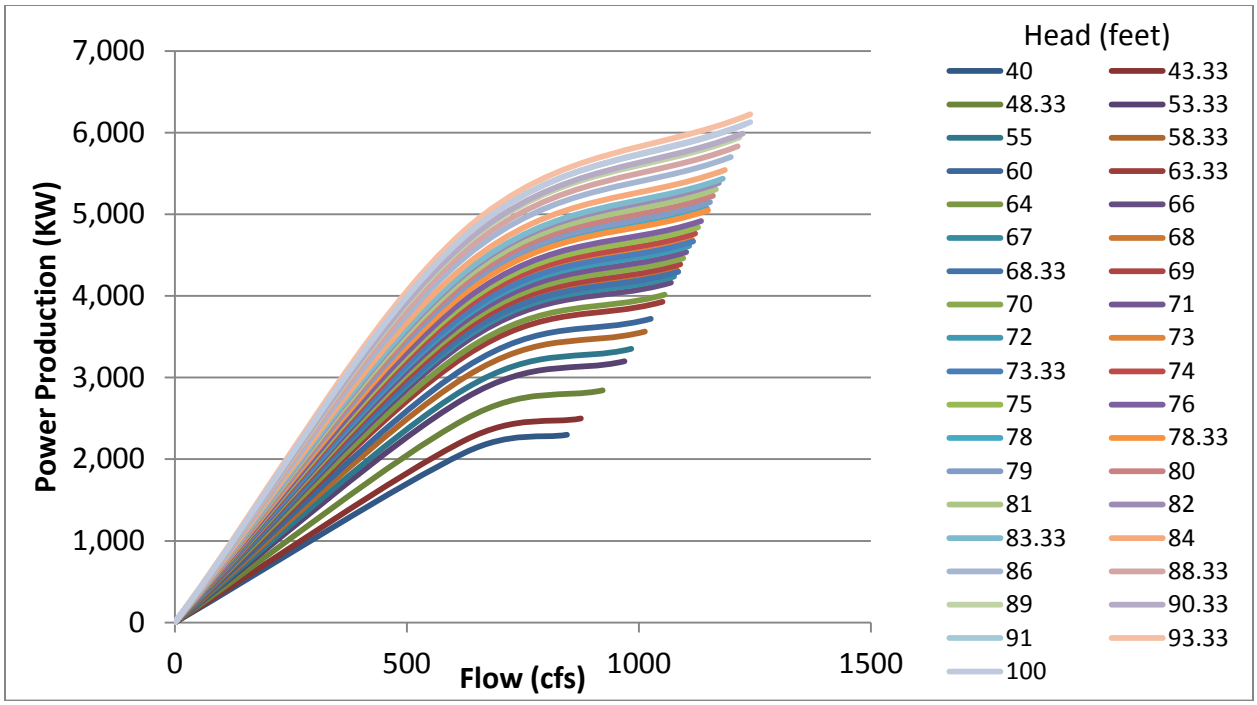
The different power plant types require different data for developing power generation characteristics. The 26-Foot Drop Powerplant requires a power vs. flow table that was estimated by extracting data points from the hydropower data provided by TCID. A linear relationship was derived through a regression analysis of the data. Figure B3-2 shows the linear relationship between power generation and flow through the power plant that was derived from the data and was used in the RiverWare Planning Model.



Key:
cfs = cubic foot per second
KW = kilowatt
R^2 = Root-Mean Squared difference between data and regression equation
TROA = Truckee River Operating Agreement

Figure B3-2. Flow vs. Power Relationship for the 26-Foot Drop Inline Powerplant used in the Pre-TROA Planning Model

To model the power generation at Lahontan Reservoir, a set of power generation curves needed to be developed where power vs. flow relationships are derived for a range of head values. RiverWare requires that each power to flow relationship at a given head be a concave curve with a lower and upper flow limit included for that head. The curves developed for RiverWare are shown in Figure B3-3. Because of the limited amount of data from which to derive accurate power plant characteristics, the following curves were developed using a combination of regressions of actual data and scaling of results to ensure that annual power generation results were within the range of actual annual power generation as reported by TCID.



Key:
cfs = cubic foot per second
KW = kilowatt
TROA = Truckee River Operating Agreement

Figure B3-3. Head – Flow – Power Relationship for Lahontan Power Plant for Pre-TROA Planning Model

These defined flow versus power relationships provide a method to calculate power production at both the 26-Foot Drop Power Plant and the Lahontan Reservoir. Hydropower generation is examined in this study due to its role in generating revenue for TCID. Therefore, examining actual energy production in megawatt-hours is more relevant than examining power generating potential in kilowatts or megawatts. This conversion was done by assuming power was being generated at all hours of the day. Power was simply multiplied by the number of hours in a given year. Because this overestimates actual energy production, these results were calibrated by a scaling factor, to ensure that energy generation is similar in magnitude to the annual aggregated energy output during the years for which TCID provided data. RiverWare is configured to run between the years 1900 and 2000, so direct data comparison with the TCID data is not possible but the values of annual production can be compared.

Calibration

To compare the model runs and to have confidence in RiverWare output data, the base run with a 350 cfs canal capacity was compared to data provided by TCID in the form of energy output. The 350 cfs Reference Scenario condition was used for this calibration (see Appendix D1 for a description of 350 cfs Reference Scenario). TCID provided three years of monthly energy generation

data for 2008, 2009, and 2010. The TCID data from 2010 was selected to be used for calibration as 2010 proved to be an average hydrologic year with a full allocation to the TCID irrigators. 2009 was a drier year and 2008 was an abnormal year with the breach on the Truckee Canal and a delivery shortage imposed on the Newlands Project irrigators. The average annual energy generated for the 100 year simulation with a canal capacity of 350 cfs was compared to the reported energy generation in 2010.

