Appendix E
Descriptions and Costs for Water Supply Measures and Alternatives

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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Consideration of Measures for Water Supply Objective

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Attachments

Appendix E1 – Consideration of Measures for Water Supply Objective

Initially, more than 40 potential water supply measures were identified by the Study based on information from previous studies, programs, and projects. These measures were reviewed and others developed during Study team meetings, field inspections, and meetings to discuss the Study with Project stakeholders, agencies, and the public. The resulting 51 measures were grouped into 5 broad categories based on their intent or purpose, and further organized into 18 subcategories to allow for easy comparison and evaluation. This appendix provides a description of each measure and the type of information developed and used to assess it. The measures descriptions are provided in alphabetical order by category.

Table E1-1 indicates which measures are included in one or more of the preliminary alternatives described in Chapter 4.

Table E1-1. Measures Used in Preliminary Alternatives for Each Flow Stage

Water Supply Measure	600 cfs	350 cfs	250 cfs	150 cfs	0 cfs
Import Dixie Valley Groundwater		x	x	x	x
Line Main Canals and Laterals (Carson Division)		x	x	x	x
Compact Soil Lining of Main Canals and Laterals (Carson Division)		x	x	x	x
Line Truckee Canal		x	x		
Compact Soil Lining of Truckee Canal				x	
Acquire and Retire Water Rights		x	x	x	x
Crop Insurance/Fallowing		x	x	x	x
Partial Season Forbearance Agreements		x	x	x	x
Construct Pipeline to Agricultural Users					x
Treat Effluent and Deliver for Agricultural Use					x

Measure Name: Construct Carson River Pipeline to Serve Agricultural Users
Measure Category: Develop Alternative Sources
Measure Subcategory: Replace Truckee Canal Supply
Status: Not retained

Description: This measure serves water rights for agricultural use in the Truckee Division from the Carson River. It includes construction of a pump station and pipeline to convey Carson River supplies to the head works of the current distribution laterals. For alternatives where Truckee Canal capacities are zero, this measure serves rights within the Truckee Division without relying on the Truckee Canal.

Source: Study team

Estimated Cost: Cost estimates were not developed for measures that were not retained.

Water Supply Performance: The pumps and pipeline would need to supply approximately 2,301 acre-feet annually to the Truckee Division's agricultural users. While current levels of demand in the Truckee Division are about twice this amount, future changes in land uses are projected to reduce demand for Project water (see Appendix C).

Implementation Considerations: Implementation requires obtaining what would amount to "new" Carson River rights, or entails transferring rights from the Truckee Division to the Carson Division; both require the approval of the Nevada State Engineer for a change in point of diversion. There is no precedent for such acts, and the nature of Project rights as described in the *Orr Ditch* Decree and *Alpine* Decree likely prohibit transfers of rights across the two divisions (Jeff Rieker, Reclamation, personal conversation, December 15, 2011). Water rights in the Truckee Division are rights to Truckee River supplies diverted at Derby Dam only, and water rights in the Carson Division are rights to water stored at Lahontan Reservoir, primarily from the Carson River (Reclamation 2011i)[1]. Applications to transfer water rights across the divisions of the Project were filed before the State Engineer in 2011 and met with letters of protest from Reclamation, TCID, Churchill County, the City of Fernley, the City of Fallon, and CWSD (NDWR 2012).

Environmental Effects: Environmental effects were not assessed for measures that were screened out for unrelated reasons.

Rationale for Not Retaining: This measure is not retained for consideration due to high legal and institutional barriers to implementation.

Note:
[1] All references cited may be found in Chapter 7, "References."

Measure Name: Develop Local Groundwater to Serve Agricultural Users
Measure Category: Develop Alternative Sources
Measure Subcategory: Replace Truckee Canal Supply
Status: Not retained

Description: This measure installs new groundwater wells in the Truckee Division to supply water for irrigation. For alternatives where the Truckee Canal capacity is limited, this measure increases the capacity available for making deliveries to Lahontan Reservoir. For alternatives where Truckee Canal capacities are zero, this measure serves rights within the area without conveying water through the Fernley Reach.

Source: 1997 OCAP

Estimated Cost: Cost estimates were not developed for measures that were not retained.

Water Supply Performance: Water supply performance was not evaluated for measures that were not retained.

Implementation Considerations: Nevada's designated groundwater basins 76 and 101, which encompass the Truckee Division, is closed to new groundwater uses for irrigation purposes per Nevada State Engineer's Orders 1116 and 772 (NDWR 1978; NDWR 1995).

Environmental Effects: Environmental effects were not assessed for measures that were screened out for unrelated reasons.

Rationale for Not Retaining: This measure is not retained because of conflicts with current Nevada laws and regulations, which prohibit new groundwater wells to supply irrigation uses.

Measure Name: Develop Local Groundwater to Supply Stockwater
Measure Category: Develop Alternative Sources
Measure Subcategory: Replace Truckee Canal Supply
Status: Not retained

Description: This measure installs new groundwater wells to supply stockwater in the Truckee Division. For alternatives where the Truckee Canal capacity is limited, this measure increases the capacity available for making deliveries to Lahontan Reservoir. For alternatives where Truckee Canal capacities are zero, this measure serves rights within the area without conveying water through the Fernley Reach.

Source: 1997 OCAP

Estimated Cost: Cost estimates were not developed for measures that were not retained.

Water Supply Performance: The wells would need to satisfy the Truckee Division's current demand for stockwater (supplied by the Fernley Pipeline and direct canal takeouts) of approximately 1,300 acre-feet annually, and up to 325 acre-feet in the future (see Appendix A and Appendix C). The volume of stockwater deliveries, and thus canal capacity gains, is expected to be lower than necessary to satisfy the water supply performance criteria for this study. Additionally, groundwater in the Fernley-Wadsworth area may not be abundant enough to satisfy stockwater needs.

Implementation Considerations: This measure is subject to the same legal and institutional considerations as "Develop Local Groundwater to Serve Agricultural Users." However, since the use in this case is for stockwater, current laws and regulations may allow drilling of a domestic well to supply groundwater for this purpose under specific conditions. Domestic wells may be drilled without the Nevada State Engineer's approval, but are limited to household purposes in single family dwellings, such as the watering of a family garden, lawns, and the watering of livestock and domestic animals. The maximum amount of water that may be pumped from a domestic well is limited to 2 acre-feet per year (1,800 gallons per day) (NDCNR 2011; NDWR 2008). Nonetheless, drilling a domestic well is illegal when the subject parcel of land can be physically and legally supplied water from a public supply, which is likely the case so long as the Truckee Canal is still in use to serve the Truckee Division (NDWR 2011).

Environmental Effects: Environmental effects were not assessed for measures that were screened out for unrelated reasons.

Rationale for Not Retaining: This measure is not retained because it is unlikely to be sufficiently effective in meeting the water supply objective. This measure also has the potential to conflict with current Nevada laws and regulations, which prohibit new groundwater wells to supply irrigation uses in the vicinity of the Truckee Division.

Measure Name: Treat Effluent and Deliver for Agricultural Use
Measure Category: Develop Alternative Sources
Measure Subcategory: Supplement Truckee Division Supply
Status: Retained

Description: This measure serves agricultural water rights in the Truckee Division with treated wastewater from the City of Fernley's East Wastewater Treatment Facility. The facility is a secondary treatment plant with a current average treatment volume of 1.5 million gallons per day (MGD) (City of Fernley 2008b). At present, there are no plans for the City of Fernley to reuse treated wastewater, and it is discharged to the Fernley Wildlife Management Area and infiltrated into the local aquifer. Modifications would be required to the current treatment process to provide a higher level of filtration and disinfection (similar to California Title 22 drinking standards) for stockwater use or use on agricultural fields. Depending on the actual use, for instance if all supplies are applied to fields and not applied to stock, then the current level of treatment could be sufficient and the additional cost of tertiary treatment may be avoided. This measure would also require a conveyance equivalent to the "Construct Pipeline to Agricultural Users" measure for the Truckee Division; however, this cost is not included in the cost assessment below. For alternatives where Truckee Canal capacities are zero, this measure serves rights within the area without diverting water from the Truckee River.

Source: Study team

Estimated Cost:

Secondary Treatment

Secondary treatment is already provided and no additional costs are assumed to be required.

Tertiary Treatment

Field Cost: $3.1 million to $13 million
Annual Cost: $440,000 to $1.85 million
Estimate Level: Preliminary
Price Level: March 2012
Service-Life: 40 years

(See Appendix E2)

Water Supply Performance: Approximately 1,700 acre-feet per year may be available (City of Fernley 2008b). While this will only offset 26 percent of the anticipated agricultural demand, it could reduce the cost of operating the measure for "Construct Truckee River Intake and Pipeline to City of Fernley" if secondary treatment can meet the needs of agricultural water rights holders in these areas (see Appendix A and Appendix C).

Implementation Considerations: The City of Fernley would need to dedicate this supply for the Project's use, and would have to navigate the permitting process for supply treated effluent for agricultural use. At present time, no such reuse of treated effluent is planned (Fernley 2008b).

Measure Name: Treat Effluent and Deliver for Agricultural Use (contd.)
Environmental Effects: Implementation of this measure diverts supplies currently dedicated to the Fernley Wildlife Management Area and to the local groundwater, and potentially results in adverse effects for both (City of Fernley 2008b).

Compatibility with Other Measures: This measure is retained only for alternatives constructed around the 0 cfs flow stage.

Measure Name: Import Dixie Valley Groundwater
Measure Category: Develop Alternative Sources
Measure Subcategory: Supplement Carson Division Supply
Status: Retained

Description: This measure considers delivering groundwater from Dixie Valley for use in the Carson Division and is based on a proposal developed and studied by Churchill County. This measure includes a range of actions depending on the desired capacity (5,000 – 11,000 gpm) for facilities to deliver Dixie Valley supplies into the Lahontan Valley. Construction of several facilities would be required, including a pressurized pipeline that would cross over Sand Pass adjacent to Highway 50, groundwater wells, one or several large-scale pumping plants, a treatment facility to remove arsenic and fluoride, and electrical transmission lines (Churchill County 2007). This measure could contribute to the water supply objective of this Study through augmenting the Carson Division's supply in all years, or in years where supplies from the Carson and Truckee rivers are not sufficient for meeting the water rights within the division.

Source: Churchill County 2007

Estimated Cost:
Field Cost: $63 million to $135 million
Annual Cost: $4.4 million to $11 million
Estimate Level: Preliminary
Price Level: January 2012
Service-Life: Varies 20 – 65 years
(See Appendix E2)

Water Supply Performance: The anticipated yield is assumed to be up to 35,000 acre-feet per year, which is a middle value among the range of various estimates between 20,000 and 56,000 acre-feet per year (Churchill County 2003a; Churchill County 2007; Mahannah 2005; Reclamation 2009b; Brad Goetsch, Churchill County, personal communication, August 25, 2011). For the purpose of analyses, this supply is assumed to remain constant across all year types.

Implementation Considerations: Competition for Dixie Valley's groundwater is fierce, and rights to the water would need to be secured to use it for the Project's purposes. Currently 30 leases within or along the edges of Dixie Valley have been obtained for planned geothermal plants that could use up all of the groundwater resources (Brad Goetsch, Churchill County, personal communication, August 25, 2011). Churchill County owns title to the vast majority, if not all, of the groundwater rights in the basin (Reclamation 2009b). The county has indicated that they view the water as a potential source of future supply and dry-year supply, presumably for M&I (Churchill County 2007; Brad Goetsch, Churchill County, personal communication, August 25, 2011). For this reason, although it is possible that the water may be useable for Newlands Project needs, agreement from Churchill County is both required and may also represent a challenge to obtain (Reclamation 2009b).

Measure Name: Import Dixie Valley Groundwater (contd.)
Environmental Effects: To be determined only if this measure is included in an alternative.

Compatibility with Other Measures: This measure is retained only for potential use in combination with other measures in alternatives built around flow stages of 350 cfs, 250 cfs, 150 cfs, and 0 cfs.

Measure Name: Construct Pipeline to Agricultural Users
Measure Category: Develop Alternative Sources
Measure Subcategory: Establish New Truckee Division Points of Diversion and Delivery
Status: Retained

Description: This measure serves agricultural water rights in the Truckee Division from the Truckee River. This measure includes construction of a 50 cfs, 1,700 horsepower pump station and pipeline (approximately 18.3 miles) to convey these supplies to the head works of the current distribution laterals (TC-01 to TC-13). The pipeline would connect to the City of Fernley's planned surface water diversion facility, which will either take water directly from the Truckee River or from the Truckee Canal at the TC-1 lateral. For alternatives where Truckee Canal capacities are zero, this measure serves rights within the area without conveying water through the Fernley Reach. This measure could also be combined with other measures to serve Truckee Division agriculture with direct diversions from treated effluent.

Source: Study team

Estimated Cost:
Field Cost: $110 million to $120 million
Annual Cost: $7.9 million to $8.6 million
Estimate Level: Preliminary
Price Level: March 2012
Service-Life: Varies 20 – 30 years
(See Appendix E2)

Water Supply Performance: The pumps and pipeline would need to supply approximately 6,530 AF annually to the Truckee Division's agricultural users. While current levels of demand in the Truckee Division are about twice this amount, future changes in land uses are projected to reduce demand for Project water (see Appendix C). As this supply is derived from the Truckee River, it would be delivered with the same certainty or reliability as water rights holders in these areas currently experience.

Implementation Considerations: Direct diversion from the Truckee River may require obtaining approval of the Nevada State Engineer for a change in point of diversion for Project rights held by Truckee Division users. There may be a related question about the legality of exercising Claim 3 rights under the *Orr Ditch* Decree directly from the Truckee River (Reclamation 2011i); it is possible that this question would be resolved if the intake and pipeline facilities are owned by Reclamation and operated under contract by TCID or another entity subject to and in concert with the diversion rules and restrictions specified by OCAP.

Environmental Effects: To be determined only if this measure is included in an alternative.

Measure Name: Construct Pipeline to Agricultural Users (contd.)
Compatibility with Other Measures: This measure is retained only for potential use in combination with other measures in alternatives built around flow stages of 0 cfs. This measure could be combined with measures to serve Truckee Division agriculture from treated effluent.

Measure Name: Construct Truckee River Intake and Pipeline to City of Fernley
Measure Category: Develop Alternative Sources
Measure Subcategory: Establish New Truckee Division Points of Diversion and Delivery
Status: Not retained

Description: This measure serves the water rights held by City of Fernley and agricultural users within the Truckee Division, through a consolidated diversion located on the Truckee River. The on-river intake and pipeline would deliver surface water to the Fernley Water Treatment Facility and then to the existing distribution network capable of delivering these surface water rights. For alternatives where the Truckee Canal capacity is limited, this measure increases the capacity available for making deliveries to Lahontan Reservoir. For alternatives where Truckee Canal capacities are zero, this measure satisfies water rights within the area. Fernley is already studying the feasibility and preliminary design for a similar facility (City of Fernley 2011a).

Source: Suggestion from the Pyramid Lake Paiute Tribe and Stetson Engineering, Inc. (Ali Shahroody, personal communication, August 24, 2011). Proposal evaluated in City of Fernley 2011a.

Estimated Cost:
Field Cost: $8.9 million to $14 million
Annual Cost: $860,000 to $1.35 million
Estimate Level: Preliminary
Price Level: January 2012
Service-Life: Varies 30 – 65 years
(See Appendix E2)

Water Supply Performance: The intake and delivery system would need to supply between 11,249 AF and 17,779 AF per year, commensurate with the projected future Newlands Project demands from the City of Fernley and Truckee Division agricultural users (see Appendix C).

Implementation Considerations: Implementation would likely require consultation with the Pyramid Lake Paiute Tribe, as studies by the City of Fernley indicate one of the best locations for an intake structure and associated facilities is on or crossing land that is part of the Pyramid Lake Paiute Indian Reservation (City of Fernley 2011a). It also may require obtaining approval of the Nevada State Engineer for a change in point of diversion for Project rights held by Truckee Division users. There may be a related question about the legality of exercising Claim 3 rights under the *Orr Ditch* Decree directly from the Truckee River (Reclamation 2011i); this question may be resolved if the facility is owned by Reclamation and operated under contract by TCID or another entity, subject to and in concert with the same diversion rules and restrictions specified by OCAP. Additional detail on requirements Fernley would need to meet to be served Newlands Project water is discussed in Attachment: Settlement Agreement Between the City of Fernley and the United States.

Measure Name: Construct Truckee River Intake and Pipeline to City of Fernley (contd.)

Environmental Effects: Environmental effects were not assessed for measures that were screened out for unrelated reasons.
Compatibility with Other Measures: **This measure is not retained. The City of Fernley has indicated that it intends to move forward and implement a plan that would construct a structure similar what this measure proposes.**

Measure Name: Deliver from TC-1
Measure Category: Develop Alternative Sources
Measure Subcategory: Establish New Truckee Division Points of Diversion and Delivery
Status: Not retained

Description: This measure would help serve the water rights held by City of Fernley and Truckee Division agricultural users through a consolidated diversion from the Truckee Canal, located at TC-1. The Truckee Canal's TC-1 turnout would be improved and upgraded to provide convenient access to: (1) the City of Fernley's water treatment plant, and (2) surface water delivery system for agricultural users within the Fernley area. A check structure and wasteway would be constructed at the new location for safe operation of the Truckee Canal. This measure assumes the existing pipe distribution network capable of delivering surface water for agricultural users within the Fernley area. For alternatives where the Truckee Canal capacity is limited, this measure increases the capacity available for making deliveries to Lahontan Reservoir. For alternatives where Truckee Canal capacities are zero, this measure serves rights within the area without conveying water through the Fernley Reach.

Source: Idea developed by Study team, using Corrective Action Study (Reclamation 2011e).

Estimated Cost:
Costs for this measure vary, based on the flow-stage condition for the Truckee Canal specified by each alternative.

<u>600, 350, and 250 cfs Flow Stages</u>

Alternatives with flow stages between 600 and 250 cfs, which already include extensive repairs to the Truckee Division, have costs for this measure included in the cost for providing for the safety objective.

<u>150 cfs Flow Stage</u>

Alternatives with a flow stage of 150 cfs, which does not necessarily include actions to refurbish the canal outside of this measure, would require the costs of relocating the TC-1 check structure.

Field Cost: $1.25 million

Annual Cost: $61,000

<u>0 cfs Flow Stage</u>

Alternatives considering decommissioning the canal would receive a cost savings through the implementation of this measure, as the cost of relocating TC-1, and refurbishing both Derby Dam and the Derby Reach would be less than the cost of decommissioning them.

Field Cost: $940,000 savings

Annual Cost: $46,000 savings

Estimate Level: Appraisal
Price Level: January 2012
Service-Life: 50 years
(See Appendix E2)

Measure Name: Deliver from TC-1 (contd.)
Water Supply Performance: The intake and delivery system would supply up to 10,000 AF per year, commensurate with Fernley's existing Newlands Project water rights (City of Fernley 2011a); and, in the future, it would need to supply up to11,300 AF for the City of Fernley and 3,300 AF for Truckee Division agriculture (see Appendix C).