An "efficiency" factor of 0.7743 needed to be applied to the energy output from the Lahontan Power Plants in the RiverWare model to best match the real data from 2010. For the 26 Foot Drop Power Plant, the regression was accurate enough to not need an "efficiency" factor. The factor for the Lahontan Power Plant was applied to all of the modeled energy generation for all of the simulated runs. Figure B3-4 compares the energy production model outputs for the base 350 cfs canal capacity condition before calibration to the energy production from 2008, 2009 and 2010. Figure B3-5 shows the same comparison after calibration.

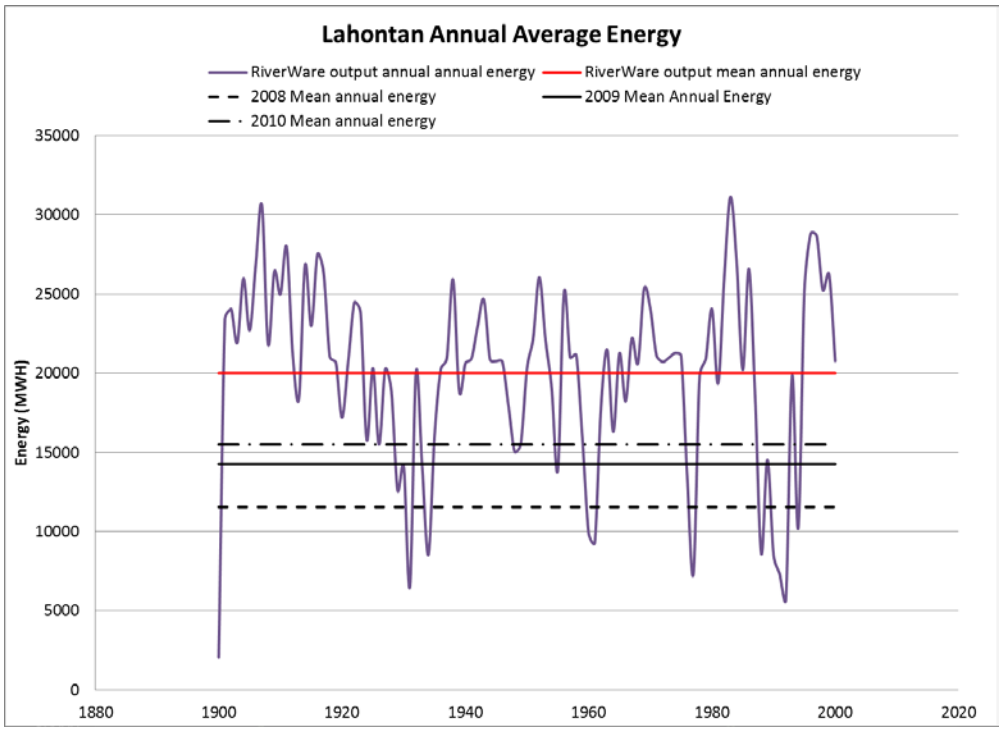


Figure B3-4. Lahontan Average Annual Energy

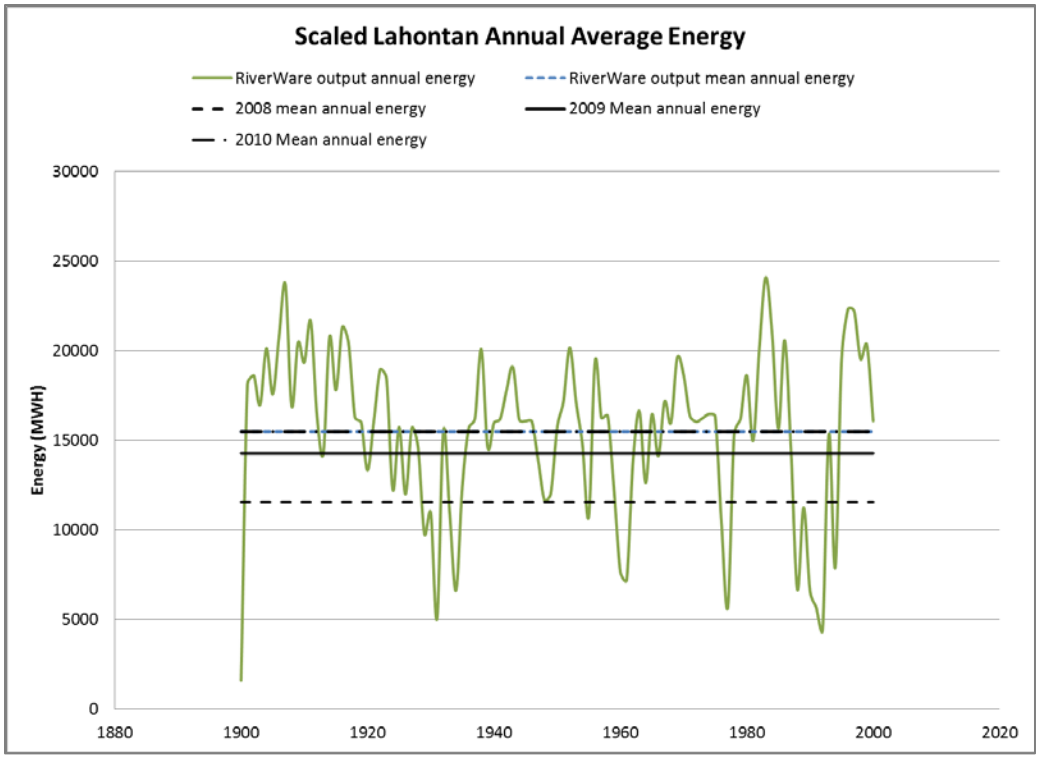


Figure B3-5. Scaled Model Output for Lahontan Average Annual Energy

Results

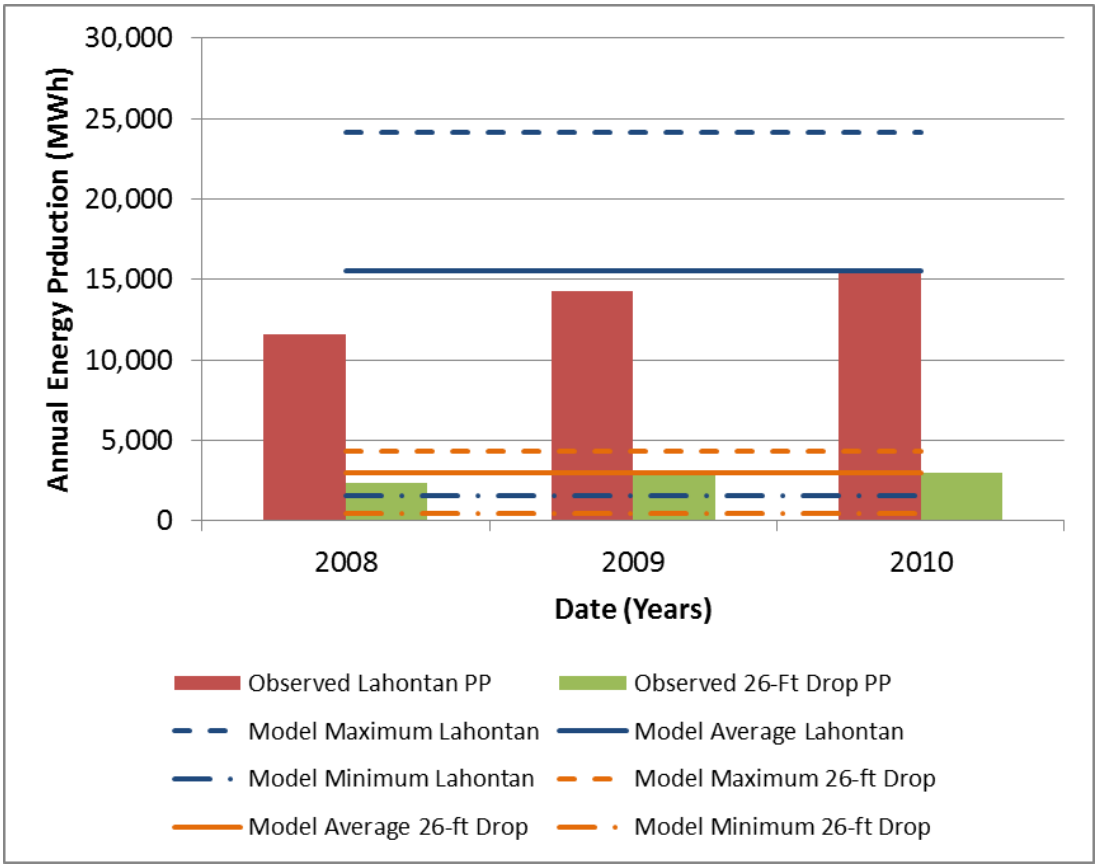
Energy Comparison

Table B3-1 and Figure B3-6 present summary results for the range of annual energy produced by the Lahontan Power Plants and the 26-Foot Drop Powerplant in 100 years of simulation. These RiverWare results are compared with the actual annual energy production reported TCID. Table B3-1 shows that TCIDs reported energy production for the years 2008 to 2010 were all within the range of the minimum and maximum values produced by the model. Figure B3-6 shows the same information in a plot format. Again, TCID data from 2008 to 2010 fall within the minimum and maximum boundaries set by the simulation. Table B3-2 shows annual simulation results for energy production. It is therefore concluded that the power generation facilities of the Newlands Project as configured in the RiverWare model are sufficiently representative of the actual power plants to be useful for the purposes of this Study.

Table B3-1. Simulated variability of Energy Generation by TCID

Annual Energy Generation by TCID Hydropower Facilities on the Newlands Project (Megawatt-Hours)						
	Simulated Energy Generation (350 cfs Canal Capacity)			Observed Energy Generation (2009 – 2011)		
	Lahontan Dam Facilities	26-Foot Drop Powerplant	TOTAL	Lahontan Dam Facilities	26-Foot Drop Powerplant	TOTAL
Minimum	1,595	436	2,031	11,553	2,332	13,884
Average	15,499	3,009	18,508	13,776	2,811	16,587
Maximum	24,103	4,316	28,314	15,499	3,093	18,508

Notes:
Values calculated using operations, as simulated by the Pre-TROA Planning Model (Appendix B1).
Observed Values are only exist for 2008, 2009, and 2010
Key:
TCID = Truckee-Carson Irrigation District



Key:
ft = foot
MWh = megawatt-hour
PP= Power Plant

Figure B3-6. Annual Power Distribution of Screening Dataset and Statistical Reference to Simulated Annual Power Generation 1901 – 2000 at Lahontan Dam and 26-Foot Drop Powerplant (MW)

Table B3-2. Simulated Energy Generation 1902 to 2000 at Lahontan Dam and 26-Food Drop Powerplant (MWh)