Implementation Considerations: Implementation would likely require consultation with the Pyramid Lake Paiute Tribe, as the TC-1 turnout is located on the Pyramid Lake Paiute Indian Reservation near Wadsworth (City of Fernley 2009b). Fernley would also need to submit a formal Authorization Request to Reclamation for use of Federal facilities to deliver their water. Pursuant to a settlement agreement with the Federal Government, to make such a request, Fernley would need to undertake an environmental review process, as well as produce an efficiency study, a comprehensive accounting of all the community's water rights and sources, a water conservation plan, and a construction plan (Kenneth Parr, Reclamation, personal communication, December 15, 2011). Additional detail on requirements Fernley would need to meet to be served Newlands Project water is discussed in Attachment: Settlement Agreement Between the City of Fernley and the United States.

Environmental Effects: Environmental effects were not assessed for measures that were screened out for unrelated reasons.

Compatibility with Other Measures: This measure is not retained. The City of Fernley has indicated that it intends to move forward and implement a plan that would construct a structure similar what this measure proposes.

Measure Name: Deliver TCID Supplies from Donner Lake
Measure Category: Develop or Use Upper Basin Storage
Measure Subcategory: Access Truckee River Storage
Status: Not retained

Description: This measure considers allowing for the conveyance of up to half of the water at Donner Lake to be delivered through the Truckee Canal for Project use during periods when Carson River and Truckee River supplies are insufficient for meeting Newlands Project demands or OCAP storage targets in Lahontan Reservoir. Rights to the water are owned privately by TCID and Truckee Meadows Water Authority (TMWA) (CDWR 1991; NDWR 1997).

Source: Suggestion from TCID (Rusty Jardine and Walt Winder, personal communication, June 15, 2011).

Estimated Cost: Cost estimates were not developed for measures that were not retained.

Water Supply Performance: Up to about 4,200 acre-feet per year could be available for Project use, if authorized. Donner Lake is capable of storing up to 9,500 acre-feet, although the annual average released from the lake is approximately 6,285 acre-feet, and the total amount of water stored is owned jointly with TMWA.

Implementation Considerations: Conveying privately owned water from Donner Lake through public facilities such as the Truckee Canal would require TCID to obtain a Warren Act contract with Reclamation (Rusty Jardine and Walt Winder, TCID, personal communication, August 23, 2011; Harvey Edwards, Reclamation, personal communication, September 26, 2011). Previous attempts by TCID to obtain such a contract met with protest from the Pyramid Lake Paiute Tribe (NDWR 1997). In the past, Donner Lake water has been used to satisfy TCID's recoupment obligations, and thus may be dedicated to such uses in the future (TCID 2010). Additionally, based on the Nevada State Engineer's June 2011 ruling on water rights application 9330, Donner Lake water could only be used for the Project's benefit during times when the amount of water diverted into the Truckee Canal was the maximum allowed; however, under such conditions the canal would not have enough carrying capacity to divert additional flows.

Environmental Effects: Environmental effects were not assessed for measures that were screened out for unrelated reasons.

Rationale for Not Retaining: Not retained due to high institutional barriers to implementation.

Measure Name: Multi-Year Upstream Storage
Measure Category: Develop or Use Upper Basin Storage
Measure Subcategory: Access Truckee River Storage
Status: Retained in concept only

Description: This measure considers allowing Newlands Project supplies from the Truckee River (Claim 3 under the *Orr Ditch* Decree) to be stored in upstream reservoirs on the Truckee River (e.g. Prosser Reservoir) during periods when either the Truckee Canal or Lahontan Reservoir are incapable of capturing, storing, or delivering those supplies. This measure considers allowing those supplies to be held in storage as carry over, from year-to-year, until such a time that they could be delivered.

Source: Suggestion from TCID (Rusty Jardine and Walt Winder, personal communication, June 15, 2011; Ernie Schank, personal communication, August 25, 2011).

Estimated Cost: This measure requires changes in operations that would require costs to negotiate, but no additional costs to implement and administrate beyond current project operations.

Water Supply Performance: Multi-year storage on the Truckee River could be the cheapest and most effective method for improving the reliability of the Newlands Project water supplies, regardless of Truckee Canal capacities (see Appendix D6). Several institutional barriers exist that prevent this measure from being evaluated with modeling tools. An appropriate technical evaluation would require the development of computer logic describing the constraints on such a program. The development of an appropriate framework of constraints would require the participation of several stakeholders, and the time and scope to achieve this does not exist within the scope of this Study. Because the necessary legal and political foundations for evaluating this measure do not exist, the technical evaluation of this measure is not possible.

Implementation Considerations: Currently, TCID and Project users do not have access to storage in upstream Truckee River reservoirs under TROA, the negotiated agreement that allows other water users in the basin to exchange water supplies and storage space to ensure water is available when needed for human and environmental uses. A multi-year storage agreement would likely need to be negotiated separately between TCID, Reclamation, and another party such as TMWA or the Pyramid Lake Paiute Tribe. Given the ultimate withdrawal of TCID from the TROA negotiations, this measure does not seem politically feasible at this time.

Environmental Effects: Environmental effects were not assessed for this measure.

Compatibility with Other Measures: This measure presents a high potential for meeting the Study's water supply objective. However, the ability to estimate the effectiveness of this measure is impossible to test without large, speculative assumptions.

Measure Name: Construct East Fork Carson Reservoir
Measure Category: Develop or Use Upper Basin Storage
Measure Subcategory: Increase Storage in the Upper Carson Basin
Status: Not retained

Description: This measure considers building a reservoir on the upper Carson River, possibly in the East Fork Carson River location originally identified for Watasheamu Dam, to capture inflow from the Carson River for use by the Newlands Project.

Source: Suggestion from TCID management (Rusty Jardine and Walt Winder, personal communication, June 15, 2011).

Estimated Cost: Cost estimates were not developed for measures that were not retained.

Water Supply Performance: Yield for the Project's use is not anticipated from any additional storage. Under administration of the *Alpine* Decree, the Carson River is managed such that it is extremely difficult to ensure that water released upstream would be available for downstream users. It is likely that the supply stored would be used entirely by *Alpine* Decree rights holders in the upper Carson River basin before reaching Lahontan Reservoir.

Implementation Considerations: Attempts have been made to build a dam on the East Fork of the Carson River. Watasheamu Dam, originally authorized as part of the Washoe Project (Reclamation 1991), was never built, and the Federal Government's authorization to construct it was revoked with the passage of Public Law 101-618 in 1990. The plan for the dam and reservoir included a footprint that stretched across the state line into California; thus, California would likely need to be involved in pursuing this action (Harvey Edwards, Reclamation, personal conversation, September 26, 2011). Additionally, to implement this measure effectively for the Project's benefit, Carson River management practices would need to change significantly from those outlined in the *Alpine* Decree (Edwin James, CWSD, personal conversation, December 5, 2011).

Environmental Effects: In addition to the specific environmental effects that are possible in the immediate dam and reservoir area, there is the potential that additional storage in the upper Carson River basin could actually result in reduced supplies flowing to Lahontan Reservoir. If this were the case, the Project as a whole could become more dependent on Truckee River supplies. This formed the basis of the Pyramid Lake Paiute Tribe's challenge to the Washoe Project (Wilds 2010).

Rationale for Not Retaining: Not retained due to negligible contributions to meeting the water supply objective, high institutional barriers, and large potential environmental concerns.

Measure Name: Expansion or Dedication of Existing Carson Reservoirs for Project Use
Measure Category: Develop or Use of Upper Basin Storage
Measure Subcategory: Increase Storage in the Upper Carson Basin
Status: Not retained

Description: This measure considers expansion or dedication of existing reservoirs in the upper Carson River watershed to allow for storage of Carson River water for use by Newlands Project water rights holders.

Source: Suggestion from the Carson Water Subconservancy District (Edwin James, personal communication, December 5, 2011).

Estimated Cost: Cost estimates were not developed for measures that were not retained.

Water Supply Performance: Performance for dedicating existing storage was evaluated and found to be modest, although very few reservoirs exist in the upper Carson River basin and total storage is small (11,766 acre-feet) relative to the needs of Study alternatives. While these reservoirs typically fill even in dry conditions, these reservoirs play a crucial role in helping existing agricultural endure dry conditions and may not be easily obtainable for conditions where the supply would help the Newlands Project most (Garry Stone, Federal Watermaster, personal communication, March 19, 2012). Nonetheless, this Study's analysis indicates that dedication of all upper basin storage would contribute modestly to the water supply objective (see Appendix D5).

Implementation Considerations: To implement this measure effectively for the Project's benefit, Carson River management practices would need to change significantly from those outlined in the *Alpine* Decree (Edwin James, CWSD, personal conversation, December 5, 2011). Additionally, it would require acquisition or dedication of all upstream storage rights. Given the competition for upper basin rights and the demand from communities such as Carson City, it is highly unlikely that the present owners of such rights would be willing to sell or dedicate them to the Project.

Environmental Effects: There would be specific environmental effects that are possible in the immediate dam and reservoir area because of the increase in inundation.

Rationale for Not Retaining: Not retained due to negligible contributions to meeting the water supply objective, high institutional barriers, and large potential environmental concerns.

Measure Name: Dredge or Reshape Sheckler Reservoir
Measure Category: Improve Carson River Supplies
Measure Subcategory: Improve Storage Below Lahontan Dam
Status: Not retained

Description: This measure considers dredging or reshaping Sheckler Reservoir to expand its available storage space beyond the existing capacity of 27,600 AF. Since 1991, the reservoir has been dry except during years of high flows when it is used to store precautionary and spill releases from Lahontan Reservoir to minimize any flooding potential within Lahontan Valley (TCID 2010). Increasing Sheckler's storage space would allow the reservoir to be used as supplementary storage for Lahontan Reservoir, but without removing its function as a flood risk management feature.

Source: Study team

Estimated Cost: Cost estimates were not developed for measures that were not retained.

Water Supply Performance: The yield from this measure is undetermined and highly dependent on other factors, such as the capacity gained through dredging and reshaping, as well as the frequency of use beyond spill recovery and flood management needs. If filled regularly and used as supplementary storage, Sheckler would improve TCID's ability to deliver water quickly when it is required, possibly helping irrigators avoid over-estimating their needs. Unless combined with a measure to reduce seepage, expanding storage capacity at Sheckler Reservoir may result in increased efficiency losses of around 5,700 acre-feet annually, depending on how often it is used (Reclamation 1994). Additionally, as the reservoir is very shallow, evaporation rates from Sheckler would likely be high.

Further, the effect of storage increases in the Newlands Project were assessed and found to result in negligible changes to water supply reliability, mostly because of the way in which Truckee Canal deliveries are balanced with inflows to Project reservoirs under the Operating Criteria and Procedures for the Newlands Project (see Appendix D7).

Implementation Considerations: Implementation considerations were not identified for measures that were not retained.

Environmental Effects: Environmental effects were not assessed for measures that were screened out for unrelated reasons.

Rationale for Not Retaining: Not retained due to uncertain contributions to meeting the water supply objective, high institutional barriers, and large potential environmental concerns.

Measure Name: Storage at Naval Bombing Range
Measure Category: Improve Carson River Supplies
Measure Subcategory: Improve Storage Below Lahontan Dam
Status: Not retained

Description: This measure considers constructing a new reservoir at the NAS Fallon Bravo-16 bombing range to capture and store water within the Carson Division. The range is south of Sheckler Reservoir and 9 miles southwest of NAS Fallon. This includes development of the site to allow for suitable storage conditions, and a dual-directional conveyance that can convey supplies to the site, and pump supplies back into the Carson Division from the site.

Source: Public Comments, August 2011

Estimated Cost: Cost estimates were not developed for measures that were not retained.

Water Supply Performance: Water supply performance was not assessed for measures that were not retained.

Implementation Considerations: The B-16 range is part of the Fallon Range Training Complex, and is thus in regular use for naval strike warfare training purposes, including integrated air-to-ground training, practice/inert ordnance, and ground training. This land, and more than 600 acres east of B-16, is considered "closed" to non-military personnel and uses for safety reasons (BLM 2001).

Further, the effect of storage increases in the Newlands Project were assessed and found to result in negligible changes to water supply reliability, mostly because of the way in which Truckee Canal deliveries are balanced with inflows to Project reservoirs under the Operating Criteria and Procedures for the Newlands Project (see Appendix D7).

Environmental Effects: Chemical constituents related to ordnance detonation may exist within the groundwater or soils that could make water stored in this location unsuitable for agricultural use (Public Comments, August 2011).

Rationale for Not Retaining: Not retained due to restrictions on non-military activities and public access at the potential storage site.

Measure Name: Storage on Tribal Lands
Measure Category: Improve Carson River Supplies
Measure Subcategory: Improve Storage Below Lahontan Dam
Status: Not retained

Description: This measure considers constructing new reservoir facilities at the Fallon Paiute-Shoshone Tribal reservation to capture and store water within the Carson Division.

Source: Suggestion from the Fallon Paiute-Shoshone Tribe (Alvin Moyle, personal communication, August 22, 2011).

Estimated Cost: Cost estimates were not developed for measures that were not retained.

Water Supply Performance: The effect of storage increases in the Newlands Project were assessed and found to result in negligible changes to water supply reliability, mostly because of the way in which Truckee Canal deliveries are balanced with inflows to Project reservoirs under the Operating Criteria and Procedures for the Newlands Project (see Appendix D7).

Implementation Considerations: Implementation considerations were not identified for measures that were not retained.

Environmental Effects: Environmental effects were not assessed for measures that were screened out for unrelated reasons.

Rationale for Not Retaining: Not retained due to anticipated low contributions to water supply objective.

Measure Name: Open Carp Dam
Measure Category: Improve Carson River Supplies
Measure Subcategory: Increase Lahontan Dam Storage
Status: Not retained

Description: This measure considers reopening the southeastern portion of Lahontan Reservoir, currently closed to storage by Carp Dam. This measure includes the removal of Carp Dam, and possibly lining or compacting the reservoir bed to reduce seepage losses.

Source: Suggestion from USFWS Stillwater National Wildlife Refuge Office (Richard Grimes, personal communication, August 25, 2011).

Estimated Cost: Cost estimates were not developed for measures that were not retained.

Water Supply Performance: Opening this area to storage would increase active reservoir capacity by up to 7,800 acre-feet (Reclamation 1994). However, this volume of water is unlikely to be captured every year, as the Carp Dam lobe would not begin to fill until the reservoir storage exceeds 244,200 acre-feet (Reclamation 2009b). If this area is not improved to prevent seepage, a daily 2 percent loss would be assumed (Reclamation 1994).

Further, the effect of storage increases in the Newlands Project were assessed and found to result in negligible changes to water supply reliability, mostly because of the way in which Truckee Canal deliveries are balanced with inflows to Project reservoirs under the Operating Criteria and Procedures for the Newlands Project (see Appendix D7).

Implementation Considerations: Implementation considerations were not identified for measures that were not retained.

Environmental Effects: Reopening Carp Dam for additional storage may require moving cottonwood trees currently in this area of the reservoir pool. Additional, it could inundate a nearby Boy Scout camp area. However, these would not be difficult to mitigate.

Rationale for Not Retaining: Not retained due to anticipated low contributions to water supply objective and minimal benefit to the overall Project.

Measure Name: Raise Lahontan Dam
Measure Category: Improve Carson River Supplies
Measure Subcategory: Increase Lahontan Dam Storage
Status: Not retained

Description: This measure considers raising the spillway invert and the crest of Lahontan Dam by 10 feet to increase the active storage of the reservoir.

Source: Reclamation 2009b

Estimated Cost: Cost estimates were developed in a previous Reclamation study (Reclamation 2009b), but were not included in this Study because this measure was not retained.

Water Supply Performance: In theory, a 10-foot dam raise would provide space for an additional 166,000 acre-feet of water by increasing the available active storage from 316,900 acre-feet (current capacity when flashboards are in use) to 456,100 acre-feet (Reclamation 2009b). In reality, additional storage capacity in Lahontan Reservoir produces a number of changes to water supply deliveries in the Truckee and Carson river basins, but does not increase water supply reliability for the Newlands Project overall (see Appendix D7). Increased storage capacity would allow Lahontan Reservoir to capture a greater portion of Carson River inflows, resulting in a reduction in spills. However, OCAP establishes end-of month storage targets in Lahontan Reservoir, and limits the volume of water that can be delivered from the Truckee River to the volumes necessary for meeting these storage targets. Thus, additional storage space would not benefit the Project unless OCAP storage targets—or the process for setting them—were modified.

Implementation Considerations: Raising Lahontan Dam may require acquiring Federal, state, and private land along the portions of the shoreline that would be inundated by the raise, as well as land for enlargement of the current dam, dikes and embankments. In addition to acquiring land for the facilities, 3 miles of Highway 50 and 10 miles of railroad track would also need to be protected or relocated.

Environmental Effects: This measure would likely reduce the total diversion into the Truckee Canal in the long term to the benefit of the Truckee River and Pyramid Lake, but would reduce total deliveries to the Stillwater NWR, which benefits from water received when the Lahontan Reservoir spills. By increasing the reservoir's total pool, this measure would inundate existing recreational facilities that support boating, camping, fishing, and other activities at Lahontan State Recreation Area. There is the potential that it could impact the wastewater treatment plant and property in Silver Springs (Reclamation 2009b).

Rationale for Not Retaining: Not retained due to anticipated low contributions to water supply objective.

Measure Name: Retrofit or Improve Flashboards
Measure Category: Improve Carson River Supplies
Measure Subcategory: Increase Lahontan Dam Storage
Status: Not retained

Description: This measure considers improving flashboards on Lahontan Dam to increase their structural integrity, thereby providing additional surcharge storage during conditions with high inflows and high reservoir elevations. Different options could provide up to 1.5 feet of additional reservoir elevation, such as a rubber dam or Obermeyer gates (Locke Hahne, Reclamation, personal communication, September 26, 2011). This measure would also involve a change to Lahontan Dam operations to allow water to be stored on the flash boards before peak runoff has occurred.

Source: Study team

Estimated Cost: Cost estimates were not developed for measures that were not retained.

Water Supply Performance: A 1.5-foot dam raise would provide 20,000 acre-feet of additional storage, obtained by allowing the Lahontan Reservoir to surcharge during wet hydrologic conditions. Additional storage capacity in Lahontan Reservoir was evaluated, and found to produce a number of changes to water supply deliveries in the Truckee and Carson river basins, but does not increase water supply reliability for the Newlands Project overall (see Appendix D7). Increased storage capacity would allow Lahontan Reservoir to capture a greater portion of Carson River inflows, resulting in a reduction in spills. However, OCAP establishes end-of month storage targets in Lahontan Reservoir, and limits the volume of water that can be delivered from the Truckee River to the volumes necessary for meeting these storage targets. Thus, additional storage space would not benefit the Project unless OCAP storage targets—or the process for setting them—were modified.

Implementation Considerations: Regular use of flashboards to increase storage could trigger dam safety concerns, depending on the availability of conveyance for spills below Lahontan Reservoir. Improved conveyance below Lahontan could provide appropriate mitigation for this concern. (Jeff Rieker, Reclamation, personal conversation, September 26, 2011).