Year	Dam	26'	Year	Dam	26'	Year	Dam	26'	Year	Dam	26'
1901	1,595	436	1926	15,731	3,100	1951	15,708	3,100	1976	16,342	3,100
1902	18,134	3,100	1927	12,001	2,646	1952	17,190	3,100	1977	10,349	2,255
1903	18,631	3,100	1928	15,681	3,100	1953	20,175	3,884	1978	5,695	1,124
1904	16,981	3,100	1929	14,606	3,100	1954	17,119	3,100	1979	15,328	3,100
1905	20,123	3,737	1930	9,768	2,111	1955	14,753	3,100	1980	16,176	3,100
1906	17,584	3,100	1931	10,947	2,665	1956	10,741	2,538	1981	18,625	3,100
1907	20,796	4,057	1932	5,050	1,013	1957	19,417	3,560	1982	14,986	3,100
1908	23,700	4,316	1933	15,542	3,100	1958	16,266	3,100	1983	20,182	3,670
1909	16,898	3,100	1934	10,922	2,503	1959	16,373	3,100	1984	24,103	4,211
1910	20,449	3,874	1935	6,619	1,293	1960	12,221	2,707	1985	20,987	3,685
1911	19,354	3,292	1936	12,422	3,100	1961	7,656	1,729	1986	15,660	3,100
1912	21,659	4,151	1937	15,661	3,100	1962	7,211	1,546	1987	20,584	3,804
1913	16,393	3,100	1938	16,228	3,100	1963	13,812	3,100	1988	14,405	3,100
1914	14,238	3,100	1939	20,077	3,817	1964	16,639	3,100	1989	6,679	1,288
1915	20,778	3,975	1940	14,628	3,100	1965	12,638	2,967	1990	11,252	2,846
1916	17,816	3,100	1941	15,969	3,100	1966	16,456	3,100	1991	6,604	1,345
1917	21,297	4,085	1942	16,212	3,100	1967	14,124	3,100	1992	5,662	1,312
1918	20,420	3,729	1943	17,807	3,100	1968	17,179	3,100	1993	4,441	855
1919	16,311	3,100	1944	19,082	3,219	1969	15,986	3,100	1994	15,365	3,100
1920	16,005	3,100	1945	16,160	3,100	1970	19,621	3,742	1995	7,902	1,588
1921	13,331	3,100	1946	16,078	3,100	1971	18,657	3,100	1996	19,512	3,730
1922	16,088	3,100	1947	16,047	3,100	1972	16,372	3,100	1997	22,304	3,987
1923	18,959	3,480	1948	13,874	3,100	1973	16,045	3,100	1998	22,201	3,999
1924	18,458	3,100	1949	11,646	2,931	1974	16,240	3,100	1999	19,537	3,454
1925	12,230	2,650	1950	12,048	2,934	1975	16,471	3,100	2000	20,321	3,780

Appendix B4
Determining the Water Supply Reliability for the City of Fernley

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

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Attachments

Letter from Mayor Leroy Goodman, City of Fernley, to Commissioner Michael Connor, Bureau of Reclamation, dated October 18, 2012.

Letter from Mid-Pacific Regional Director Don Glaser, Bureau of Reclamation, to Mayor Leroy Goodman, City of Fernley, dated December 7, 2012.

Abbreviations and Acronyms

cfs	cubic feet per second
M&I	municipal and industrial
Project	Newlands Project
Study	Newlands Project Planning Study

Appendix B4 – Determining Water Supply Availability for the City of Fernley

An important characteristic of the alternatives developed for the Newlands Project Planning Study (Study) is their potential effect on the City of Fernley's water supply portfolio. City of Fernley's 20-year water master plan identifies reliance upon two sources of water to meet their long-term water supply needs: (a) Newlands Project (Project) Truckee River water rights and (b) local groundwater supplies. Project Truckee River water rights are available under Claim 3 of the *Orr Ditch* Decree for delivery along the Truckee Canal (Truckee Division) and delivery at Lahontan Reservoir (Carson Division). The Truckee Division receives Project supplies exclusively from the Truckee Canal, and approximately half of all Truckee Division rights have been dedicated to the City of Fernley for municipal and industrial (M&I) use. The Nevada State Engineer has permitted the City of Fernley to pump groundwater from the local unconfined aquifer. Several groundwater and canal infiltration studies have been conducted to look at groundwater conditions along the Truckee Canal and all of these studies concur that the groundwater pumped by the City of Fernley is almost entirely recharged by seepage losses from the Truckee Canal (City of Fernley 2012). While Truckee Canal losses are beneficial and relied upon by the City of Fernley for their long-term water supply plans, and while the State of Nevada has permitted the City of Fernley to take advantage of these groundwater supplies, groundwater recharge from the Truckee Canal has not been identified as an authorized purpose of the Federal Project and the current Truckee Canal losses are not recognized as a right for Truckee River water under Claim 3 of the *Orr Ditch* Decree.

Study alternatives have been formulated to provide an appropriate level of safety for the citizens of City of Fernley against possible failures of the Truckee Canal, and water supply reliability for Project water rights. Some of the Study alternatives achieve these objectives, in part, through Truckee Canal rehabilitation measures that would reduce or eliminate groundwater recharge in the vicinity of the City of Fernley. Study alternatives that reduce groundwater recharge from the Truckee Canal would potentially compromise the City of Fernley's ability to meet its long-term water supply needs.

The purpose of this appendix is to present the approach used to estimate the potential impact of study alternatives on the City of Fernley resulting from Project operations. Ownership of current and anticipated future Project water rights is given greater discussion in Appendix C to this Study. The Study alternatives that would reduce seepage from the Truckee Canal are described in Chapters 4 and 5, and Appendix F.

Methods

This Study assesses the potential effect of alternatives on the City of Fernley water supplies by comparing the future demand of the city to the combined reliability of the city's Project water rights and groundwater supplies. These effects are calculated, using the following equation:

Demand – (Project rights + Groundwater supplies) =

If results are greater than zero, potential water supply shortages
If results are less than zero, potential water supply surplus

Demand was assumed to be equal to the forecasted annual demand identified in the City of Fernley 2008 Water Master Plan (18,930 thousand acre-feet per year by 2028). The City of Fernley is currently updating its Water Master Plan, which will reflect changes in the projected rate of growth for the City and forecast demands further into the future than 2028. The City has indicated that the demands published in the 2008 Master Plan are below the expected level of demand at full build-out, but are appropriate estimates of demand for approximating future demand in the Study (Shari Whalen City of Fernley, personal communication, November 3, 2012).

Demand =

18,960 acre-feet per year

Project rights reflect a combination of two factors: the assumed total volume of City of Fernley's water rights under the future condition and the simulated reliability of water supply for the Truckee Division water rights. The Study expects the City of Fernley to continue to obtain additional water rights from the Truckee Division, and have 11,242 acre-feet of Project water rights. A description of the assumptions behind this estimate is provided in Appendix C to this Study.

The Study uses the Pre-TROA Planning Model (Planning Model) to simulate the operation of the Truckee and Carson rivers, and to calculate the water supply available to the Project's Truckee and Carson divisions. The City of Fernley currently diverts a small fraction of its surface water rights (400 acre-feet in 2012), mostly to support irrigation within the city's borders (City of Fernley 2012). At present, a facility for diverting these supplies for M&I use does not exist. Although there are no specific plans for a facility to divert all of the City of Fernley's Project rights, the city has indicated that the long-term plan will be the full diversion of these rights (Shari Whalen, City of Fernley, personal communication, November 3, 2012). The Study assumes that the City takes full diversion of all Project rights. The Planning Model tracks City of Fernley supplies as a delivery at Derby Dam, and model results must be adjusted (i.e. post-processed) to reflect that these diversions are made for the

City of Fernley and do not flow to Pyramid Lake. The Planning Model output slot used to quantify simulated average annual Truckee Division water supply was NPPS.PercentTotalTDDDelivered.

Project rights =

*11,242 acre-feet per year **
simulated, average annual Truckee Division water supply

Groundwater supplies were calculated using estimates of groundwater availability at various Truckee Canal flow rates, which were provided for use in the Study by City of Fernley. Volumes of infiltration, or groundwater availability, were estimated by the City of Fernley at flow-stages of 100 cubic feet per second (cfs), 300 cfs, and 700 cfs (City of Fernley 2012). Several Study alternatives were developed at flow-stages of 250, 350 and 600 cfs, and groundwater infiltration corresponding to these flows were estimated from City of Fernley data through linear interpolation. The relationship between groundwater availability and Truckee Canal capacity were developed from modeling analysis, and are described in the table below.

Groundwater supplies =

Look up value from Table B4-1, based on flow stage and Study Alternative conditions

Table B4-1. Fernley Groundwater Supply Reliability Compared to Features of Study Alternatives

Study Alternative Conditions	Truckee Canal Flow-Stage (cfs)	Groundwater Supplies Available to Fernley (AF)
No Action or Alternatives with HDPE Cutoff Walls	900*	12,571
	700	11,671
	600*	11,221
	350	9,871
	250*	9,306
	150*	8,176
	100	7,611
Alternatives with a lined Truckee Canal	Any	0

Source: City of Fernley 2012

Key
AF = acre-foot
cfs = cubic feet per second
HDPE = high-density polyethylene

Required Post-Processing of Pyramid Lake Inflows

Annual inflows into Pyramid Lake is a RiverWare model output, from a slot named NPPS.PyramidAnnualInflow. This inflow volume is decreased to account for the water delivered to Fernley, as described in the calculation for *Project rights*.

Appendix B4
Determining the Water Supply Reliability for the City of Fernley

Attachment: Correspondence Regarding Fernley Groundwater

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

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Correspondence Regarding Fernley Groundwater

This attachment contains correspondence from 2012 between Reclamation and the City of Fernley regarding Fernley's Project water rights and the groundwater the city relies on to satisfy its municipal demands.

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CITY OF FERNLEY
Mayor's Office

Mayor & City Council
Legislative
Public Policy

October 18, 2012

Michael L. Connor
Commissioner
Bureau of Reclamation
1849 C Street NW
Washington DC 20240-0001

RECEIVED
OCT 24 2012
BUREAU OF RECLAMATION
Lahontan Basin Area Office

Dear Commissioner Conner:

The City of Fernley, Nevada ("Fernley") would like to express to you the importance of the Truckee Canal ("Canal") to our community. Recent developments have led to concern on the part of the citizens of Fernley about the future of the Canal. As you are aware, since the 2008 breach of the Canal, flows have been severely restricted, often leaving water users with inadequate supplies. Now, the Bureau of Reclamation ("Reclamation") is conducting a study regarding the future of this important resource. Fernley supports efforts by Reclamation to assure the safety of the Canal for our residents, and urges Reclamation to give equal consideration to the water rights that exist because of the Canal, and particularly Fernley's municipal groundwater supply.

Fernley's sole municipal water supply comes from groundwater. That groundwater is recharged from the Truckee Canal into the local Fernley groundwater aquifer. Without the recharge from the Canal, hydrologic studies clearly indicate Fernley's municipal water supply would disappear. Nearly 20,000 citizens of Fernley rely on this water, and, in response to a federal regulatory mandate, Fernley expended over 74 million dollars in a treatment system for that drinking water supply.

Since its inception in 1902, Reclamation's mission has been to aid in the development of local communities and economies. Reclamation's mission statement states that it exists to "manage, develop, and protect water and related resources…in the interest of the American public." This mission is further clarified by Reclamation's "Vision Statement," which states that Reclamation "will seek to protect local economies and preserve natural resources…through the effective use of water."

The Department of the Interior's ("Interior") 2016 "Strategic Plan" echoes these priorities. It states that "[a] new approach and creative efforts are required to sustain the economy, environment, and culture of the American West." In 2010, Interior Secretary Ken Salazar initiated the WaterSMART program, directing Reclamation to work with local governments to provide sustainable strategies for water development. As you will see, continued Canal operations are crucial to the economy of Fernley, and Reclamation decisions regarding the Canal should be made with an eye toward protecting Fernley's

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www.cityoffernley.org

economy. Not only do Reclamation and Interior policies mandate this approach, but the very future of our community depends on it.

The Newlands Project, one of the first projects undertaken by Reclamation, was conceived and developed in order to encourage settlement in Nevada's high desert. Without the Canal, there would not have been any development, and subsequently, no Fernley. To the citizens of Fernley, it does not seem logical to build a canal to encourage the growth of a city only to remove the canal once a city has grown around it.