Environmental Effects: This measure would likely reduce the total diversion into the Truckee Canal in the long term to the benefit of the Truckee River and Pyramid Lake, but would reduce total deliveries to the Stillwater NWR, which benefits from water received when the Lahontan Reservoir spills. It is unlikely that increasing the reservoir's total pool by 1.5 feet would inundate existing recreational facilities that support boating, camping, fishing, other activities at Lahontan State Recreation Area, or the wastewater treatment plant and property in Silver Springs.

Rationale for Not Retaining: Not retained due to anticipated low contributions to water supply objective and minimal benefit to the overall Project.

Measure Name: Change Enforcement of *Alpine* Decree
Measure Category: Improve Carson River Supplies
Measure Subcategory: Reduce Diversions from Upper Carson Basin
Status: Not retained

Description: This measure involves fundamentally changing enforcement of water rights on the Carson River to approach that enforces duties from a basin-wide perspective, rather than by individual river segments. As such, this action would also include establishment of a comprehensive metering and monitoring program to ensure consistent compliance with water rights across each segment of the Carson River.

Source: 1997 OCAP

Estimated Cost: Cost estimates were not developed for measures that were not retained.

Water Supply Performance: Given the uncertainties noted below, it is not possible to estimate anticipated yield for the purposes of this Study.

Implementation Considerations: Enforcing Carson River water rights in a consistent manner across the whole river based on duty would require wholesale changes to the Alpine Decree, which would likely need to be resolved through comprehensive litigation (Jeff Rieker, Reclamation, personal conversation, September 26, 2011; Edwin James, CWSD, personal communication, December 5, 2011). This represents a challenge given that the original adjudication of the Carson River took approximately 55 years to complete. However, TCID, the Pyramid Lake Paiute Tribe, Churchill County, and other Project users and stakeholders have expressed interest in additional scrutiny of water use in the upper Carson River basin, which indicates that there may be opportunities for pursuing this measure in the future following additional study.

Environmental Effects: Environmental effects were not assessed for measures that were screened out for unrelated reasons.

Rationale for Not Retaining: Not retained due to high institutional barriers and uncertain contributions to water supply objective.

Measure Name: Purchase and Retire Upper Carson River Rights
Measure Category: Improve Carson River Supplies
Measure Subcategory: Reduce Diversions from Upper Carson Basin
Status: Not retained

Description: This measure considers purchasing and retiring water-righted properties from willing sellers in the lower segments of the Carson River, starting with Segment 7 above Lahontan Dam. The water rights would go unexercised and thus flow into Lahontan Reservoir, adding to the available supply for Project use. Other studies have identified retirement of Carson River rights in Segment 7 as one of the only feasible means for increasing inflow to Lahontan Reservoir under the Alpine Decree (CWSD 1998).

Source: Suggestion from the Carson Water Subconservancy District (Edwin James, personal communication, December 5, 2011).

Estimated Cost:
Acquisition Cost: $1,250 to $1,500 per acre-foot
Annual Cost: $72 to $87 per acre-foot
Estimate Level: Preliminary
Price Level: March 2012
Loan-Duration: 30 years
(See Appendix E2)

Water Supply Performance: Performance for purchasing Segment 7 rights was evaluated and found to result in modest changes to the water supply of the Newlands Project for a variety of reasons. First, the available water rights are not entirely reliable, and tend to be less available during periods when the additional supplies are most needed. More significantly, OCAP establishes end-of month storage targets in Lahontan Reservoir, and limits the volume of water that can be delivered from the Truckee River to the volumes necessary for meeting these storage targets. Unless the additional inflow from the Carson River rights can exceeds Truckee River diversions, the effect of increasing inflows to Lahontan Reservoir is a net reduction in Truckee River diversions with no increase in water supply for the Newlands Project (see Appendix D7). Nonetheless, this Study's analysis indicates that purchasing all of the rights in Segment 7 would contribute to the water supply objective (see Appendix D5).

Implementation Considerations: Implementation considerations were not identified for measures that were not retained. Given the competition for upper basin rights and the demand from communities such as Carson City, it is highly unlikely that the present owners of Segment 7 rights would be willing to sell or dedicate them to the Project.

Environmental Effects: Retiring water-righted land from production could result in dust and related air quality problems similar to those associated with temporary or permanent fallowing.

Measure Name: Purchase and Retire Upper Carson River Rights (contd.)

Rationale for Not Retaining: Not retained due to anticipated low contributions to water supply objective.

Measure Name: Automate/Telemeter Structures
Measure Category: Increase Efficiency
Measure Subcategory: Improve Carson Division Delivery Operations
Status: Not retained

Description: This measure considers installing instrumentation to allow water control and delivery structures to be operated remotely or on a schedule, and adjusted automatically. This would ensure deliveries are measured and made accurately, reducing operational spills, or the potential for human error.

Source: Reclamation 1994; 1997 OCAP; suggestion from USFWS Stillwater National Wildlife Refuge Office (Richard Grimes, personal communication, August 25, 2011).

Estimated Cost: Cost estimates were developed in a previous Reclamation study (Reclamation 1994), but were not included in this Study because this measure was not retained.

Water Supply Performance: Indirect water savings from automation are impossible to calculate; however, some amount of savings is possible (Reclamation 1994).

Implementation Considerations: Implementation considerations were not identified for measures that were not retained.

Environmental Effects: Environmental effects were not assessed for measures that were screened out for unrelated reasons.

Rationale for Not Retaining: Not retained due to uncertain contributions to meeting water supply objective.

Measure Name: Community Rotation System
Measure Category: Increase Efficiency
Measure Subcategory: Improve Carson Division Delivery Operations
Status: Not retained

Description: This measure considers delivering water supplies to subdivided areas within the overall Carson Division, rather than in response to individual water orders. This could have the effect of reducing seepage during delivery.

Source: Reclamation 1994; 1997 OCAP; suggestion from USFWS Stillwater National Wildlife Refuge Office (Richard Grimes, personal communication, August 25, 2011).

Estimated Cost: Cost estimates were not developed for measures that were not retained.

Water Supply Performance: There are no anticipated water savings, as water is already delivered under such an approach (Rusty Jardine and Walt Winder, TCID, personal communication, August 23, 2011).

Implementation Considerations: Implementation considerations were not identified for measures that were not retained.

Environmental Effects: Environmental effects were not assessed for measures that were screened out for unrelated reasons.

Rationale for Not Retaining: Not retained due to anticipated low contributions to meeting water supply objective, given level of existing implementation.

Measure Name: Drain Canals in Non-Irrigation Seasons
Measure Category: Increase Efficiency
Measure Subcategory: Improve Carson Division Delivery Operations
Status: Not retained

Description: This measure considers draining primary canals within the Carson Division at the end of the irrigation season to prevent loss of water due to seepage and evapotranspiration.

Source: 1997 OCAP

Estimated Cost: Cost estimates were not developed for measures that were not retained.

Water Supply Performance: Water savings are not anticipated, as canals are already drained when not in use for irrigation or stockwater purposes, or to store water as a result of precautionary draw-downs at Lahontan Reservoir (Rusty Jardine and Walt Winder, TCID, personal communications, August 23, 2011, and February 10, 2012).

Implementation Considerations: Implementation considerations were not identified for measures that were not retained.

Environmental Effects: Environmental effects were not assessed for measures that were screened out for unrelated reasons.

Rationale for Not Retaining: Not retained due to anticipated low contributions to meeting water supply objective, given level of existing implementation.

Measure Name: Improve Ditch Rider Training
Measure Category: Increase Efficiency
Measure Subcategory: Improve Carson Division Delivery Operations
Status: Not retained

Description: This measure considers increasing the frequency and requirements for training ditch riders, who monitor and control flows within the Carson and Truckee division canals and laterals. This measure would contribute to the water rights reliability objective of this Study by reducing human error within the operation of the Carson Division.

Source: Reclamation 1994; 1997 OCAP; suggestion from USFWS Stillwater National Wildlife Refuge Office (Richard Grimes, personal communication, August 25, 2011).

Estimated Cost: Cost estimates were not developed for measures that were not retained.

Water Supply Performance: The expected water savings from training ditch riders is difficult to quantify because it would only be achieved in combination with other measures, such as metering (Reclamation 1994).

Implementation Considerations: Implementation considerations were not identified for measures that were not retained.

Environmental Effects: Environmental effects were not assessed for measures that were screened out for unrelated reasons.

Rationale for Not Retaining: Not retained due to uncertain contributions to meeting water supply objective.

Measure Name: Meter or Calibrate Checks and Takeouts
Measure Category: Increase Efficiency
Measure Subcategory: Improve Carson Division Delivery Operations
Status: Not retained

Description: This measure considers installation of calibrated or fitted checks and turnouts on Project canals and laterals with meters to ensure ditch riders and irrigators are properly measuring flows during deliveries. This measure would contribute to the water rights and reliability objective of this Study by reducing human error during water delivery. Reclamation has previously studied metering the Project's 1,500-plus takeouts.

Source: Reclamation 1994

Estimated Cost: In 2009, TCID spent an average of $2,000 each to install five measurement devices (TCID 2010); however, cost estimates were not developed for measures that were not retained.

Water Supply Performance: Significant water savings have already resulted from TCID's activities following the 1997 OCAP to install effective water measurement devices throughout the Project. In the 1994 Newlands Project Efficiency Study, Reclamation estimated that approximately 13,300 acre-feet could be saved annually through installation of measurement devices that would effectively meter all of the Project's flow. As of 2011, 68 percent of the Carson Division's volume was already metered via a variety of measuring devices, such as ramp flumes, in 130 locations, and this proportion is expected to increase to 75 percent with the installation of additional measurement devices by July 2012 (TCID 2010; Rusty Jardine and Walt Winder, TCID, personal communications, August 23, 2011, and February 9, 2012). At the completion of TCID's current work to replace conduits on the Truckee Canal, all of the Truckee Division's flow will be effectively metered.

Implementation Considerations: Implementation considerations were not identified for measures that were not retained.

Environmental Effects: Environmental effects were not assessed for measures that were screened out for unrelated reasons.

Rationale for Not Retaining: Not retained due to relatively low contributions to meeting water supply objective, given extent of existing implementation.

Measure Name: Reuse Agricultural Drain Water
Measure Category: Increase Efficiency
Measure Subcategory: Improve Carson Division Delivery Operations
Status: Not retained

Description: This measure considers capturing agricultural drain water within the Carson Division for reuse, freeing up more water in Lahontan Reservoir for use by Project water rights holders. This measure includes installation of pump-lifts throughout the Carson Division drain network (Rusty Jardine and Walt Winder, TCID, personal communication, August 23, 2011). This measure would contribute to the water supply objective of this Study by reducing the total demand for supplies from Lahontan Reservoir.

Source: Reclamation 1994; 1997 OCAP

Estimated Cost: Cost estimates were not developed for measures that were not retained.

Water Supply Performance: Up to 4,500 acre-feet annually of drain water flows out of the Project (TCID 2010), and thus could be available for recapture and reuse. There are significant hurdles to achieving this and, in the future, the volume available may decrease as the Project's overall efficiency increases and lands are retired under the USFWS acquisition program (see Appendix D1). Currently, a number of drain water reuse sites exist in the Project and are used during dry years: pumps deposit water from the Harmon Deep Drain back into the S Line, and TCID also uses Harmon Reservoir to store return flows and spills to supplement the S-Line; drains also return water, by gravity, to the G-Line, A-Line, and L-Line; additionally, all drain water between Coleman Diversion Dam and Sagouspe Dam flows back into the Carson River and is captured at Sagouspe Reservoir for reuse (TCID 2010). Reclamation has previously estimated the Project's current level of drain water reuse to be approximately 3,100 acre-feet to 5,100 acre-feet annually (Reclamation 1994). Some of this water is received by Stillwater NWR and Lahontan Valley wetlands, while other portions are returned to the system for use by irrigators.

Implementation Considerations: The Newlands Project does not lend itself easily to drain water reuse. Near the upper end of the project there are few drains, and the ones which exist do not have sufficient flow to make it economically feasible to use them. At the lower end of the project, there are a few drains which do have sufficient flows, but there are not many farms downstream left to irrigate. The District is already reusing some drain water. No remaining sites were found with good potential for additional drain water reuse (Reclamation 1994).

Environmental Effects: Increasing reuse of drain water would reduce the total supply received by Lahontan Valley wetlands such as Stillwater NWR and Carson Lake and Pasture. Currently all drain water that cannot be reused within the Project flows to the wetlands. Also, there are potential water quality implications, depending on if and how drain water was mixed with prime water before being delivered for reuse (Rusty Jardine and Walt Winder, TCID, personal communication, August 23, 2011; Reclamation 1994).

Measure Name: Reuse Agricultural Drain Water (contd.)
Rationale for Not Retaining: Not retained due to relatively low contributions to meeting water supply objective, given extent of existing implementation.

Measure Name: Automate Derby Dam and Check Structures
Measure Category: Increase Efficiency
Measure Subcategory: Improve Carson Division Delivery Operations
Status: Not retained

Description: This measure considers retrofitting Derby Dam and the primary check structures along the Truckee Canal with equipment and instrumentation to allow for remote control of diversions to, and flows and depths within the Truckee Canal. Motors, position sensors, and cameras would be installed on the gates; control panels and wireless communication equipment would be housed independently on-site. The canal's Gilpin Spill was recently automated in such a fashion (TCID 2011).

Source: Public Comments, August 2011.

Estimated Cost: Cost estimates were not developed for measures that were not retained.

Water Supply Performance: As a standalone action, automation is not likely to result in water savings. However, it does contribute to the safety objective by allowing TCID and Reclamation instant control over Derby Dam and the Truckee Canal during a flood threat or other emergency (TCID 2011; Reclamation 1994). As safety is the limiting factor on the flow stage in the canal, automation would allow the canal to operate at a higher level. As such, automation of the canal's check structures is included in the risk reduction options already developed in the Corrective Action Study (Reclamation 2011e).

Implementation Considerations: Implementation considerations were not identified for measures that were not retained.

Environmental Effects: Environmental effects were not assessed for measures that were screened out for unrelated reasons.

Rationale for Not Retaining: Not retained due to low direct contributions to meeting water supply objective.

Measure Name: Compact Regulating Reservoir Beds
Measure Category: Increase Efficiency
Measure Subcategory: Reduce Carson Division Seepage
Status: Not retained

Description: This measure considers vibratory compaction techniques to compress the upper two feet of soil in the Carson Division's regulating reservoirs in order to reduce seepage losses. This measure considers compacting up to the total 1,910 acres from the Project's four regulating reservoir beds (Reclamation 1994).

Source: Reclamation (Locke Hahne, personal communication, September 26, 2011)

Estimated Cost:
Field Cost: $14.5 million to $29 million
Annual Cost: $3.4 million to $6.7
Estimate Level: Preliminary
Price Level: March 2012
Service-Life: 5 years
(See Appendix E2)

Water Supply Performance: The effectiveness of compaction methods varies by soil type and maintenance conditions within the reservoir (Burt et. al. 2010). At best, up to 3,960 acre-feet per year could be saved through compaction, if all regulating reservoirs were operated and kept full year-round (Reclamation 1994). However, due to excessive seepage, since 1991 at least two of these reservoirs—Sheckler and Old River reservoirs—have been used only during high-flow years to store precautionary spills and drawdowns. Under current operations, compacting the beds of S-Line and Harmon reservoirs could result in water savings of between 160 acre-feet and 470 acre-feet per year (TCID 2010). The regulating reservoirs within the Carson Division were not used continuously before the 2008 Truckee Canal breach, and it is possible that alternatives will have varying needs for storage below Lahontan Reservoir. As such, the effectiveness of compacting reservoir beds will depend on other factors.

Implementation Considerations: Implementation considerations were not identified for measures that were not retained.

Environmental Effects: Compacting the soil in some regulating reservoirs to reduce seepage could affect groundwater levels in the basin underlying Fallon. Additionally, it could affect the availability of water at the Lahontan Valley wetlands, as some seepage from Harmon Reservoir eventually flows to Stillwater NWR (Rusty Jardine and Walt Winder, TCID, personal communication, February 10, 2012).

Compatibility with Other Measures: Not retained due to low direct contributions to meeting water supply objective.

Measure Name: Compact the Soil Lining of Main Canals and Laterals
Measure Category: Increase Efficiency
Measure Subcategory: Reduce Carson Division Seepage
Status: Retained

Description: This measure considers vibratory compaction techniques to compress the upper two feet of soil in the Carson Division's earth-lined canals and laterals in order to reduce seepage losses. This measure only considers compacting the main canals and laterals, where seepage losses are greatest, according to the Efficiency Study (Reclamation 1994).

Option 1 Expanded
This measure proposes compacting portions of the V, S, L, A canals, and L1 lateral (44.9 miles).

Option 1 Expanded + T Canal
This measure includes "Option 1 Expanded" and proposes compacting portions of the T canal (54.5 miles).

Source: Reclamation (Locke Hahne, personal communication, September 26, 2011); Reclamation 1994

Estimated Cost:
Option 1 Expanded
Field Cost: $2.1 million to $4.2 million
Annual Cost: $490,000 to $980,000
Option 1 Expanded + T Canal
Field Cost: $2.2 million to $4.5 million
Annual Cost: $510,000 to $1.05 million

Estimate Level: Preliminary
Price Level: March 2012
Service-Life: 5 years
(See Appendix E2)

Water Supply Performance: The total volume of seepage losses may vary, depending on total volume of deliveries to the Carson Division through its unlined canals and laterals. Nevertheless, increases in water supply gained through reductions in seepage may be offset by an increase in duty resulting from reductions in the replenishment rates of local aquifers. Previous studies have concluded that in-situ vibratory compaction performed on agricultural canals with predominantly sandy loam soils can reduce seepage losses by up to 90 percent (Burt et al. 2010).

Measure Name: Compact the Soil Lining of Main Canals and Laterals (contd.)
Implementation Considerations: A large portion of the Carson Division has been classified as bottom land due to the shallow depths to groundwater, which is supported by land application in the Project. The duty for bottom lands is set at 3.5 acre-feet per acre, with the assumption that a portion of crop demands is met from groundwater within the root-zone. If groundwater levels recede, portions of the Carson Division may need to be reclassified as bench lands, with a corresponding increase in duty for those lands to 4.5 acre-feet per acre. It is likely that each individual right would need to be reclassified, with review and approval from the Nevada State Engineer (Public Comments, August 2011).

Environmental Effects: Reducing seepage from the laterals could result in a decline in local groundwater levels throughout the Carson Division, which could affect the reliability of local groundwater supplies for the City of Fallon, Churchill County, and the U.S. Naval Air Station, Fallon.

Compatibility with Other Measures: Option 1, Option 1 Expanded, and Option 1 Expanded + T-Canal were retained for combination with other measures that reduce or prevent seepage from the Carson Division, and bring Project conveyance efficiency up to 75 percent.

Measure Name: Line Main Canals and Laterals
Measure Category: Increase Efficiency
Measure Subcategory: Reduce Carson Division Seepage
Status: Retained

Description: This measure considers the installation of a 4-inch concrete lining with a geomembrane liner to prevent seepage. This measure only considers lining the main canals and laterals, where seepage losses are greatest, according to Newlands Project Efficiency Study (Reclamation 1994).

Option 1 Expanded
This measure proposes lining portions of the V, S, L, A canals, and L1 lateral (44.9 miles).

Source: Newlands Project Efficiency Study (Reclamation 1994); OCAP 1997; Truckee Canal Permanent Repair Special Study (Reclamation 2009b)

Estimated Cost:
Option 1 Expanded
Field Cost: $165 million
Annual Cost: $8 million
Estimate Level: Preliminary
Price Level: January 2012
Service-Life: 50 years
(See Appendix E2)

Water Supply Performance: Limitations to the effectiveness for lining the main canals and laterals are similar to those for other compaction measures, except that lining the canal with concrete is expected to be more durable, more expensive, and more effective than the compaction option. Water savings can range from 26,100 to 36,200 acre-feet depending on the option. (Reclamation 1994; Reclamation 2009b).

Implementation Considerations: A large portion of the Carson Division has been classified as bottom land due to the shallow depths to groundwater, which is supported by land application in the Project. The duty for bottom lands is set at 3.5 acre-feet per acre, with the assumption that a portion of crop demands is met from groundwater within the root-zone. If groundwater levels recede, portions of the Carson Division may need to be reclassified as bench lands, with a corresponding increase in duty for those lands to 4.5 acre-feet per acre. It is likely that each individual right would need to be reclassified, with review and approval from the Nevada State Engineer (Public Comments, August 2011).

Measure Name: Line Main Canals and Laterals (contd.)
Environmental Effects: Reducing seepage from the laterals could result in a decline in local groundwater levels throughout the Carson Division, which could affect the reliability of local groundwater supplies for the City of Fallon, Churchill County, and the U.S. Naval Air Station, Fallon.
Compatibility with Other Measures: Option 1, Option 1 Expanded, and Option 1 Expanded + T-Canal were retained for combination with other measures that reduce or prevent seepage from the Carson Division, and bring Project conveyance efficiency up to 75 percent.

Measure Name: Line Regulating Reservoirs
Measure Category: Increase Efficiency
Measure Subcategory: Reduce Carson Division Seepage
Status: Not retained

Description: This measure considers application of clay and/or geo-textile liners at the Carson Division's regulating reservoirs in order to reduce seepage losses. This measure considers lining up to the total 1,910 acres from the Project's four regulating reservoir beds (Reclamation 1994).

Source: Reclamation 1994; suggestion from Pyramid Lake Paiute Tribe (Ali Shahroody, personal communication, August 24, 2011).

Estimated Cost:
Field Cost: $58 million to $100 million
Annual Cost: $2.8 million to $4.9
Estimate Level: Preliminary
Price Level: March 2012
Service-Life: 50 years
(See Appendix E2)

Water Supply Performance: Up to 4,400 acre-feet per year could be saved through lining, if all regulating reservoirs were operated and kept full year-round (Reclamation 1994). Under current operations, compacting the beds of S-Line and Harmon Reservoirs could result in water savings of 525 acre-feet per year (TCID 2010). The regulating reservoirs within the Carson Division were not used continuously before the 2008 Truckee Canal breach, and it is possible that alternatives will have varying needs for storage below Lahontan Reservoir. As such, the effectiveness of lining reservoir beds will depend on other factors.

Implementation Considerations: Implementation considerations have not been identified for this measure.

Environmental Effects: Lining some regulating reservoirs to reduce seepage could affect groundwater levels in the basin underlying Fallon. Additionally, it could affect the availability of water at the Lahontan Valley wetlands, as some seepage from Harmon Reservoir eventually flows to Stillwater NWR (Rusty Jardine and Walt Winder, TCID, personal communication, February 10, 2012).

Compatibility with Not Retaining: Not retained due to low direct contributions to meeting water supply objective.

Measure Name: Replace Main Canals and Laterals with Pipes
Measure Category: Increase Efficiency
Measure Subcategory: Reduce Carson Division Seepage
Status: Not retained

Description: This measure considers installing gravity-flow pipelines to convey water throughout the Carson Division in order to reduce seepage losses. This measure only considers installing pipes for the main canals and laterals, where seepage losses are greatest.

Source: Reclamation 1994

Estimated Cost: Cost estimates were developed in a previous Reclamation study (Reclamation 1994); however, were not included in this study because the measure was not retained.

Water Supply Performance: Anticipated to be similar to lining, as evapotranspiration losses from the canals are relatively insignificant (Jeff Reiker, Reclamation, personal conversation, December 15, 2011).

Implementation Considerations: Implementation considerations were not identified for measures that were not retained.

Environmental Effects: Environmental effects were not assessed for measures that were screened out for unrelated reasons.

Rationale for Not Retaining: Not retained due to high anticipated implementation costs.

Measure Name: Compact Soil Lining of the Truckee Canal
Measure Category: Increase Efficiency
Measure Subcategory: Reduce Truckee Division Seepage
Status: Retained

Description: This measure considers vibratory compaction techniques to compress the upper two feet of soil in the earth-lined portions of the Truckee Canal to reduce seepage losses. This measure includes construction activities along the entire Truckee Canal.

Source: Reclamation (Locke Hahne, personal communication, September 26, 2011)

Estimated Cost:
Field Cost: $780,000 to $1.55 million
Annual Cost: $190,000 to $370,000
Estimate Level: Preliminary
Price Level: March 2012
Service-Life: 5 years
(See Appendix E2)

Water Supply Performance: This measure could save up to 10,000-15,000 AF per year, depending on the flow stage allowed in the canal. Previous studies have concluded that in-situ vibratory compaction performed on agricultural canals with predominantly sandy loam soils can reduce seepage losses by up to 90 percent (Burt et al. 2010). This measure was evaluated and found to contribute significantly to the water supply objective (see Appendix D2).

Implementation Considerations: Option not available for alternatives relying on cutoff walls to meet safety concerns, as compaction methods could damage integrity of cutoff walls.

Environmental Effects: Reducing seepage from could result in a decline in local groundwater levels, which would reduce the availability of water for residents along the canal – particularly in the Fernley reach. These groundwater benefits are not served as Newlands Project water rights, and the Newlands Project has no obligation to maintain the inefficiencies which make these supplies available. However, alternate supplies would not be easily available and groundwater users would need to seek alternative sources of water if the seepage losses were reduced or eliminated.

Compatibility with Other Measures: This measure is retained only for alternatives with an active Truckee Canal, but without structural integrity improvements along the length of the canal. Thus, this measure is limited to implementation in alternatives with a 150 cfs flow stage.

Measure Name: Compact Soil Lining of Truckee Canal Laterals
Measure Category: Increase Efficiency
Measure Subcategory: Reduce Truckee Division Seepage
Status: Not retained

Description: This measure considers vibratory compaction techniques to compress the upper two feet of soil in the earth-lined portions of the Truckee Canal laterals to reduce seepage losses. This measure includes construction activities along all of the earth-lined portions of Truckee Canal laterals.

Source: Reclamation (Locke Hahne, personal communication, September 26, 2011)

Estimated Cost: Cost estimates were not developed for measures that were not retained.

Water Supply Performance: This measure could save up to 4,000 AF per year, depending on the flow stage allowed in the canal (Reclamation). Previous studies have concluded that in-situ vibratory compaction performed on agricultural canals with predominantly sandy loam soils can reduce seepage losses by up to 90 percent (Burt et al. 2010). The potential benefits of this measure were less significant and less direct than other measures for meeting the water supply objective.

Implementation Considerations: Implementation considerations were not identified for measures that were not retained.

Environmental Effects: Reducing seepage from the laterals could result in a decline in local groundwater levels, which would reduce the availability of water for residents along the canal – particularly in the Fernley reach. These groundwater benefits are not served as Newlands Project water rights, and the Newlands Project has no obligation to maintain the inefficiencies which make these supplies available. However, alternate supplies would not be easily available and groundwater users would need to seek alternative sources of water if the seepage losses were reduced or eliminated.

Rationale for Not Retaining: Not retained due to anticipated low contributions to meeting water supply objective.

Measure Name: Line Truckee Canal
Measure Category: Increase Efficiency
Measure Subcategory: Reduce Truckee Division Seepage
Status: Retained

Description: This measure considers lining the Truckee Canal with an impermeable geomembrane and covered by unreinforced concrete (see "Measures Identified for Achieving Safe Operations of the Truckee Canal" in Chapter 4). In addition to reducing seepage losses, this measure would help resolve some of the canal's structural problems caused by animal burrowing.

Source: Efficiency Study (Reclamation 1994); Truckee Canal Permanent Repair Special Study (Reclamation 2009b); Corrective Action Study (Reclamation 2011e)

Estimated Cost: Costs for this measure are discussed in "Truckee Canal Safety Measures for Potential Use in Preliminary Alternatives" measures under the concrete and geomembrane lining method in Appendix E2. Assuming that alternatives with 600, 350, 250 cfs already bear the cost for obtaining the safety requirements with the lowest-cost alternative (i.e. HDPE cutoff wall), this measure would have the following incremental costs.

<u>600 and 350 cfs Flow Stages</u>

Field Cost: $15 million

Annual Cost: $730,000

<u>250 cfs Flow Stages</u>

Field Cost: $14 million

Annual Cost: $680,000

Estimate Level: Appraisal

Price Level: January 2012

Service-Life: 50 years

(See Appendix E2)

Water Supply Performance: The total volume of seepage losses may vary, depending on total volume of deliveries through the Truckee Canal. This measure was evaluated and found to contribute significantly to the water supply objective (see Appendix D2).

Implementation Considerations: None.

Environmental Effects: Although not authorized as a purpose of the Newlands Project nor a valid delivery of Project water, seepage from the canal is responsible for a large part of groundwater recharge in the Fernley area. Lining the canal would prevent seepage into the aquifer, thus potentially reducing one of the area's major sources of municipal and domestic supplies.

Measure Name: Line Truckee Canal (contd.)
Compatibility with Other Measures: This measure is retained only for combination with other measures that reduce or prevent seepage from the Truckee Division. These other measures include only the 350 and 250 cfs flow stages safety measures.

Measure Name: Line Truckee Canal Laterals
Measure Category: Increase Efficiency
Measure Subcategory: Reduce Truckee Division Seepage
Status: Not retained

Description: This measure considers lining the earth-lined portions of the Truckee Canal laterals with an impermeable geomembrane and covered by unreinforced concrete. In addition to reducing seepage losses, this measure would help resolve some of the canal's structural problems caused by animal burrowing. This measure includes construction activities along all of the earth-lined portions of Truckee Canal laterals.

Source: Study team

Estimated Cost: Cost estimates were not developed for measures that were not retained.

Water Supply Performance: This measure could save up to 4,000 AF per year, depending on the flow stage allowed in the canal. The potential benefits of this measure were less significant and less direct than other measures for meeting the water supply objective.

Implementation Considerations: Implementation considerations were not identified for measures that were not retained.

Environmental Effects: Reducing seepage from the laterals could result in a decline in local groundwater levels, which would reduce the availability of water for residents along the canal – particularly in the Fernley reach. These groundwater benefits are not served as Newlands Project water rights, and the Newlands Project has no obligation to maintain the inefficiencies which make these supplies available. However, alternate supplies would not be easily available and groundwater users would need to seek alternative sources of water if the seepage losses were reduced or eliminated.

Rationale for Not Retaining: Not retained due to anticipated low contributions to meeting water supply objective.

Measure Name: Replace Truckee Canal Laterals with Pipes
Measure Category: Increase Efficiency
Measure Subcategory: Reduce Truckee Division Seepage
Status: Not retained

Description: This measure considers installing high-density polyethylene pipes to carry the Truckee Canal lateral's flow specifically in the Fernley Reach. The flows in the pipe will be gravity driven. The pipes would be buried with enough earth cover to not allow floatation if ground water table is high and the pipes are emptied.

Source: Developed by the Study team.

Estimated Cost: Cost estimates were not developed for measures that were not retained.

Water Supply Performance: The total volume of seepage losses may vary, depending on total volume of deliveries through the Truckee Canal. The potential benefits of this measure were less significant and less direct than other measures for meeting the water supply objective.

Implementation Considerations: Implementation considerations were not identified for measures that were not retained.

Environmental Effects: Reducing seepage from the laterals could result in a decline in local groundwater levels, which would reduce the availability of water for residents along the canal – particularly in the Fernley reach. These groundwater benefits are not served as Newlands Project water rights, and the Newlands Project has no obligation to maintain the inefficiencies which make these supplies available. However, alternate supplies would not be easily available and groundwater users would need to seek alternative sources of water if the seepage losses were reduced or eliminated.

Rationale for Not Retaining: Not retained due to anticipated low contributions and high implementation costs for meeting water supply objective.

Measure Name: Replace Truckee Canal with Pipes
Measure Category: Increase Efficiency
Measure Subcategory: Reduce Truckee Division Seepage
Status: Not retained

Description: High-density polyethylene pipes would be installed to carry the Truckee Canal's flow through the Fernley Reach. The flows in the pipe will be gravity driven. The two pipes would be 8 feet in diameter and would be installed side by side within the existing canal cross sectional width following its existing alignment. The pipes would be buried with enough earth cover to not allow floatation if ground water table is high and the pipes are emptied.

Source: Truckee Canal Permanent Repair Special Study (Reclamation 2009b)

Estimated Cost: Cost estimates were developed in a previous Reclamation study (Reclamation 2009b); however, were not included in this study because the measure was not retained.

Water Supply Performance: The total volume of seepage losses may vary, depending on total volume of deliveries through the Truckee Canal.

Implementation Considerations: Implementation considerations were not identified for measures that were not retained.

Environmental Effects: Although not authorized as a purpose of the Newlands Project nor a valid delivery of Project water, seepage from the canal is responsible for a large part of groundwater recharge in the Fernley area. Lining the canal would prevent seepage into the aquifer, thus potentially reducing one of the area's major sources of municipal and domestic supplies.

Rationale for Not Retaining: Not retained due to high anticipated implementation costs.

Measure Name: Laser-level Fields
Measure Category: Reduce Agricultural Demand
Measure Subcategory: Improve On-farm Efficiency
Status: Not retained

Description: Lasers used to control the grading equipment used on the field allow farmers to grade their land to a pre-determined slope. This provides the optimum slope for the flow which is delivered to their turnout, allowing the most even distribution of water possible to the field and reducing unused runoff (Reclamation 1994).

Source: Newland Project Efficiency Study (Reclamation 1994)

Estimated Cost: Cost estimates were not developed for measures that were not retained.

Water Supply Performance: Water savings appear unlikely. In the Carson Division, over 90 percent of the fields are already laser-leveled (Rusty Jardine and Walt Winder, TCID, personal communications, August 23, 2011, and February 10, 2012). In general, laser-leveling is not appropriate for the Truckee Division due to the area's shallow topsoil layer.

Implementation Considerations: Implementation considerations were not identified for measures that were not retained.

Environmental Effects: Environmental effects were not identified for measures that were not retained.

Rationale for Not Retaining: Not retained due to relatively low contributions to meeting water supply objective, given extent of existing implementation.

Measure Name: Transition to Sprinkler Technology
Measure Category: Reduce Agricultural Demand
Measure Subcategory: Improve On-farm Efficiency
Status: Not retained

Description: This measure considers converting current flood irrigation systems to sprinkler irrigation systems through the use of overhead devices such as center pivot, linear, or wheeline sprinkler system.

Source: Study team

Estimated Cost:
Field Cost: $52 million
Annual Cost: $5.2 million
Estimate Level: Preliminary
Price Level: March 2012
Service-Life: 15 years
(See Appendix E2)

Water Supply Performance: It has been suggested that current on-farm efficiency is at least 60, and that moving the Carson Division to sprinkler technology might achieve another 20 percent. It is estimated that this measure would save less than 0.5 acre-feet per acre during dry years.

Implementation Considerations: Implementation considerations were not identified for measures that were not retained.

Environmental Effects: Environmental effects were not identified for measures that were not retained.

Rationale for Not Retaining: Not retained due to anticipated low contributions and high implementation costs for meeting water supply objective.

Measure Name: Base Fees on Cost of Delivery
Measure Category: Reduce Agricultural Demand
Measure Subcategory: Incentivize Reductions in Demand
Status: Not retained

Description: This measure considers basing fees on the cost of delivering water to individual irrigators, factoring in the cost of for the delivery features O&M and the value of water lost due to seepage to each user. This measure would assign the cost of delivering water to inefficient portions of the Newlands Project, and encourage those lands to be relocated. This would change the TCID pricing structure from a declining-block system to one which encourages water conservation while providing the district with adequate funds, even in drought years, to operate and maintain the delivery system.

Source: Efficiency Study (Reclamation 1994); Feasibility of Alternative Water Charge Structures for the Newlands Project (UNR 2000).

Estimated Cost: Cost estimates were not developed for measures that were not retained.

Water Supply Performance: Water savings are not anticipated. Previous studies indicate that alternative price structures for the Newlands Project would result in no additional water savings (UNR 2000).

Implementation Considerations: It is likely that basing fees on delivery costs would be a violation of water rights held by Project water users (Rusty Jardine and Walt Winder, TCID, personal communication, February 10, 2012).

Environmental Effects: Environmental effects were not identified for measures that were not retained.

Rationale for Not Retaining: Not retained due to low anticipated contributions to meeting water supply objective, and to potential conflicts with Project water rights.

Measure Name: Base Fees on Volume Used
Measure Category: Reduce Agricultural Demand
Measure Subcategory: Incentivize Reductions in Demand
Status: Not retained

Description: Also known as "Conservation Pricing," this measure assesses fees for Project water users based on the amount of water delivered to their land.

Source: Newlands Project Efficiency Study (Reclamation 1994); Feasibility of Alternative Water Charge Structures for the Newlands Project (UNR 2000)

Estimated Cost: Cost estimates were not developed for measures that were not retained.

Water Supply Performance: The anticipated yield for water supply is relatively low compared to shortfalls. Previous studies indicate that alternative price structures for the Newlands Project would result in no additional water savings (UNR 2000).

Implementation Considerations: It is likely that the incremental charge on the last acre-foot used would be extremely high, making it politically and practically impossible to implement. The ability of TCID to legally or administratively enforce this measure is uncertain, although the district has broad authority to levy fees and assessments (Rusty Jardine and Walt Winder, TCID, personal communication, August 23, 2011; Ali Shahroody, Pyramid Lake Paiute Tribe, August 24, 2011).

Environmental Effects: Environmental effects were not identified for measures that were not retained.

Rationale for Not Retaining: Not retained due to low anticipated contributions to meeting water supply objective, and to potential conflicts with Project water rights.

Measure Name: Establish Fees for Stockwater Delivery
Measure Category: Reduce Agricultural Demand
Measure Subcategory: Incentivize Reductions in Demand
Status: Not retained

Description: Water rights holders who take stockwater from the Truckee Canal would pay a fee for delivery of water during non-irrigation periods. Typically, the canal is watered-up to a certain level even during the winter to ensure stockwater can be delivered.

Source: Suggestion from TCID (Walt Winder, personal communication, August 23, 2011).

Estimated Cost: Cost estimates were not developed for measures that were not retained.