Fernley relies heavily on the Canal for many facets of our existence. Our farmers use its water to irrigate, our citizens use it for many forms of recreation, and our municipal water supply depends on recharge to the local aquifer from Canal seepage. Fernley's citizens have been reliant on the Canal for over a century and the Canal is now considered a permanent waterway. Businesses create jobs and manufacture products based on Canal recharge. Regional economic activity at Fernley's industrial park depends on the use of groundwater recharge from the Canal. Reclamation's removal of the Canal from Fernley would be like removing a river from a waterfront town. The very existence of the City would be in danger.

The legislation and court decrees which govern the Truckee River, and subsequently the Canal, recognize that the Canal is used to deliver water to cities and towns along its banks. The 1944 *Orr Ditch* Decree states that the water decreed for use in the Canal is to be used, among other uses, "for supplying the inhabitants of cities and towns on the project and for domestic and other purposes." That decreed water is being used to supply our city, just as the *Orr Ditch* Decree directed. Water is delivered by the Canal into our local aquifer and is pumped into our water treatment facility for delivery to our citizens.

In 1990, Congress passed the Truckee-Carson-Pyramid Lake Water Settlement Act, Public Law 101-618. P.L. 101-618 reiterates the directive of the *Orr Ditch* Court, stating that the Canal is to be operated to provide "municipal and industrial water supply" to Lyon County. Fernley is the only municipality in Lyon County that receives water from the Truckee Canal, so this provision was clearly included specifically to recognize Fernley's reliance on the Canal for municipal and industrial water. P.L. 101-618 mandates that the Canal be operated to provide Fernley's municipal and industrial water, both from surface and groundwater sources.

Fernley's municipal water supply, and the treatment and delivery system, is designed to deliver drinking water to approximately 20,000 citizens, and is completely reliant on groundwater. Although our municipal water treatment facility, a state-of-the-art facility, was designed to accommodate an eventual expansion to treat surface water, this expansion has not taken place. In today's economic climate, expansion is cost-prohibitive and simply out of the question. For the foreseeable future, Fernley will rely on groundwater to serve its citizens.

Fernley designed our water system in its current form because we hold adequate state-permitted groundwater rights to serve our current and projected population. Fernley recently spent over $74 million dollars to construct our treatment facility, hoping to provide a reliable, safe water supply for our citizens into the future. The facility was specifically designed to meet federal requirements for arsenic content in drinking water. Throughout the planning, development, and construction of our water treatment facility, Reclamation never once objected to Fernley's reliance on groundwater, nor did Reclamation inform us that groundwater supplies could be severely curtailed in the future.

Fernley's reliance on groundwater was developed in conjunction with Reclamation through grants and other sponsorship of Fernley groundwater projects. Reclamation did not just sit silently while Fernley grew to rely exclusively on groundwater; it actively encouraged this reliance through grants and joint planning projects. Now it has come to our attention that Reclamation may consider lining the Canal or eliminating the Canal altogether. To Fernley, this reflects a complete reversal of Reclamation's long-standing policies.

Nevada water law will provide some insight into the importance of the Canal to our groundwater supply. In Nevada, all groundwater rights must be permitted by the Office of the State Engineer. The State Engineer bases the number of permits issued in a particular basin on the perennial yield of the basin, or the amount of water that can be removed from the aquifer without substantially lowering the water table. Natural recharge to the Fernley area basin is only 500 acre-feet per year, yet the State Engineer has issued permits for over 10,000 acre-feet of groundwater rights. The State Engineer issued these rights because there is adequate recharge in the basin due to seepage from the Canal. The State Engineer, just like Fernley, believed that this recharge could be relied upon permanently, and that Reclamation would not consider any course of action to curtail it.

Many studies in the basin have been conducted to truly understand the quantity of groundwater recharge that is provided by the Canal. The most recent study was actually completed under the auspices of a Reclamation grant, and it is the Canal seepage study conducted by Fernley. While still in its draft stages, the seepage study initially estimates that groundwater recharge from the Canal in the Fernley area alone is between 8,000 and 12,000 acre feet per year. Other studies conducted by the United States Geological Survey and others have estimated recharge along the entire length of the Canal to be as much as 55,000 acre-feet per year. Clearly, the Canal does not provide merely surface water to northern Nevada; it provides large amounts of groundwater as well.

Fernley is concerned that the current Reclamation Newlands Project Planning Study ("Reclamation Study") will not adequately recognize groundwater delivery to Fernley as a critical use of the Canal in the future. While the Reclamation Study states that it is not intended to result in a binding Reclamation policy for the future of the Canal, we believe that its importance cannot be overstated. We understand that Reclamation intends to rely on the study for any future NEPA scoping related to Canal actions, including identification of the preferred alternative for the future of the Canal. Clearly, the Reclamation Study is more than informational for Reclamation's purposes.

The Reclamation Study should recognize that the Canal delivers surface and groundwater to Fernley. The Reclamation Study should examine multiple options for the Canal going forward, and should calculate efficiencies for Canal operations under each option. Each option should include the delivery of groundwater to Fernley. The Canal's purpose is certainly more than the delivery of surface water. Courts acknowledge this fact, and so does Congress. Reclamation must acknowledge it as well. The Canal has been delivering groundwater to the local aquifer and, subsequently, cities and towns along it, for over one hundred years.

Also, any decision to leave the Canal dry for a portion of the year will impact Fernley. First, there are multiple citizens in Fernley who hold stock watering rights under the *Orr Ditch* Decree. These rights are as valid as any other Claim 3 right, and must be recognized. Second, irrigation rights come with an ancillary domestic right. While Canal water may no longer be fit for human consumption, it is still used by our citizens for other purposes under their domestic right. Finally, any period in which the canal is dry will have an impact on the local aquifer by limiting the recharge it gets from the Canal.