Water Supply Performance: The yield for water supply is anticipated to be relatively low compared to shortfalls.

Implementation Considerations: The ability of TCID to legally or administratively enforce this measure is uncertain, although the district has broad authority to levy fees and assessments (Rusty Jardine and Walt Winder, TCID, personal communications, August 23, 2011 and February 10, 2012; Ali Shahroody, Pyramid Lake Paiute Tribe, August 24, 2011).

Environmental Effects: Environmental effects were not identified for measures that were not retained.

Rationale for Not Retaining: Not retained due to low anticipated contributions to meeting water supply objective, and to potential conflicts with Project water rights.

Measure Name: Subsidize Crop Conversions
Measure Category: Reduce Agricultural Demand
Measure Subcategory: Incentivize Reductions in Demand
Status: Not retained

Description: This measure considers paying irrigators a premium to convert their production to a crop type with a lower demand for water, and agreeing to a forbearance on the unused portion of those rights. For much of the Project, this would mean converting crops that are currently planted in alfalfa. The premiums paid would be intended to cover the capital cost of the conversion.

Previous investigations have examined a number of such alternative crops, including onions, an annual market crop already grown in the region; leaf lettuce, an easily marketable annual; wine grapes, a high-end market perennial; teff, a specialty annual grain used for market or forage; two-row malt barley, an annual used in the niche market of beer brewing; Great Basin wild rye, a native perennial grass that can be used for restoration or forage; and switchgrass, a native perennial grass with potential as a biofuel (DRI 2010). Currently one production vineyard and winery exists in Churchill County.

This measure would reduce overall demand in the Project, which could help ensure that Project water rights holders receive water reliably even under conditions that include a lower flow in the Truckee Canal.

Source: Developed by Study Team

Estimated Cost: Cost estimates were not developed for measures that were not retained.

Water Supply Performance: It is possible that this measure may be more feasible for non-commercial farms: previous studies indicate that while some alternative crops (such as grapes, onions, and lettuce) have higher possible returns on an annual basis, most farmers in the Project choose alfalfa because it provides more certain returns (DRI 2010).

Implementation Considerations: Implementation considerations were not identified for measures that were not retained.

Environmental Effects: Environmental effects were not identified for measures that were not retained.

Rationale for Not Retaining: Not retained due to low anticipated contributions to meeting water supply objectives.

Measure Name: Lease Water Rights
Measure Category: Reduce Agricultural Demand
Measure Subcategory: Lease or Transfer Water Rights
Status: Not retained

Description: Project water rights holders who do not intend to actively exercise their rights could lease them on a short- or long-term basis to others, including for agricultural, wetlands, M&I, and environmental uses. Such a system would allow rights to "stay" within the Project, and the associated annual O&M fees would continue to provide revenue for the Project.

Source: Truckee-Carson River Basin Study Final Report (Pratt 1997)

Estimated Cost: Cost estimates were not developed for measures that were not retained.

Water Supply Performance: Water savings from leasing are very uncertain. A plan to establish a similar program was envisioned in 1993 by the Truckee-Carson Leasing Authority (TCLA) but was not pursued. After an investigation by the U.S. Department of Justice, TCLA agreed that no more than 25 percent of the water-righted acreage in the Newlands Project would be involved at any one time in leasing (Pratt 1997).

Implementation Considerations: Implementation considerations were not identified for measures that were not retained.

Environmental Effects: Such a program might actually result in an increase in Project demand overall.

Rationale for Not Retaining: Not retained due to uncertain contributions to meeting water supply objective.

Measure Name: Transfer Water Rights
Measure Category: Reduce Agricultural Demand
Measure Subcategory: Lease or Transfer Water Rights
Status: Not retained

Description: Water rights in the Carson Division would be purchased and transferred to the Truckee Division for active use or retirement as in-stream flows in the Truckee River.
This measure could reduce demand in the Carson Division, which could help ensure that Project water rights holders receive water reliably even under conditions that include a lower flow in the Truckee Canal.

Source: Pyramid Lake Paiute Indian Tribe (Ali Shahroody, personal communication, August 24, 2011)

Estimated Cost: Cost estimates were not developed for measures that were not retained.

Water Supply Performance: Water supply performance was not assessed for measures that were not retained.

Implementation Considerations: Such an action would require approval by the Nevada State Engineer, and would be heavily contested by effectively all Project stakeholders. Reclamation, TCID, Churchill County, the cities of Fallon and Fernley, and CWSD have all recently filed formal protests against an application before the Nevada State Engineer to transfer a water right from the Carson Division to the Truckee Division (Reclamation 2011i). The applicant, Tahoe-Reno Industrial General Improvement District, seeks to change the point of diversion for this right from within the Carson Division to an induction well upstream of Derby Dam; effectively, this would increase diversions from the Truckee River and also Truckee River water use in the Truckee Division (Harvey Edwards and Jeff Rieker, Reclamation, personal communications, September 26, 2011 and December 15, 2011).

Environmental Effects: Environmental effects were not identified for measures that were not retained.

Rationale for Not Retaining: Not retained due to political and public unacceptability.

Measure Name: Acquire and Retire Water Rights
Measure Category: Reduce Agricultural Demand
Measure Subcategory: Modify Land Uses
Status: Retained

Description: This measure seeks to retire a sufficient volume of water rights that the remaining Newlands Project water rights can be considered reliable. Water rights would be obtained from willing sellers and would then be retired from production thereby reducing the volume of shortage experienced by the Project's remaining water rights holders.

Source: Newlands Project Efficiency Study (Reclamation 1994); Truckee Canal Permanent Repair Special Study (Reclamation 2009b).

Estimated Cost:
Acquisition Cost: $1,285 per acre-foot
Annual Cost: $74 per acre-foot
Estimate Level: Preliminary
Price Level: March 2012
Loan-Duration: 30 years
(See Appendix E2)

Water Supply Performance: This measure has been assessed and demonstrated to have a potential ability to meet the Study's water supply objective. Performance would depend on the level of participation, and on the size and extent of purchases (see Appendix D4).

Implementation Considerations: There is a large potential for public unacceptability, if the purchasing program is perceived as equivalent to condemnation (Brad Goetsch and Eleanor Lockwood, Churchill County, personal communication, August 25, 2011; Richard Grimes, USFWS, personal communication, August 25, 2011). However, the future condition for this Study assumes completion of the USFWS program; thus, a strategic purchasing program would operate in conditions where no such competition exists. Additionally, TCID has demonstrated a reluctance to take any actions that would hasten the rate of water rights sales to USFWS under their Water Rights Acquisition Program for Lahontan Valley wetlands because reductions in regional agricultural production are viewed as a loss of community and heritage (Rusty Jardine and Walter Winder, TCID, personal communication, August 23, 2011).).

Environmental Effects: Retiring water-righted land from production could result in dust and related air quality problems.

Compatibility with Other Measures: This measure is retained for sole application, or combination with other measures that improve Newlands Project water supplies.

Measure Name: Subsidize Relocation of Properties to Consolidate Project/Purchase and Retire Strategic Parcels
Measure Category: Reduce Agricultural Demand
Measure Subcategory: Modify Land Uses
Status: Not retained

Description: This measure seeks to reduce seepage losses within the Carson Division without removing land from production by consolidating agricultural lands in the center of the Carson Division and decreasing the acreage of lands on remote portions of the current canal network, where seepage losses are highest. Owners of large parcels of marginal land on the edges of the Project would be offered a premium to move their operations and water rights to land with more direct access to Project supplies.

Source: Suggestion from TCID (Rusty Jardine and Walt Winder, personal communication, August 23, 2011).

Estimated Cost: Cost estimates were not developed for measures that were not retained.

Water Supply Performance: Through Lahontan Valley wetlands water rights acquisition program, USFWS has purchased and stripped water rights from many parcels of land throughout the Project, some with higher-quality soil (Rusty Jardine and Walter Winder, TCID, personal communication, August 23, 2011). Many of these properties remain unirrigated in the central portions of the Carson Division.

Performance would depend on the seepage losses to the old property in comparison to those to the new property. Likely insignificant for individual properties unless massive seepage losses to an individual property have been identified. This is the case for 31 Corporation alone, although previous attempts to retire the 31 Corporation water rights were unsuccessful.

Implementation Considerations: There is a large potential for public unacceptability, if the purchasing program is perceived as equivalent to condemnation (Brad Goetsch and Eleanor Lockwood, Churchill County, personal communication, August 25, 2011; Richard Grimes, USFWS, personal communication, August 25, 2011).

Environmental Effects: Retiring water-righted land from production could result in dust and related air quality problems.

Rationale for Not Retaining: Not retained due to uncertain success in reducing demand.

Measure Name: Crop Insurance/Fallowing
Measure Category: Reduce Agricultural Demand
Measure Subcategory: Reduce Dry-Year Demand
Status: Retained

Description: This measure considers compensating water rights holders who agree not to exercise their rights during drier years for the lost production. This measure would help reduce Project demand during dry years, when deliveries from the Truckee Canal are needed to supplement low water levels in Lahontan Reservoir, which could help ensure that Project water rights holders receive water reliably, even under conditions that include a lower flow in the Truckee Canal.

Source: Suggestion from Pyramid Lake Paiute Tribe (Ali Shahroody, personal communication, August 24, 2011); Restoration of a Desert Lake in an Agriculturally Dominated Watershed: The Walker Lake Basin (DRI 2010).

Estimated Cost:
Annual Acquisition Cost: $65 to $100 per acre-foot
Estimate Level: Preliminary
Price Level: March 2012
(See Appendix E2)

Water Supply Performance: This measure has been assessed and demonstrated to have a potential ability to meet the Study's water supply objective. Performance would depend on the level of participation and the extent of land that is temporarily pulled out of production (see Appendix D4).

Implementation Considerations: Establishing a reasonable baseline for production and crop values may be a challenge. This analysis assumes that water right owners that choose to participate in the program are compensated to forgo irrigation for the season. It is likely that the annual cost per acre of land enrolled in the program will vary according to hydrologic conditions and crop prices, among other factors. Annual program payments must be at least equal to the foregone net income associated with agricultural production. As a result, higher crop prices will likely require higher program payments to compensate participating water right owners that are actively irrigating hay and grain crops. Hydrologic conditions may affect program payments by affecting water supply and associated crop production under both the action and no-action alternatives. As a result of these factors, annual program payments to participating agricultural producers may vary significantly from year to year.

There may be an opportunity to apply this measure in a manner that also contributes to the goals of the USFWS Water Rights Acquisition Program for Lahontan Valley Wetlands, if the USFWS program has not yet achieved its goals by the time that a Study alternative is implemented.

Measure Name: Crop Insurance/Fallowing (contd.)

Environmental Effects: Weeds, dust problems and significant damage to existing land could result from implementing this measure without continuing to apply some amount of water to the land (Brad Goetsch and Eleanor Lockwood, Churchill County, personal communication, August 25, 2011; Public Comments, August 2011). Previous examples of this effect within the Newlands Project include a portion of Swingle Bench where USFWS acquired and retired land without implementing such mitigation measures (DRI 2010).

Compatibility with Other Measures: This measure is retained for sole application, or combination with other measures that improve Newlands Project water supplies.

Measure Name: Partial Season Forbearance Agreements
Measure Category: Reduce Agricultural Demand
Measure Subcategory: Reduce Dry -Year Demand
Status: Retained

Description: In drier years, farmers would be paid a sum to end irrigation and crop production earlier than they ordinarily would. This effectively shortens the irrigation season for many farmers. The terms, conditions, and payment for exercising this option would be preestablished in individual forbearance agreements. As with fallowing and crop insurance, this measure would help reduce Project demand during dry years, when deliveries from the Truckee Canal are needed to supplement low water levels in Lahontan Reservoir, which could help ensure that Project water rights holders receive water reliably, even under conditions that include a lower flow in the Truckee Canal.

Source: Suggestion from Pyramid Lake Paiute Tribe (Ali Shahroody, personal communication, August 24, 2011).

Estimated Cost:
Annual Acquisition Cost: $65 to $100 per acre-foot
Estimate Level: Preliminary
Price Level: March 2012
(See Appendix E2)

Water Supply Performance: This measure has been assessed and demonstrated to have a potential ability to meet the Study's water supply objective. Performance would depend on the terms of the agreements and the extent of their adoption by water rights holders (see Appendix D4).

Implementation Considerations: Establishing and administering such a program would require significant time and effort. As with the "Crop Insurance or Fallowing" measure, payments to participating water right owners would be based, in part, upon the foregone net income associated with crop production. Consequently, the annual payments would be related to crop prices, crop production costs, and hydrologic conditions, among other factors. Additionally, it is likely that Project stakeholders, including cities and counties, TCID, and tribes, would request to participate in negotiating the terms of the agreement. It is possible that the Federal Water Master's office, which sets the irrigation season each year, would need to be involved in implementation.

Environmental Effects: No significant environmental effects noted.

Compatibility with Other Measures: This measure is retained for sole application, or combination with other measures that improve Newlands Project water supplies.

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Appendix E1
Consideration of Measures for Water Supply Objective

Attachment: Settlement Agreement Between the City of Fernley and the United States

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

November 17, 2009

LO-100
ADM-13.00

FEDERAL EXPRESS

Mr. Stephen Macfarlane
U.S. Department of Justice
Environmental & Natural Resource Division
501 "I" Street, Suite 9-700
Sacramento, California 95814-2322

Subject: Agreement Between the City of Fernley and the United States Regarding Settlement of Claims and Protests Over Use of Federal Reclamation Facilities

Dear Steve:

Enclosed is your original copy regarding the above agreement with original signatures from all parties involved.

Sincerely,

Kenneth L. Parr
Area Manager

Enclosure

bc: MP-400 (Richard Woodley), MP-3000 (Lora Close)

WBR:KParr:kgibson:11/17/09:775-884-8344
U:\CORRESPO\PARR\2009\11-17-09 Macfarlane.doc

November 12, 2009

LO-100
ADM-13.00

HAND DELIVER

Mr. Paul G. Taggart
Attorney at Law
Taggart & Taggart, LTD.
108 N. Minnesota Street
Carson City, Nevada 89703

Subject: Agreement Between the City of Fernley and the United States Regarding Settlement of Claims and Protests Over Use of Federal Reclamation Facilities

Dear Paul:

Enclosed are three originals regarding the above agreement requiring the signature of Leroy Goodman, Mayor of the City of Fernley. When Mayor Goodman signs all of the originals, would you please be sure that two of the originals are returned to the Lahontan Basin Area Office.

Sincerely,

Kenneth L. Parr
Area Manager

Enclosures – 3

WBR:KParr:kgibson:11/12/09:775-884-8344
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AGREEMENT BETWEEN THE CITY OF FERNLEY AND THE UNITED STATES REGARDING SETTLEMENT OF CLAIMS AND PROTESTS OVER USE OF FEDERAL RECLAMATION FACILITIES

I. EXPLANATORY RECITALS

WHEREAS the City of Fernley, Nevada ("Fernley") seeks to expand its existing municipal water supply and treatment system to serve customers within its service area;

WHEREAS Fernley has acquired surface water rights within the Truckee Division of the Newlands Reclamation Project ("Newlands Project"), and has submitted applications to the Nevada State Engineer to transfer the purpose and place of use of said water rights from irrigation to municipal and industrial use within Fernley's service area;

WHEREAS the Bureau of Reclamation ("Reclamation") and the Pyramid Lake Paiute Tribe ("Tribe") have filed protests of those transfer applications, and Reclamation has asserted as protest grounds that, among other things, its approval was required before Fernley could use Federal reclamation facilities, including but not limited to the Truckee Canal, to convey water under any transferred water rights for municipal and industrial purposes;

WHEREAS the Nevada State Engineer on May 31, 2007 issued Ruling #5744, and on June 12, 2007 issued Ruling #5744A, in which he approved the transfer of certain water rights requested by Fernley over protests by Reclamation and the Tribe;

WHEREAS the United States, on behalf of Reclamation, timely appealed Ruling #5744/5744A to the United States District Court for the District of Nevada. *United States v. Orr Water Ditch Co./Re: Nevada State Eng'r Ruling #5744/5744A*, Case No. 3:73-cv-19-LDG (D. Nev.) ;

WHEREAS Reclamation has protested Fernley water right transfer applications nos. 74911, 74943, 74944, 74980, 75503, 75504, 75581, 75582, 75583, 75862, 75863, 75864, 75865, 76061, 76209, 76292, 76837, 76976, 76977, 77006, 77050, 77276, 77923, 77924, and 78626 which are currently pending before the Nevada State Engineer;

WHEREAS Fernley now seeks federal approval for the use of Federal reclamation facilities in the Newlands Project to assist in the delivery of water for municipal, industrial, and domestic purposes within Fernley's service area;

WHEREAS Reclamation now seeks to develop, in a collaborative process with Fernley, a procedure by which Fernley may request, and Reclamation will consider, after consultation with the Tribe, Federal approval of Fernley's use of Federal reclamation facilities in connection with Fernley's municipal water supply and treatment system;

WHEREAS the United States and Fernley seek to settle claims by the United States in *United States v. Orr Water Ditch Co./Re: Nevada State Eng'r Ruling #5744/5744A*, Case No. 3:73-cv-19-LDG (D. Nev.) ;

WHEREAS Reclamation and Fernley seek to settle protests by Reclamation of Fernley transfer application nos. 74911, 74943, 74944, 74980, 75503, 75504, 75581, 75582, 75583, 75862, 75863, 75864, 75865, 76061, 76209, 76292, 76837, 76976, 76977, 77006, 77050, 77276, 77923, 77924, and 78626;

NOW, THEREFORE, Fernley and the United States ("the Parties") mutually stipulate and agree as follows:

II. AGREEMENT

1. GENERAL PROVISIONS

A. This Agreement is executed solely for the purpose of compromising and settling litigation and nothing herein shall be construed as a precedent in any other context. This Agreement is not, and shall not be construed as, an admission against interest or of wrongdoing or liability by any party hereto with respect to any fact or issue involved in any pending or future litigation.

B. Nothing in this Agreement shall be construed to deprive any federal official of authority to revise, amend, or promulgate regulations. Nothing in this Agreement shall be deemed to limit the authority of the executive branch to make recommendations to Congress on any particular piece of legislation.

C. No Member of, or Delegate to, Congress, Resident Commissioner or official or employee of Fernley shall benefit from this Agreement other than as a water user or landowner in the same manner as other water users or landowners.

D. Nothing in this Agreement shall be construed to commit a federal official to expend funds not appropriated by Congress.

E. The Parties do not intend by this Agreement to confer any rights or interests on any third-parties or non-parties to the Agreement.

F. The Parties reserve the right to amend this Agreement upon mutually agreeable terms to comply with any subsequent court order issued by a court of competent jurisdiction concerning the operation of the Newlands Project or the administration of the Orr Ditch Decree.

/////

G. The terms set forth in this Agreement are intended by the Parties as a final expression of agreement with respect to such terms, and may not be contradicted by evidence of any prior agreement or any contemporaneous oral statement. This Agreement is a complete and exclusive statement of the Parties' agreement which may not be explained or supplemented by evidence of additional terms. This Agreement may not be altered or modified except by written instrument signed by each of the Parties or as otherwise provided by order of a court of competent jurisdiction.

H. This Agreement shall be governed by, and construed and enforced in accordance with, and pursuant to, the laws of the United States of America, including federal reclamation law and federal law applicable to contracts made or performed by the United States or to which it is a party. In the event that Fernley is granted approval by Reclamation, pursuant to this Agreement, to access the Truckee Canal and use Project Water for M&I purposes, Fernley acknowledges that the delivery of Project Water and the use of Federal facilities will be subject to Federal reclamation law, as amended and supplemented, and the rules and regulations promulgated by the Secretary of the Interior under Federal reclamation law, as well as Reclamation determinations necessary to administer the operation and maintenance contract between the United States and the Truckee-Carson Irrigation District ("TCID") (Contract No. 7-07-20-X0348), or any subsequent operation and maintenance contract entered into by the United States regarding Newlands Project facilities.

I. The underlined paragraph headings in this Agreement are for the convenience of the Parties and are not intended to be given any substantive effect in interpreting the Agreement.

J. Nothing in this Agreement shall be construed to constitute a waiver of the sovereign immunity of the United States.

K. The Parties acknowledge that each party and/or its counsel have reviewed and revised this Agreement and that no rule of construction to the effect that any ambiguities are to be resolved against the drafting party shall be employed in the interpretation of this Agreement or any amendments or exhibits to this Agreement or any document executed and delivered by the Parties in connection with this Agreement.

2. <u>FERNLEY'S EXERCISE OF TRANSFERRED NEWLANDS PROJECT WATER RIGHTS</u>

A. All water rights acquired by Fernley for municipal and industrial purposes within its service area shall be transferred in accordance with Nevada law and the Orr Ditch Decree. For the purposes of this Agreement, "acquired water rights" refers

to Newlands Project Water Rights that have been acquired by the City of Fernley, and does not include groundwater rights or surface water rights that are not delivered via the Newlands Project.

B. Fernley's exercise of its acquired water rights shall be subject to all applicable federal and state laws, decrees, and regulations, including the Orr Ditch Decree, the Newlands Project Operating Criteria and Procedures ("OCAP"), and water quality laws; all orders or settlements pursuant thereto; and determinations made by Reclamation pursuant to the operations and maintenance contract between Reclamation and the operator of the Newlands Project. Any use of Federal reclamation facilities in the Newlands Project for the conveyance of non-Project water shall be subject to federal reclamation law as amended and supplemented.

C. Fernley's exercise of its acquired water rights shall be subject to beneficial use not to exceed water duties under the Orr Ditch Decree, including uses of Fernley Municipal Credit Water as provided in the Truckee River Operating Agreement executed September 6, 2008 ("TROA"). In cooperation with Reclamation, Fernley shall prepare a water conservation and efficiency plan that Fernley shall implement within its service area as provided in Paragraph 6 below.

D. Fernley shall divert water under its acquired Newlands Project water rights at Derby Dam on an irrigation season specified by the operator of the Newlands Project, subject to the Newlands Project OCAP.

E. Fernley shall share proportionately in any Newlands Project water shortages, subject to the exercise of Fernley's rights under TROA. On account of drought, as determined by the operator of the Newlands Project, inaccuracy in distribution, or other cause, there may occur at times a shortage in the water supply, and in no event shall any liability accrue to the United States, its officers, agents, or employees, for any damage direct or indirect arising therefrom. "Other causes" may include, but are not limited to, court orders or Acts of Congress that are applicable to the Newlands Project, including Fernley's acquired water rights. "Other causes," however, do not include criminal acts, intentional torts or negligence of the United States, its officers, agents or employees.

F. Fernley shall indemnify and hold harmless the United States with regard to any damage claim, Fifth Amendment takings claim, or request for injunctive relief pertaining to the control, distribution, disposal or delivery of water beyond the Truckee Canal. Fernley agrees that the United States does not warrant the quality of any water transported or conveyed through Federal reclamation facilities, including but not limited to the Truckee Canal.

G. Fernley shall pay its proportionate share of Newlands Project Operations and Maintenance charges and any applicable Newlands Project assessments.

H. Fernley shall pay the costs of any environmental documentation prepared by Reclamation or by a consultant approved by Reclamation in connection with a request made pursuant to the provisions of Section 3 of this Agreement. If environmental documentation is prepared by Reclamation, Fernley shall be provided notice and the opportunity to comment on an estimate of the costs of the preparation of environmental documentation prior to Reclamation's expenditure of funds on such work.

3. PROCEDURE FOR REQUESTING AUTHORIZATION TO USE FEDERAL RECLAMATION FACILITIES

A. Fernley shall submit to Reclamation a request in writing for authorization to use Federal reclamation facilities in the Newlands Project, including the Truckee Canal, for the delivery of water under Fernley's acquired water rights from the diversion point at Derby Dam to its municipal water supply system and treatment plant ("Authorization Request").

B. Such Authorization Request shall be in a form deemed satisfactory by the United States, shall be consistent with the terms of this Agreement and shall incorporate the terms in Section 2 of this Agreement including all subparts. For purposes of this Agreement, Reclamation has determined that a formal letter with attached reports and data will be acceptable.

C. Such Authorization Request shall include or be accompanied by the following:

(1) An efficiency study in form and content as provided in Section 4 of this Agreement.

(2) Accounting rules for the accounting of Fernley's exercise of its acquired water rights for municipal and industrial purposes within its service area as provided in Section 5 of this Agreement, including but not limited to any groundwater recharge and recovery, or storage not covered under the TROA.

(3) A draft water conservation and efficiency plan as provided in Section 6 of this Agreement.

(4) A construction plan as provided in Section 7 of this Agreement.

D. Upon receipt of Fernley's Authorization Request, Reclamation shall review the Authorization Request for completeness as provided in this Agreement. If the Authorization Request is incomplete, Reclamation will promptly return the Authorization Request to Fernley with a written explanation of deficiencies. If

the Authorization Request is determined by Reclamation to be complete, Reclamation will review the Authorization Request as provided in subpart E of this Section 3.

E. Reclamation shall determine whether to grant authorization for Fernley's use of Federal reclamation facilities based upon Fernley's Authorization Request, subject to compliance with the National Environmental Policy Act, 42 U.S.C. §§ 4321 *et seq.* ("NEPA"), the Endangered Species Act, 16 U.S.C. §§ 1531 *et seq.*, federal reclamation law as amended and supplemented, all other applicable law, and after consultation with the Tribe. Fernley and the United States understand and agree that Reclamation's consideration of Fernley's Authorization Request will include a NEPA process, and that no final determination whether to approve Fernley's Authorization Request will occur until such NEPA process is completed.

F. In reviewing the Authorization Request as provided in Section 3.E, Reclamation reserves the right to request additional information from Fernley, and Fernley shall promptly provide information in response to such a request.

4. EFFICIENCY STUDY

A. As provided in Section II.3(C)(1) of this Agreement, Fernley will prepare a study, in cooperation with Reclamation, on the impact of Fernley's diversions on Newlands Project efficiency as determined under OCAP. Such efficiency study shall be completed prior to the submission of any Authorization Request and shall be attached to such Request.

B. The efficiency study shall further be based on the assumptions, which may be amended by mutual agreement at a later date, set forth in a technical memorandum attached hereto as Appendix A.

C. In the event the efficiency study prepared pursuant to this subsection discloses potentially significant adverse impacts on Newlands Project efficiency from Fernley's diversions, Reclamation and Fernley will develop mutually acceptable measures to mitigate such adverse impacts. Any such mitigation measures shall also be submitted to the Nevada State Engineer with the request that they be incorporated into and made a part of any permits issued by the Nevada State Engineer approving applications to transfer Fernley's acquired water rights.

5. ACCOUNTING

A. As provided in Section II.3(C)(2) of this Agreement, Fernley's Authorization Request will include and be consistent with the following rules for accounting of Fernley's diversions of water from the Truckee Canal and the treatment and

distribution of such diverted water to Fernley's customers.

B. Fernley shall meter and report to Reclamation all water that it receives delivery of through Federal reclamation facilities, including but not limited to the Truckee Canal, for any purpose. The following accounting practices and rules will apply to all water diverted by Fernley through Federal reclamation facilities.

1. Fernley shall install, at its expense, a meter or meters, at each Truckee Canal intake approved by Reclamation for Fernley's use.

2. Fernley shall meter the quantity of water diverted at the proposed Fernley municipal Truckee Canal intake, and shall report monthly that quantity to Reclamation. Fernley shall also report diversion quantities to the operator of the Newlands Project in accordance with the operator's reporting requirements.

3. Fernley shall meter and report monthly to Reclamation the quantity of water delivered at the point of delivery to Fernley, and at any other locations where Fernley receives water from the Truckee Canal for any purpose. Such locations may include, but are not limited to, the Fernley Golf Course, Out of Town Park, and other locations as may be added from time to time.

4. Fernley shall meter and report monthly to Reclamation the quantity of all water diverted by Fernley from Federal reclamation facilities, including but not limited to the Truckee Canal, that Fernley places into any surface or subsurface storage. Fernley shall meter and report to Reclamation all quantities of such water withdrawn from storage. Although underground storage of Newlands Project water rights under Claim 3 of the Orr Ditch Decree is not proposed at this time, Fernley shall negotiate accounting rules to account for any underground storage, if underground storage is proposed. These accounting rules will be based on applicable federal law and the Nevada Division of Water Resources recharge and recovery permit terms and reporting requirements as identified in Nevada Revised Statutes 535.250 through 535.340.

5. Fernley shall report monthly to Reclamation data on water deliveries to Fernley's customers. The City of Fernley Rate Table Summary for water usage, in substantial form as provided in Appendix B hereto, may be used for this reporting requirement.

6. Meters used by Fernley in the measurement of water shall be of a type and design mutually agreeable to Fernley, Reclamation, and the operator of the Newlands Project. The type and design of such meters are required to be

submitted as part of the Authorization Request. Any future modifications to existing meters, or new metering devices, shall be mutually agreeable to Fernley, Reclamation, and the operator of the Newlands Project. Fernley shall maintain all meters installed pursuant to the Authorization Request.

6. WATER CONSERVATION AND EFFICIENCY PLAN

A. Fernley shall submit with its Authorization Request a draft Water Conservation Plan ("Plan"). A Plan meeting Reclamation's standards must be finalized by Fernley and approved by Reclamation before Fernley may divert water through, or otherwise use, Federal reclamation facilities within the Newlands Project for municipal and industrial use within Fernley's service area.

B. Continued diversion of Project Water pursuant to Fernley's Authorization Request, if approved, shall be contingent upon Fernley's continued implementation of the Plan and this Agreement. In the event that Fernley's Plan or any revised water conservation plan completed pursuant to this Agreement are determined to not meet Reclamation's standards due to circumstances which Reclamation determines are beyond the control of Fernley, Project Water diversion shall be made pursuant to any approved Authorization Request so long as Fernley diligently works with Reclamation to create a Plan acceptable to Reclamation.

C. If Fernley is engaged in direct groundwater recharge, such activity shall be described in Fernley's Plan or any revision to that Plan.

D. Fernley shall submit annually to Reclamation a report on the status of the implementation of the Plan. This report shall be due on October 1 of each year.

E. Fernley shall revise its Plan at five-year intervals to remain acceptable to Reclamation, and shall submit the revised Plan to Reclamation for review and evaluation. Reclamation will then determine if the revised Plan meets Reclamation's then current criteria. The revised Plan will be due at five year intervals on October 1st, beginning with the fifth October following Reclamation's approval of the initial Plan.

7. CONSTRUCTION PLAN

A. Fernley shall submit, as part of its Authorization Request, an *Application for Transportation and Utility Systems and Facilities of Federal Lands "SF-299"* (the SF-299 Application). The SF-299 Application shall include the following:

1. A design of the canal takeout structure that will be used to divert water from the Truckee Canal to the pipeline that extends to Fernley's municipal

water treatment plant. The design shall be at an approximate 75% level of the full completed design, including all major structural elements and approximate dimensions, locations, and specifications for construction.

2. A plan and profile design of the pipeline that will be used to divert water from the takeout on the Truckee Canal to Fernley's municipal water treatment plant. The plan and profile design shall be at conceptual level, including general structural elements, approximate dimensions, and estimated locations.

3. A full topographic survey of the location of the proposed takeout on the Truckee Canal, as well as a full geotechnical site evaluation. These field activities must be acceptable in scope to Reclamation, and the information gained from these activities shall be used in the design of the takeout structure.

4. A construction plan. The construction plan shall include all typical elements of a plan for the construction of a water management feature on a Reclamation easement, including but not limited to descriptions of the construction execution; emergency action procedures; and required permissions from the operator of the Newlands Project, the underlying landowner, and any other required permits or permissions.

B. The engineering design and construction plan referred to in this section shall conform to all requirements specified by Reclamation's *Engineering and O&M Guidelines for Crossings* (Current Draft; "6C"), as well as the requirements, standards, and guidelines set forth in Reclamation's *Design of Small Canal Structures (1978)*, and Reclamation's *Design Standards #3; Canals and Related Structures (1967)*.

8. DISMISSAL OF CLAIMS AND PROTESTS

Upon execution of this Agreement, the United States shall dismiss all of its claims on appeal of Ruling 5744/5744A of the Nevada State Engineer, in *United States v. Orr Water Ditch Co.*, Case No. 3:73-cv-19-LDG. Upon execution of this Agreement, Reclamation shall dismiss all of Reclamation's protests of Fernley transfer application nos. 74911, 74943, 74944, 74980, 75503, 75504, 75581, 75582, 75583, 75862, 75863, 75864, 75865, 76061, 76209, 76292, 76837, 76976, 76977, 77006, 77050, 77276, 77923, 77924, and 78626 pending before the Nevada State Engineer.

9. OTHER PROVISIONS

A. Any federal authorization of Fernley's use of Federal reclamation facilities in the Newlands Project pursuant to an Authorization Request as provided in this Agreement shall be in addition to any agreement required for the exercise of

Fernley's rights under TROA.

B. Nothing in this Agreement shall waive, or be construed to waive, any claim of the Parties regarding rights to the use of canal seepage within Fernley's service area. The United States, Reclamation and Fernley expressly reserve all rights not explicitly modified by this Agreement.

C. Continued diversion of Fernley's acquired water pursuant to an Authorization Request, if approved, shall be contingent upon Fernley's continued adherence to the provisions, procedures, and rules established by this Agreement.

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10. SIGNATURES

The undersigned certify that they are fully authorized by the Party whom they represent to enter into the terms and conditions of this Agreement and legally to bind such Party thereto.

IN WITNESS WHEREOF, the Parties agree to the provisions set forth herein as evidenced by the signatures of their authorized representatives below:

FOR THE CITY OF FERNLEY:

LEROY GOODMAN, Mayor, City of Fernley — Dated: 11/13/09

Attest: Lena Shumway, City Clerk, City of Fernley — Dated: 11/13/09

FOR THE UNITED STATES:

STEPHEN M. MACFARLANE, Trial Attorney
United States Department of Justice — Dated: 11/9/2009

FOR THE BUREAU OF RECLAMATION:

KENNETH L. PARR, Area Manager
Bureau of Reclamation — Dated: 11/12/09

RICHARD J. WOODLEY, Regional Resources Manager
Bureau of Reclamation — Dated: 11/6/2009

Appendix A
Technical Memorandum for Efficiency Study

This technical memorandum sets forth the assumptions upon which the efficiency study ("study") prepared by Fernley pursuant to Sections II.3.C.3 and II.4 of the "*Agreement Between the City of Fernley and the United States Regarding Settlement of Claims and Protests Over Use of Federal reclamation facilities*" shall be based, and procedures that will be followed in preparing this study.

A. Efficiency Study Assumptions:

1. The study shall use existing OCAP and Reclamation available information as source data for the study. This information includes but is not limited to the Newlands Project Efficiency Study Report, and historic OCAP efficiency evaluations.

2. The study shall assume that Fernley will be diverting water from the Truckee Canal through a pipeline connected directly to the Municipal Water Treatment system and efficiency for those deliveries will be 100%.

3. The study shall use, as its "baseline," the average of the two most recent Reclamation OCAP efficiency calculations in full (100%) normal water supply years.

4. The study shall include efficiency analyses under scenarios consisting of Fernley utilizing 50%, 75%, and 100% of its permitted Newlands Project water rights for municipal and industrial purposes.

5. The study shall assume that Fernley will divert water during irrigation season.

6. The study shall present the efficiency of No-Action, current condition, and Action (diversion of Fernley municipal water rights from Truckee Canal) alternatives.

7. The study shall assume all reductions in future irrigation and flow through laterals will be converted to Fernley municipal use.

8. The study will be restricted to Fernley area TC-1 through TC-13 and direct takeouts.

9. The study will present, in graphical and tabular form, the combined efficiencies of TC-1 through TC-13 (and direct takeouts) for the no-action and action alternatives.

B. Procedures:

1. Reclamation will make available any applicable studies or reports relating to this study.

2. Fernley shall submit the study to Reclamation in support of Fernley's Authorization Request as provided in Section II.3.C.1 of the Agreement.

3. The study shall be re-evaluated and may be amended in the future if Fernley proposes additional diversion locations and the manner of diversion differs from the assumption stated above.