Fernley urges Reclamation to assure the safety of the Canal, and to recognize the importance of the Canal to the citizens of Fernley. We have been relying on the Canal and its recharge of the local aquifer for over a century, and must continue to do so in order to live here. We cannot stress enough that the Canal must remain operational, it must not be lined, and water must be maintained in it on a year-round basis. Any consideration of different Canal operation will jeopardize the future of our City.

Sincerely,

Leroy Goodman
Mayor

Cc: Senator Dean Heller
Senator Harry Reid
Congressman Mark Amodei
Pyramid Lake Paiute Tribe, Honorable Chairman Wayne Burke
Ernest Shank, TCID Board of Commissioners
Donald R. Glaser, Regional Director, Mid-Pacific Regional Director
Kenneth Parr, Mid-Pacific Region Lahontan Basin Manager
State Engineer Jason King, P.E.
Churchill County Commissioner, Norman Frey
Lyon County Commissioner, Joe Mortensen
Governor, Brian Sandoval

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United States Department of the Interior

BUREAU OF RECLAMATION
Mid-Pacific Regional Office
2800 Cottage Way
Sacramento, CA 95825-1898

IN REPLY REFER TO:

MP-100
ADM-1.10

DEC 07 2012

Honorable Leroy Goodman
Mayor of Fernley
595 Silver Lace Boulevard
Fernley, NV 89408

Dear Mayor Goodman:

On behalf of Bureau of Reclamation Commissioner Michael L. Connor, I am responding to your letter of October 18, 2012, regarding the importance of the Truckee Canal (Canal) to the City of Fernley (City). Commissioner Connor has requested that I provide a response to the concerns you raise in your letter regarding the future of the Canal.

As background, the Canal is an earthen structure constructed in the early 1900s as part of the Newlands Project. It is a Federal facility, operated by the Truckee-Carson Irrigation District (TCID) under contract with Reclamation. The Canal has long been the subject of litigation between the Pyramid Lake Paiute Tribe, the United States, and Newlands Project (Project) irrigators in which the efficiency of the Newlands Project has been a central theme. In 2008, the Canal breached during a January storm event and properties in the City were flooded. Since the breach, Reclamation has restricted Canal usage and maximum flows for public safety. The breach has resulted in new litigation and other concerns over the future of the Canal. It is under these circumstances that Reclamation has initiated a Newlands Project Planning Study (Planning Study).

The City is concerned that the Planning Study will not adequately address the importance of Canal seepage to the City and stresses that the Canal "must remain operational, it must not be lined, and water must be maintained in it on a year-round basis." As part of the Planning Study, Reclamation will consider the City's historic use of Canal seepage water as we deliberate on our options for the future of the Canal. The City will have an opportunity to submit comments on a draft of the Planning Study, which we anticipate issuing for public comment in January 2013. In addition, we are hopeful that the City can resolve its water supply issues and that we can assist in this endeavor under our existing authorities. However, the City should be aware that Reclamation cannot recognize or enforce purported claims of rights to seepage water which are not valid under Nevada law, nor can Reclamation view the City's use of Canal seepage water as valid Project water delivery under the current circumstances.

Under Section 8 of the Reclamation Act of 1902, 43 U.S.C. § 383, nothing in the Reclamation Act "shall be construed as affecting or intended to affect or to in any way interfere with the laws of any

State or Territory relating to the control, appropriation, use, or distribution of water used in irrigation ...." Since at least 1945, the Supreme Court of Nevada has held that a landowner cannot obtain a valid appropriation right simply by diverting surplus or waste water from an artificial ditch of a neighboring irrigator (In re Rights of Claimants, 62 Nev. 456, 466 [Nev. 1945]). Instead, valid water rights in Nevada are obtained only from natural sources.

This principle was reaffirmed in 2007 by the Nevada State Engineer in Ruling 5760. The relevant portion of this ruling was in response to similar concerns and claims raised by the City of Fallon against an application to change the place and manner of use of Newlands Project water under Claim 3 of the Orr Ditch Decree. The application sought to alter the historical use of those water rights from irrigation use on Project lands to wildlife use in the Truckee River, thereby foregoing the diversion of water associated with those rights into the Canal. The City of Fallon protested the application on various grounds including that such a change would decrease the amount of irrigation water ultimately seeping below Project lands and recharging groundwater. The City of Fallon argued that such a change would harm its valid rights to appropriate groundwater in the area.

The State Engineer rejected the City of Fallon's arguments with respect to groundwater recharge and approved the application. As stated in Ruling 5760, pp. 14-15 (footnotes omitted) (2007):

> The State Engineer has previously found that he cannot force a farmer to continue to irrigate lands with a surface-water source in order to provide continued ground-water recharge or to protect the water quantity or quality of a junior ground-water user or any ground-water user. The City of Fallon argues that it does not assert that the water rights must continue to be used at their existing places of use, but rather NRS § 533.370 precludes the transfer if it conflicts with the City's existing water rights, whether surface or ground water, junior or senior or threatens to prove detrimental to the public interest.
>
> If a person merely ceased to irrigate and let the water right lapse, the effect would be the same, but it is the change application process through which the Protestants are trying to express their dissatisfaction with P.L. 101-618 and other changes taking place within the Newlands Project. In effect, the Protestants are arguing, that as junior ground-water right holders who have come to rely on the unnatural recharge the Project created, that any change from that artificial recharge will impact its existing rights and threaten to prove detrimental to the public interest.
>
> The State Engineer, in Order No. 1116, recognized the fact that the recharge experienced from surface-water irrigation was declining in the Carson Desert Hydrographic Basin and thereby restricted further ground-water development in the area. Ground-water development was restricted based on the fact that application of surface water for irrigation was disappearing, but the order did not nor could it order the use of surface water for irrigation to continue. Since the turn of the 20th century and creation of the Newlands Reclamation Project, it is true that surface-water irrigation in the Newlands Project has changed the depth to water over large areas of the valley floor and has increased the amount of water that recharges the ground-water aquifers from that which occurs naturally. The water brought into the