Appendix B

Sample Water Delivery Reporting Form (Paragraph 5.B (5))

The City of Fernley Rate Table Summary

City of Fernley

Rate Table Summary

Report Date(s): 10/01/2008 to 10/31/2008

Nov 18, 2008 03:17pm

	Rate Table	Title	Service	Number of Customers	Number of Units	Base / Minimum	Excess/Amount	Adjustments	Total/Amount	Usage
A	101	WATER - RESIDENTIAL - 3/4"	WATEF	6,829	6,898.0000	86,174.67	151,477.34	28,330.91 -	209,321.10	79,179,000
	102	WATER - RESIDENTIAL - 1"	WATEF	40	40.0000	800.52	1,243.94	-	2,044.46	617,000
	103	WATER - RESIDENTIAL - 1 1/2"	WATEF	2	2.0000	74.70	229.14	-	303.84	98,000
	104	WATER - RESIDENTIAL - 2"	WATEF	1	1.0000	55.46	190.84	-	246.30	76,000
B	111	WATER - COMMERCIAL - 3/4"	WATEF	114	114.0000	1,583.59	2,256.03	-	3,839.62	1,165,000
	112	WATER - COMMERCIAL - 1"	WATEF	40	48.0000	1,035.05	1,804.20	-	2,839.25	935,000
	113	WATER - COMMERCIAL - 1 1/2"	WATEF	38	38.0000	1,786.73	2,851.80	-	4,638.53	1,470,000
	114	WATER - COMMERCIAL - 2"	WATEF	103	103.0000	7,368.96	26,951.64	-	34,320.60	13,892,600
	115	WATER - COMMERCIAL - 4"	WATEF	14	14.0000	3,017.00	21,010.20	-	24,027.20	10,830,000
	116	WATER - COMMERCIAL - 6"	WATEF	2	2.0000	839.64	3,041.92	-	3,881.56	1,568,000
	117	WATER - COMMERCIAL - 8"	WATEF	1	1.0000	-	-	-	-	-
	118	WATER - COMMERCIAL - 3"	WATEF	1	1.0000	133.66	638.26	-	771.92	329,000
C	119	WATER - WELL 8 HOUR DIAL	WATEF	25	25.0000	376.77	-	-	376.77	5,700
D	121	Master Metered 3/4"	WATEF	10	44.0000	108.40	284.16	-	392.56	148,000
	122	Master Metered 1"	WATEF	44	186.0000	988.24	2,561.28	-	3,549.52	1,334,000
	123	Master Metered 1-1/2"	WATEF	9	47.0000	334.35	723.84	-	1,056.19	377,000
	124	Master Metered 2"	WATEF	27	291.0000	1,488.51	3,557.76	-	5,046.27	1,853,000
	125	Master Metered 4"	WATEF	2	126.0000	319.58	2,131.20	-	2,450.78	1,110,000
	127	Master Metered 3"	WATEF	2	42.0000	200.46	320.64	-	521.12	187,000
E	199	WATER - NON BILL	WATEF	9	9.0000	-	-	-	-	3,380,600
F	301	SEWER - RESIDENTIAL - 3/4"	SEWEF	6,024	6,092.0000	119,914.61	-	18.88	119,933.49	370,003
	302	SEWER - RESIDENTIAL - 1"	SEWEF	1	4.0000	81.36	-	-	81.36	-
	311	SEWER - COMMERCIAL 3/4"	SEWEF	97	97.0000	1,615.70	413.40	-	2,029.10	565,510
	312	SEWER - COMMERCIAL 1"	SEWEF	29	29.0000	587.00	227.76	-	814.76	339,000
	313	SEWER - COMMERCIAL 1 1/2"	SEWEF	29	29.0000	976.43	323.44	-	1,299.87	401,000
	314	SEWER - COMMERCIAL 2"	SEWEF	66	66.0000	4,144.80	5,919.68	-	10,064.48	6,036,100
	315	SEWER - COMMERCIAL 4"	SEWEF	8	8.0000	1,298.40	5,212.37	-	6,510.77	5,061,900
	316	SEWER - COMMERCIAL 6"	SEWEF	2	2.0000	523.62	-	-	523.62	700
	321	Master Metered Per Unit	SEWEF	85	708.0000	14,400.72	-	-	14,400.72	-
G	501	HYDRANT METER CHARGE	HYD	23	23.0000	1,010.71	4,790.56	2,649.28 -	3,151.99	1,381,100
H	701	FIRE	FIRE	19	19.0000	760.00	163.00	-	923.00	-
	901	SERVICE CHARGE	SVCHG	98	98.0000	-	1,900.00	21.33 -	1,878.67	1
	1101	WATER SERVICE CALL	WSVCI	1	1.0000	-	60.00	-	60.00	-
	1501	RECONNECT FEE	RCONF	101	101.0000	-	9,100.00	249.22 -	8,850.78	2
	1701	Ret Check FEE	NSF	11	11.0000	-	330.00	-	330.00	-
	1801	MATERIAL/LABOR - WATER	WTLBF	1	1.0000	-	140.00	-	140.00	-
I	2501	CANAL PUMP METER CHARGE	NPT	4	4.0000	-	-	-	-	-
J	3901	Late Fees	LATE	1,095	1,095.0000	10,840.00	-	164.56 -	10,675.44	-
		Grand Totals:		15,007	16,418.0000	262,839.66	249,854.40	31,396.42 -	481,297.64	132,690,216

A	RESIDENTIAL USERS
B	COMMERCIAL USERS
C	NON-POTABLE WELL #8 — CONSTRUCTION WATER
D	MULTI-FAMILY USERS (APARTMENTS / CONDOS / ETC.)
E	BENNETT READINGS - CORRECTED MONTHLY
F	SEWER - NOT APPLICABLE
G	HYDRANT USERS — CONSTRUCTION WATER
H	COSTS — NOT APPLICABLE
I	CANAL PUMP PERMITS
J	COSTS - NOT APPLICABLE

Appendix E2
Initial Cost Estimates for Screening of Measures

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

Attachments

Abbreviations and Acronyms

AACE	Advancement of Cost Engineering
APS	Allowance for Procurement Strategies
cfs	cubic feet per second
HDPE	high-density polyethylene
IDC	interest during construction
MBR	Membrane Bioreactor
MGD	million gallons per day
NEPA	National Environmental Policy Act
O&M	operation and maintenance
Project	Newlands Project
Reclamation	U.S. Department of the Interior, Bureau of Reclamation
RR3	Risk Rating 3
Study	Newlands Project Planning Study
TCID	Truckee-Carson Irrigation District
USFWS	U.S. Fish and Wildlife Service

Appendix E2 – Initial Cost Estimates for Screening of Measures

This appendix summarizes initial cost estimate information for measures that were identified in Chapter 4 of the Special Report and used for measure screening and preliminary alternatives formulation. Cost estimates were only developed for measures that were retained in Chapter 4 or for measures not retained because of cost effectiveness.

Cost Estimate Methodology

The initial cost estimates are for screening of measures and development of initial alternatives, which are intended for planning purposes only. Cost estimates were developed from a variety of sources. Existing information and previous studies were used as the basis of cost estimates to the greatest extent possible. But for measures with limited or no existing cost information available, initial cost estimates were developed based on experience with similar projects and programs. These initial cost estimates will be updated and refined for measures that are included in the alternatives to be evaluated further in the Newlands Project Planning Study (Study). The initial cost estimates were prepared with less-than-complete designs and have inherent levels of risk and uncertainties.

Costs estimates presented in this appendix are either preliminary- or appraisal-level. Preliminary-level cost estimates are prepared for studies conducted at the very early stage of the planning process. Preliminary-level cost estimates use readily available data and sound estimating practices, although no minimum criteria or formal standards dictate requirements for these estimates. Appraisal-level costs estimates are developed to determine whether more detailed investigations of a potential project are justified. Appraisal-level designs are based on standard practice with little analysis, and cost estimates may be prepared from cost graphs, simple sketches, or rough general designs, which use the available site-specific design data. Preliminary- and appraisal-level cost estimates are not suitable for requesting project authorization or construction fund appropriations.

The initial cost estimates reflect pricing for materials, wages and salaries, accepted productivity standards, and typical construction practices, procurement methods, construction economic conditions, and site conditions at the time of the estimate (which varies). Depending on the level of study, it is often impractical to identify all items associated with a project. Accordingly, preliminary- and appraisal-level estimates should contain various allowances, as follows:

- Mobilization costs include contractor bonds, and mobilizing contractor personnel and equipment to the Newlands Project (Project) site during initial project setup. If mobilization is expressed as a percentage, it is applied to the subtotal of the line item costs.

- Design contingencies are intended to account for three types of uncertainties inherent as a project advances from the planning stage through final design, including: (1) minor unlisted items, (2) minor design and scope changes, and (3) minor cost estimating refinements. Design contingency percentages are applied to the subtotal of line item costs with mobilization.

- Allowance for Procurement Strategies (APS) may be included in preliminary- and appraisal-level cost estimates to account for additional costs when solicitations will be advertised and awarded under other than full and open competition. APS was set at 0 percent for the estimates.

- Construction contingencies cover minor differences in actual and estimated quantities, unforeseeable difficulties at the site, changed site conditions, possible minor changes in plans, and other uncertainties during the construction period. Construction contingencies percentages are applied to the contract cost, which is the subtotal of line item costs with mobilization, design contingencies, and APS.

As more details are developed to refine a specific cost estimate, the number of direct-cost line items increases, the accuracy of the quantity takeoffs increases, and the allowance for unlisted items decreases.

For each structural measure, field and annual costs are presented. Field cost is an estimate of capital costs of a feature or project from award to construction closeout. Allowances for mobilization, design contingencies, APS, and construction contingencies are included in field costs. Non-contract costs are not included in the field cost value; however, some cost estimate sources reported construction costs. Construction cost is the sum of the feature field costs plus non-contract costs. If construction costs were reported, costs were adjusted to reflect field costs to make comparable with other cost estimates by removing non-contract costs.

Non-contract costs refer to costs of work or service provided in support of the Project, and other work that can be attributed to the Project as a whole, known as distributed costs, which include facilitating services, investigations, design and specifications, construction management, environmental compliance, and archeological considerations. If non-contract costs are expressed as a percentage, it is applied to the field cost.

None of the cost estimates report total capital costs, which is the sum of the construction costs and interest during construction (IDC). IDC was not estimated because a construction schedule has not been developed for each measure. For cost estimates based on existing information or previous studies, costs were indexed to January 2012 price level using Reclamation's Construction Cost Trends (Reclamation 2012). New cost estimates were developed with a March 2012 price level. Allowances for escalation from published price levels to the notice to proceed milestone and escalation for duration of the construction contract were also not included because of the undefined construction schedule.

Annual costs include interest and amortization of the field costs based on the current Federal discount rate of 4 percent, unless specified otherwise, over an assumed service life. Typically interest and amortization is determined using total capital costs; however, as discussed previously, total capital costs were not available. Operation and maintenance (O&M) costs are also included in the annual costs and are typically expressed as a percentage of the field or construction cost. O&M costs estimated at an older price level were indexed to January 2012 using Reclamation's Construction Cost Trends (Reclamation 2012).

All cost estimates, especially at this preliminary stage in the planning process, have inherent risks and uncertainties. In development of the initial cost estimates for the measures, the Study team has no control over the costs of labor, materials, competitive bidding environments, unidentified field conditions, financial and/or commodity market conditions, or any other factors likely to affect the initial cost estimates of the Study measures, all of which are and will unavoidably remain in a state of change, especially in light of high market volatility attributable to Acts of God and other market forces or events beyond the control of the parties. As such, these initial estimates are based on normal market conditions, defined by stable resource supply/demand relationships, and do not account for extreme inflationary or deflationary market cycles. These initial estimates are a "snapshot in time" and their reliability will degrade over time. No warranty, promise, guarantee or representation, either express or implied, is given that proposals, bids, project construction costs, or cost of O&M functions will not vary significantly from these good faith initial estimates.

Measure Cost Estimate Summaries

The following sections are organized by the grouping of measures evaluated in Chapter 4, and summarize the basis for the initial cost estimates. Each section will identify each measure’s cost, estimate level and type, price level, and briefly summarize the cost estimate approach and assumptions.

Truckee Canal Safety Measures for Potential Use in Preliminary Alternatives

Actions identified by the U.S. Department of the Interior, Bureau of Reclamation (Reclamation) to reduce the risk of failure along the Truckee Canal include physical repairs, upgrades, and reduced flow-stages. This section describes how the structural corrective actions have been identified and combined with reduced canal flow-stages to meet the Study's safety objective.

This Study was initiated following the completion of both the *Truckee Canal Risk Assessments* (Reclamation 2008c, 2011d) and *Corrective Action Study* (Reclamation 2011e). These studies identify a host of repairs and other actions that, when enacted, would allow the Truckee Canal to operate safely at a range of different flow-stages. This study relies upon those recommendations for measures that meet the safety objective.

Table E2-1 summarizes the range of field and annual costs for corrective actions that each flow-stage may require to meet "Risk Rating 3" (RR3). RR3 is discussed in detail in Chapter 4 and the required corrective actions are discussed in the following sections.

Table E2-1: Truckee Canal Safety Measures for Potential Use in Preliminary Alternatives

Measure	600 cfs[1]			350 cfs[1]			250 cfs[1 2]			0 cfs	150 cfs
	Concrete/ Geomembrane Lining	**CB Cutoff Wall**	**HDPE Cutoff Wall**	**Concrete/ Geomembrane Lining**	**CB Cutoff Wall**	**HDPE Cutoff Wall**	**Concrete/ Geomembrane Lining**	**CB Cutoff Wall**	**HDPE Cutoff Wall**	**Truckee Canal Decommissioning**	**TBD/Likely Future Without-Action Condition**
Estimate Level	*Appraisal*	*Appraisal*	*Appraisal*	*Appraisal*	*Appraisal*	*Appraisal*	*Appraisal*	*Appraisal*	*Appraisal*	*Appraisal*	*Preliminary*
Price Level	*October 2010*	*October 2010*	*October 2010*	*October 2010*	*October 2010*	*October 2010*	*October 2010*	*October 2010*	*October 2010*	*October 2010*	*March 2012*
Estimate Type	*Field Cost*	*Field Cost*	*Field Cost*	*Field Cost*	*Field Cost*	*Field Cost*	*Field Cost*	*Field Cost*	*Field Cost*	*Field Cost*	*Field Cost*
Estimate Source	*Reclamation 2011e*	*Reclamation 2011e*	*Reclamation 2011e*	*Reclamation 2011e*	*Reclamation 2011e*	*Reclamation 2011e*	*Reclamation 2011e*	*Reclamation 2011e*	*Reclamation 2011e*	*Reclamation 2011e*	*MWH*
Field Cost[3] ($ million, not indexed)	**$55**	**$52**	**$41**	**$55**	**$52**	**$41**	**$55**	**$52**	**$41**	**$10**	**$0.13**
Index Category[4]	*Canals*	*Canals*	*Canals*	*Canals*	*Canals*	*Canals*	*Canals*	*Canals*	*Canals*	*Canals*	*N/A*
Original Price-Level Index[5]	*332*	*332*	*332*	*332*	*332*	*332*	*332*	*332*	*332*	*332*	*N/A*
January 2012 Index[5]	*355*	*355*	*355*	*355*	*355*	*355*	*355*	*355*	*355*	*355*	*N/A*
Escalation	*7%*	*7%*	*7%*	*7%*	*7%*	*7%*	*7%*	*7%*	*7%*	*7%*	*N/A*
Field Cost[3 6] ($ million, indexed)	**$59**	**$56**	**$44**	**$59**	**$56**	**$44**	**$59**	**$56**	**$44**	**$11**	**$0.13**
Service-Life (years)	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*20*
Federal Discount Rate	*4.0%*	*4.0%*	*4.0%*	*4.0%*	*4.0%*	*4.0%*	*4.0%*	*4.0%*	*4.0%*	*4.0%*	*4.0%*
Interest and Amoritzation[7] ($ million)	$2.70	$2.60	$2.00	$2.70	$2.60	$2.00	$2.70	$2.60	$2.00	$0.50	$0.0096
O&M Percent	*0.20%*	*0.20%*	*0.20%*	*0.20%*	*0.20%*	*0.20%*	*0.20%*	*0.20%*	*0.20%*	*0.20%*	*5.00%*
O&M Allowance Reference	*Reclamation 1994*	*Reclamation 1994*	*Reclamation 1994*	*Reclamation 1994*	*Reclamation 1994*	*Reclamation 1994*	*Reclamation 1994*	*Reclamation 1994*	*Reclamation 1994*	*Reclamation 1994*	*Reclamation 1994*
O&M Costs[8] ($ million)	$0.1	$0.1	$0.088	$0.1	$0.1	$0.088	$0.1	$0.1	$0.088	$0.022	$0.0065
Annual Cost ($ million)	**$2.8**	**$2.7**	**$2.1**	**$2.8**	**$2.7**	**$2.1**	**$2.8**	**$2.7**	**$2.1**	**$0.52**	**$0.016**

Note:
Cost estimates may have discrepancies due to rounding
[1] Up to $1.7 million in field costs could be saved for 600, and 350 cfs safety measures because of the current TCID Truckee Canal turnout replacements.
[2] Costs for the 250 ft^3/sec flow-stage were presented as a "transport-only" option in the *Corrective Action Study* (2011e), and differ from the 350 ft^3/sec flow-stage because the turnout and check structure replacements are not included. For this Study, those structural features would be required and costs are assumed to be same as the 350 ft^3/sec flow-stage.
[3] Field cost is an estimate of capital costs of a feature or project from award to construction closeout. Allowances for mobilization, design contingencies, procurement strategies, and construction contingencies are included in field cost. Non-contract costs are not included in the field cost; some cost estimate sources reported construction costs and were adjusted to reflect field costs by removing non-contract costs outlined in the cost estimate.
[4] From Reclamation's Construction Cost Trends (Reclamation 2012). Cost index category is based on majority of line item costs and assumed to represent the estimate as a whole. Costs are not anticipated to vary significantly from current labor and materials pricing.
[5] From Reclamation's Construction Cost Trends (Reclamation 2012).
[6] Costs were indexed to January 2012 using Reclamation's Construction Cost Trends (Reclamation 2012).
[7] 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. Typically interest and amortization is determined using total capital costs; however, total capital costs were not available.
[8] Operation and maintenance (O&M) costs are included in the annual costs and are typically expressed as a percentage of the field or construction cost for preliminary- and appraisal-level estimates. O&M costs estimated at source price level were indexed to January 2012.
Key:
CB = cement bentonite
cfs = cubic feet per second
N/A = not applicable
O&M = operations and maintenance

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600, 350, and 250 cfs Flow-Stages

Reclamation's *Corrective Action Study* (2011e) identified three techniques to achieve safety, organized around a range of Truckee Canal flow-stages between 600 and 250 cubic feet per second (cfs).

- **Concrete and geomembrane lining** – For this lining option, a low-density polyethylene geomembrane 40 thousandth of an inch thick would be placed on the canal's prism (along the sides and bottom of the structure) and covered by a layer of unreinforced concrete 3 inches thick. The canal section would be designed to a smaller cross-section prism than the existing channel geometry. The concrete lining protects the geomembrane from being damaged during maintenance work or large debris flows, and by animals. The installation of a properly installed geomembrane and concrete liner would essentially eliminate seepage into the canal embankment and foundation. Once the lining system is installed, all static failure modes evaluated for the canal would be eliminated.

- **Cement bentonite cutoff wall** – For this non-lining option, a trench would be excavated in the centerline of the canal embankment and filled with a slurry mix of cement, bentonite, and water. Exposed defects, such as animal burrows or cracks, within the trench would also be filled with the slurry. The cement bentonite slurry would harden over time to form an impermeable barrier within the canal embankment. The excavated soil and slurry from the trench would be used to reshape the canal embankment, as needed. The installation of a cement bentonite cutoff wall would eliminate all of the existing seepage paths and provide a deterrent to future rodent activity through the canal embankment.

- **High-density polyethylene (HDPE) cutoff wall** – For this non-lining option, interlocking panels of high-density polyethylene (HDPE) would be pushed and vibrated into the centerline of the canal embankment. The installation of an HDPE wall would eliminate all of the existing seepage paths and eliminate the potential for future rodent activity through the canal embankment. A cap would be installed at the crest to prevent damage to the top of the HDPE geomembrane wall.

Each measure includes a number of general upgrades to checks, wasteways, conduits, and takeouts, along with three different options for structural improvements along the length of the canal surface. Each option provides for the minimum standard of safety – termed "Risk Rating 3" (RR3) – required by Reclamation for canals. These measure does not include the addition of drains on the toe side of canal.

In parallel with this Study, Reclamation is refining the hydrologic analysis used in developing the above safety measures. The updated analysis may reduce the assessed risks of natural runoff, and thereby reduce the extents and cost of

structural requirements for safety options. The revised hydrology study is expected to be completed by the end of 2012. Development of additional analyses will be required to update cost estimates for the safety measures, but is unlikely to occur before the completion of this Study.