> Newlands Project from the Truckee River is not native to the Carson Desert Hydrographic Basin. The water under consideration in this application is water that the Applicants are requesting to be changed back for use in its river of origin.
>
> The State Engineer recognizes that the effect of changes in water use on local ground-water supplies is not known and is a major public concern. The State Engineer finds he cannot force a person to continue to irrigate with surface water and he will not restrict a change in use of a senior surface-water right in order to provide ground-water recharge. A farmer is not required to continue farming because someone else drilled a ground-water well which depends on the farmer applying water to his land. The State Engineer recognizes that ground-water recharge experienced from surface-water irrigation is declining in the Carson Desert Hydrographic Basin and that ground-water development has been restricted in the area due to the fact that the application of surface water is disappearing, but the surface water users are not going to be restricted in what they can do because others hold ground-water rights that were granted in times when there was much greater surface water irrigation that recharged the ground-water basin. It is the ground-water users that need to be planning for the acquisition of additional water rights to recharge the ground-water basin if they believe such is required.

Contrary to the assertions in your letter, the Nevada State Engineer does not appear to believe that recharge from Newlands Project facilities could be relied upon "permanently."

Reclamation is also prohibited from viewing the City's use of Canal seepage as a valid delivery of Project water. In order to obtain rights to use Project water, the City, or the City's predecessor in interest, would have had to obtain such rights by entering into a contract with either the United States or TCID. We are not aware of any such contract. The terms of any such contract would have provided for the City's proportional share of the repayment of the capital and operation and maintenance costs of Project facilities and provided for the City to proportionally share shortages to Project water supplies with other Project water users. [1]

The contract would also have reserved to the United States, or TCID, the right to collect and use Project seepage water as against any individual Project water user. The United States, or TCID, can use that water in support of authorized Project purposes unless and until such water is abandoned. The United States has not abandoned and does not intend to abandon Project water that seeps from the Canal. The right to reserve and claim seepage water from Reclamation project facilities for use of overall project supplies and purposes was upheld by the United States Supreme Court in Ide v. United States, 263 U.S. 497 (U.S. 1924). Central to the Court's holding on that point was the

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[1] The City is aware of the key provisions of Project water contracts because the City has acquired several such contractual rights for approximately 10,000 acre-feet of Project water and has applied to the State Engineer for a change in the use of those rights from irrigation to municipal use. Reclamation protested the City's change applications, and Reclamation and the City have entered into a settlement agreement which provides a mechanism to ensure that the City's use of the water for municipal purposes will maintain project efficiencies and otherwise comply with Federal law.

benefit of conserving water diverted from natural sources by a Reclamation project and encouraging use or re-use of project waste water to decrease Reclamation project diversions. While the Canal seepage has occurred in the past, the City cannot force Canal seepage to continue, and such Canal seepage can be used for authorized Project purposes in the future, including to further Project use efficiencies, even if such use results in a reduction or discontinuation of Canal seepage.

In the case of the Newlands Project, conserving Project water, decreasing diversions from the Truckee River, and increasing Project facility efficiencies are mandates set forth under Tribe v. Morton, 354 F. Supp. 252 (D.D.C. 1972), as well as codified by the Newlands Project Operating Criteria and Procedures (OCAP) 43 C.F.R. § 418.1 et seq. The Newlands OCAP set forth criteria for determining the maximum allowable diversions and enforcing Project efficiency standards. In addition, the OCAP mandates that:

> Project water must be managed to make maximum use of Carson River water and to minimize diversions of Truckee River water through the Truckee Canal. This will make available as much Truckee River water as possible for use in the lower Truckee River and Pyramid Lake.

Your letter states that municipal use is a valid use of Project water, as evidenced by P.L. 101-618. Reclamation agrees that municipal use is an authorized use of Project water as provided in P.L. 101-618; however, we do not agree that such authorization provides grounds for Reclamation to maintain seepage from the Canal at historical levels to support the City's municipal use. In fact, P.L. 101-618 states that, "[a]dditional uses of the Newlands Project made pursuant to this section shall have valid water rights ..." (P.L. 101-618, Section 209(a)(2)). Therefore, the authorization to use Project water for municipal purposes does not result in recognition of the City's use of seepage water, as that use is not recognized as a valid water right under the laws of the State of Nevada concerning the appropriation of water.

In addition, in order to use Project water for municipal purposes, such use will need to comply with the efficiency mandates of Tribe v. Morton and the Newlands Project OCAP. Currently, the OCAP does not expressly address efficiency standards for municipal use. This is one reason why Reclamation and the City entered into a settlement agreement over the Truckee Division surface water rights acquired by the City. The settlement agreement provides a process to ensure that future municipal use by the City of those surface water rights achieves substantially the same efficiencies as Project irrigation uses. Otherwise, such use may conflict with P.L. 101-618's mandate to not "increase diversions of Truckee River water to the Newlands Project over those allowed under applicable operating criteria and procedures" (P.L. 101-618, Section 209(b)(1)).

Reclamation remains concerned about the City's water supply and hopes to work with the City on solutions as a way forward; however, your October 18, 2012, letter requests that Reclamation keep the Canal operational, not line the Canal, and keep water in the Canal on a year-round basis, all in recognition of claimed rights to seepage water which are not valid under Nevada law and which are not supported by Federal law. As part of Reclamation's Planning Study, all options must remain on the table as Reclamation considers future plans for this Federal facility. Reclamation commits to considering the City's historical use of Canal seepage water in our Planning Study and intends to assist the City, consistent with our authority.

Please direct any questions to Mr. Kenneth Parr, Lahontan Basin Area Office Area Manager, at kparr@usbr.gov or 775-882-3436.

Sincerely,

ACTING FOR

Donald R. Glaser
Regional Director

cc: Honorable Harry Reid
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