600 cfs Flow-Stage

Estimated Cost:

- Field Cost: $44 million to $59 million
- Annual Cost: $2.1 million to $2.8 million
- Estimate Level: Appraisal
- Price Level: January 2012

Estimate Approach and Assumptions: Field costs were taken from the *Corrective Action Study* (2011e). Costs include allowances of 5 percent for mobilization, 15 percent for design contingency, and 25 percent for construction contingency. Field costs were indexed to January 2012 price level using Reclamation's Construction Cost Trends (Reclamation 2012). Up to $1.7 million in field costs could be saved for 600, 350, and 250 cfs safety measures because of the current TCID Truckee Canal turnout replacements. Non-contract costs, including any permitting or National Environmental Policy Act (NEPA) compliance studies, are not included in the cost. In addition to these costs, IDC and escalation are required to determine a total capital cost.

Annual costs are based on a 4 percent discount rate, 50-year service life, and annual O&M costs equal to 0.2 percent of the field cost. The O&M percent assumption is based on canal O&M costs from Reclamation's Final Report of the Secretary of the Interior to the Congress of the United States of Newlands Project Efficiency Study (Newlands Project Efficiency Study) (1994).

Source: Field costs from Reclamation 2011e; O&M percentage from Reclamation 1994; costs indexed and annualized by MWH.

350 cfs Flow-Stage

Estimated Cost:

- Field Cost: $44 million to $59 million
- Annual Cost: $2.1 million to $2.8 million
- Estimate Level: Appraisal
- Price Level: January 2012

Estimate Approach and Assumptions: The same approach and assumptions as "600 cfs Flow-Stage."

Source: Field costs from Reclamation 2011e; O&M percentage from Reclamation 1994; costs indexed and annualized by MWH.

250 cfs Flow-Stage

Estimated Cost:

- Field Cost: $44 million to $59 million
- Annual Cost: $2.1 million to $2.8 million
- Estimate Level: Appraisal
- Price Level: January 2012

Estimate Approach and Assumptions: Similar approach and assumptions as "600 cfs Flow-Stage," however, costs for the 250 cfs flow-stage were presented as a "transport only" only option in the *Corrective Action Study* (2011e) and differ from the 350 cfs flow-stage because the turnout and check structure replacements are not included. For this Study, those structural features would be required and costs are assumed to be same as the 350 cfs flow-stage.

Source: Field costs from Reclamation 2011e; O&M percentage from Reclamation 1994; costs indexed and annualized by MWH.

0 cfs Flow-Stage

The *Corrective Action Study* (2011e) also evaluated reducing the risk of canal failure by decommissioning the canal from use. Decommissioning the canal would address all of the public safety risks its use currently poses, as well as risks that an abandoned canal might pose without further action (e.g., attractive nuisances and stormwater drainage).

Estimated Cost:

- Field Cost: $11 million
- Annual Cost: $520,000
- Estimate Level: Appraisal
- Price Level: January 2012

Estimate Approach and Assumptions: This cost includes the same approach as the other *Corrective Action Study* (2011e) measures discussed previously.

Source: Field costs from Reclamation 2011e; O&M percentage from Reclamation 1994; costs indexed and annualized by MWH.

150 cfs Flow-Stage

This Study also includes a 150 cfs flow-stage for the Truckee Canal as a method for achieving the safety objective, although this flow-stage was not evaluated in the *Corrective Action Study* (Reclamation 2011e). Following the 2008 breach, Reclamation determined that the Truckee Canal could safely operate at a 150 cfs flow-stage without additional repairs or upgrades (Reclamation 2008c, d). The 150 cfs flow-stage reflects the operational and capacity restrictions on the Truckee Canal under the "Likely Future Without-Action Condition," as described in Chapter 3. This measure includes additional pumping costs for Truckee Division turnouts.

Estimated Cost:

- Field Cost: $130,000
- Annual Cost: $16,000
- Estimate Level: Preliminary
- Price Level: March 2012

Estimate Approach and Assumptions: Six turnouts on the Truckee Canal would require additional pumping in order to meet Truckee Division deliveries. Pumps were sized based on the required head and flow at each turnout. Each turnout would contain two pumps for reduncy; one for duty, and one for backup. Unit costs for installed capacity were developed from previous project experience.

Costs include allowances of 5 percent for mobilization, 15 percent for design contingency, and 25 percent for construction contingency. Non-contract costs, including any permitting or National Environmental Policy Act (NEPA) compliance studies, are not included in the cost. In addition to these costs, IDC and escalation are required to determine a total capital cost.

Annual costs are based on a 4 percent discount rate, 20-year service life, and annual O&M costs equal to 5 percent of the field cost. The O&M percent assumption is based on previous project experience.

Source: Field and annual costs developed by MWH.

Additional Backup Information: A backup cost estimate worksheet for this measure is shown in Attachment: Cost Estimate Worksheets.

Water Supply Measures Retained for Potential Use in Preliminary Alternatives

All alternatives formulated for this Study must meet the Study's safety and water supply objectives. The safety measures for the Truckee Canal described above will ensure all alternatives developed meet the Study's safety objective, but they may also result in a less reliable or available supply of water for Project users when compared to pre-breach conditions. More than 50 water supply measures were developed to meet the water supply objective. Table E2-2 summarizes the range of field and annual costs for water supply measures retained for potential use in preliminary alternatives, which are described in the following sections.

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Table E2-2: Water Measures Retained for Potential Use in Preliminary Alternatives

Category	**Develop Alternative Sources**				**Increase Efficiency**					
Subcategory	**Supplement Truckee Division Supply**		**Supplement Carson Division Supply**	**Establish New Truckee Division Points of Diversion and Delivery**	**Reduce Carson Division Seepage**			**Reduce Truckee Division Seepage**		
Measure	**Treat Effluent and Deliver for Agricultural Use: Secondary**	**Treat Effluent and Deliver for Agricultural Use: Tertiary**	**Import Dixie Valley Groundwater**	**Construct Pipeline to Agricultural Users**	**Compact Soil Lining of Main Canals and Laterals: Option 1 Expanded**	**Compact Soil Lining of Main Canals and Laterals: Option 1 Expanded + T Canal**	**Line Main Canals and Laterals: Option 1 Expanded**	**Compact Soil Lining of the Truckee Canal**	**Line Truckee Canal: 600 cfs and 350 cfs**	**Line Truckee Canal: 250 cfs**
Estimate Level	*Preliminary*	*Preliminary*	*Preliminary*[1]	*Preliminary*	*Preliminary*	*Preliminary*	*Preliminary*[1]	*Preliminary*	*Appraisal*	*Appraisal*
Price Level	*March 2012*	*March 2012*	*2007*	*March 2012*	*March 2012*	*March 2012*	*April 1994*	*March 2012*	*October 2010*	*October 2010*
Estimate Type	*Field Cost*	*Field Cost*	*Construction Cost*	*Field Cost*	*Field Cost*	*Field Cost*	*Construction Cost*	*Field Cost*	*Field Cost*	*Field Cost*
Estimate Source	*MWH*	*MWH*	*Churchill County 2007*	*MWH*	*MWH*	*MWH*	*Reclamation 1994*	*MWH*	*Reclamation 2011e; MWH*	*Reclamation 2011e; MWH*
Field Cost[2] ($ million, not indexed)	**$0**	**$3.1 - $13**	**$54 - $115[3]**	**$110 - $120**	**$2.1 - $4.2**	**$2.2 - $4.5**	**$81.0[4]**	**$0.78 - $1.55**	**$14**	**$13**
Index Category[6]	*N/A*	*N/A*	*Steel pipelines*	*N/A*	*N/A*	*N/A*	*Canals*[7]	*N/A*	*Canals*	*Canals*
Original Price-Level Index[8]	*N/A*	*N/A*	*315.5*	*N/A*	*N/A*	*N/A*	*176*	*N/A*	*332*	*332*
January 2012 Index[8]	*N/A*	*N/A*	*371*	*N/A*	*N/A*	*N/A*	*355*	*N/A*	*355*	*355*
Escalation	*N/A*	*N/A*	*18%*	*N/A*	*N/A*	*N/A*	*102%*	*N/A*	*7%*	*7%*
Field Cost[2 9] ($ million, indexed)	**$0**	**$3.1 - $13**	**$63 - $135**	**$110 - $120**	**$2.1 - $4.2**	**$2.2 - $4.5**	**$165**	**$0.78 - $1.55**	**$15**	**$14**
Service-Life (years)	*40*	*40*	*Varies 65-20 years*	*Varies 30-20 years*	*5*	*5*	*50*	*5*	*50*	*50*
Federal Discount Rate	*4.0%*	*4.0%*	*4.0%*	*4.0%*	*4.0%*	*4.0%*	*4.0%*	*4.0%*	*4.0%*	*4.0%*
Interest and Ammoritzation[10] ($ million)	$0	$0.16 - $0.66	$2.9 - $6.2	$6.8 - $7.4	$0.47 - $0.94	$0.49 - $1	$7.70	$0.18 - $0.35	$0.70	$0.65
O & M Percent	*9.00%*	*9.00%*	*Varies*	*1.00%*	*1.00%*	*1.00%*	*Approx 0.15%*	*1.00%*	*0.20%*	*0.20%*
O & M Allowance Reference	*MWH*	*MWH*	*Churchill County 2007*	*Churchill County 2007*	*MWH*	*MWH*	*Reclamation 1994*	*MWH*	*Reclamation 1994*	*Reclamation 1994*
O & M Costs[11] ($ million)	$0	$0.28 - $1.2	$1.5 - $4.9	$1.1 - $1.2	$0.021 - $0.042	$0.022 - $0.045	$0.3	$0.0078 - $0.0155	$0.03	$0.028
Annual Cost[12] ($ million)	**$0**	**$0.44 - $1.85**	**$4.4 - $11**	**$7.9 - $8.6**	**$0.49 - $0.98**	**$0.51 - $1.05**	**$8**	**$0.19 - $0.37**	**$0.73**	**$0.68**

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Table E2-2: Water Measures Retained for Potential Use in Preliminary Alternatives (contd.)

Category	**Reduce Demand**		
Subcategory	**Modify Land Uses**	**Reduce Dry-Year Demand**	
Measure	Acquire and Retire Water Rights	Crop Insurance/Fallowing	Partial Season Forbearance Agreements
Estimate Level	*Preliminary*	*Preliminary*	*Preliminary*
Price Level	*March 2012*	*March 2012*	*March 2012*
Estimate Type	*Acquisition Cost*	*Acquisition Cost*	*Acquisition Cost*
Estimate Source	*MWH*	*MWH*	*MWH*
Acquisition Cost[5] ($ million, not indexed)	**$0.001285 per acre-foot**	**$0.000065 - $0.0001 per acre-foot per year**	**$0.000065 - $0.0001 per acre-foot per year**
Index Category[6]	*N/A*	*N/A*	*N/A*
Original Price-Level Index[8]	*N/A*	*N/A*	*N/A*
January 2012 Index[8]	*N/A*	*N/A*	*N/A*
Escalation	*N/A*	*N/A*	*N/A*
Acquisition Cost[5 9] ($ million, indexed)	**$0.001285 per acre-foot**	**$0.000065 - $0.0001 per acre-foot per year**	**$0.000065 - $0.0001 per acre-foot per year**
Service-Life (years)	*30*	*N/A*	*N/A*
Federal Discount Rate	*4.0%*	*N/A*	*N/A*
Interest and Amoritzation[10] ($ million)	$0.000074	N/A	N/A
O & M Percent	*N/A*	*N/A*	*N/A*
O & M Allowance Reference	*N/A*	*N/A*	*N/A*
O & M Costs[11] ($ million)	N/A	N/A	N/A
Annual Acquisition Cost ($ million)	**$0.000074 per acre-foot**	**$0.000065 - $0.0001 per acre-foot**	**$0.000065 - $0.0001 per acre-foot**

Note:
Cost estimates may have discrepancies due to rounding.
[1] Estimate level assumed to be preliminary based on criteria discussed in Reclamation Manual Directives and Standards FAC 09-01.
[2] Field cost is an estimate of capital costs of a feature or project from award to construction closeout. Allowances for mobilization, design contingencies, procurement strategies, and construction contingencies are included in field cost. Non-contract costs are not included in the field cost; some cost estimate sources reported construction costs and were adjusted to reflect field costs by removing non-contract costs outlined in the cost estimate.
[3] $24 to $50 million in non-contract costs were removed from the source cost estimate in order to adjust the estimate to a field cost.
[4] $29 million in non-contract costs were removed from the source cost estimate in order to adjust the estimate to a field cost.
[5] These costs are only acquisition costs, representing a portion of non-contract costs related to land acquisition, and are not considered field costs.
[6] From Reclamation's Construction Cost Trends (Reclamation 2012). Cost index category is based on majority of line item costs and assumed to represent the estimate as a whole. Costs are not anticipated to vary significantly from current labor and materials pricing.
[7] Reclamation Manual Directives and Standards FAC 09-01 state that cost indexes shall not be applied to estimates over 5 years old; however, for this stage in the planning process, indexing is assumed to be appropriate and costs are not anticipated to vary significantly from current labor and materials pricing.
[8] From Reclamation's Construction Cost Trends (Reclamation 2012).
[9] Costs not developed by MWH were indexed to January 2012 using Reclamation indices.
[10] 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. Typically interest and amortization is determined using total capital costs; however, total capital costs were not available.
[11] Operation and maintenance (O&M) costs are included in the annual costs and are typically expressed as a percentage of the field or construction cost for preliminary- and appraisal-level estimates. O&M costs estimated at source price level were indexed to January 2012.
[12] Annual costs do not include non-contract costs, such as facilitating services, investigations, design and specifications, construction management, environmental compliance, and archeological considerations. Interest during construction and escalation to mid-point of construction are also not included.
Key:
cfs = cubic feet per second
N/A = not applicable
O & M = operations and maintenance

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Develop Alternative Sources

Supplement Truckee Division Supply – Treat Effluent and Deliver for Agricultural Use

This measure serves agricultural water rights in the Truckee Division with treated wastewater from the City of Fernley's East Wastewater Treatment Facility. The facility is a secondary treatment plant with a current average treatment volume of 1.5 million gallons per day (MGD) (City of Fernley 2008b). At present, there are no plans for the City of Fernley to reuse treated wastewater, and it is discharged to the Fernley Wildlife Management Area and infiltrated into the local aquifer. Modifications would be required to the current treatment process to provide a higher level of filtration and disinfection (similar to California Title 22 drinking standards) for stockwater use or use on agricultural fields. Depending on the actual use, for instance if all supplies are applied to fields and not are applied to stock, then the current level of treatment may be sufficient, and the additional cost of tertiary treatment may be avoided. This measure would also require conveyance equivalent to the "Deliver Truckee Division Agricultural Water from Pipeline" measure; however, this cost is not included.

Secondary Treatment
Estimated Cost:

- Field Cost: $0
- Annual Cost: $0
- Estimate Level: Preliminary
- Price Level: March 2012

Estimate Approach and Assumptions: Secondary treatment is already provided and no additional costs are assumed to be required.

Source: MWH.

Tertiary Treatment
Estimated Cost:

- Field Cost: $3.1 million to $13 million
- Annual Cost: $440,000 to $1.85 million
- Estimate Level: Preliminary
- Price Level: March 2012

Estimate Approach and Assumptions: Two treatment options were assessed to give a range of costs for bringing the City of Fernley's East Wastewater Treatment Facility from secondary to tertiary treated effluent; (1) addition of traditional microfiltration/ultrafiltration treatment system, or (2) addition of a Membrane Bioreactor (MBR) system. MBR is typically more expensive; however, it would provide a more reliable operation to meet the tertiary standard. All of the 1.5 mgd effluent was assumed to be treated (equivalent to California Title 22 requirements for unrestricted use). Unit costs for both treatment methods were developed from previous project experience. Costs were also indexed to 2012 costs using the U.S. Army Corps of Engineers EM 1110-2-1304 – Civil Works Construction Cost Index System (2012). As discussed previously, costs for conveyance are not included in this estimate.

Costs include mobilization and allowances of 15 percent for design contingency and 25 percent for construction contingency. Non-contract costs are not included. In addition to these costs, IDC and escalation are required to determine a total capital cost.

Annual costs are based on a 4 percent discount rate, 40-year service life, and annual O&M costs equal to 9 percent of the field cost.

Source: Field and annual costs developed by MWH.

Additional Backup Information: A backup cost estimate worksheet for this measure is shown in Attachment: Cost Estimate Worksheets.

Supplement Carson Division Supply – Import Dixie Valley Groundwater

This measure considers delivering groundwater from the Dixie Valley for use in the Carson Division. This measure includes construction of several facilities to deliver Dixie Valley supplies into the Lahontan Valley, including a pressurized pipeline that would cross over Sand Pass adjacent to Highway 50, groundwater wells, one or several large-scale pumping plants, a treatment facility to remove arsenic and fluoride, and electrical transmission lines.

Estimated Cost:

- Field Cost: $63 million to $135 million
- Annual Cost: $4.4 million to $11 million
- Estimate Level: Preliminary
- Price Level: January 2012

Estimate Approach and Assumptions: This cost is based on a proposal developed and studied by Churchill County and includes a range of actions depending on the desired capacity (5,000 – 11,000 gallons per minute) for facilities to deliver Dixie Valley supplies into the Lahontan Valley. The

estimate level was assumed to be preliminary based on criteria discussed in Reclamation Manual Directives and Standards FAC 09-01. Costs include a pressurized pipeline, wells, one or several large-scale pumping plants, a treatment facility to remove arsenic and fluoride, electrical transmission lines, and environmental and construction permitting costs (Churchill County 2007).

Costs were reported as construction costs and were adjusted to reflect field costs to make comparable with other cost estimates. Field costs were indexed to January 2012 price level using Reclamation's Construction Cost Trends (Reclamation 2012). Right-of-way permits, water rights acquisitions, and escalation costs and other non-contract costs are not included in the cost. In addition to these costs, IDC is required to determine a total capital cost.

Annual costs were developed by the Churchill County study, using varying service life spans (20 – 65 years) and O&M costs for each component. Annual costs were reannualized based on the new field costs using the same service life spans and 4 percent discount rate.

Source: Construction and annual costs developed by Churchill County 2007; costs adjusted to field costs, indexed, and annualized by MWH.

Establish New Truckee Division Points of Diversion and Delivery – Construct Pipeline to Agricultural Users

This measure serves agricultural water rights in the Truckee Division from the Truckee River. This measure includes construction of a 50 cfs, 1,700 horsepower pump station and pipeline (approximately 18.3 miles) to convey these supplies to the head works of the current distribution laterals (TC-01 to TC-13). For alternatives where the Truckee Canal capacity is limited, this measure increases the capacity available for conveyance to Lahontan Reservoir. For alternatives where Truckee Canal capacities are zero, this measure serves rights within the area without conveying water through the Fernley Reach. This measure could also be combined with other measures to serve the Fernley area with direct diversions from the Truckee River, from a relocated TC-1, or from treated effluent.

Estimated Cost:

- Field Cost: $110 million to $120 million
- Annual Cost: $7.9 million to $8.6 million
- Estimate Level: Preliminary
- Price Level: March 2012

Estimate Approach and Assumptions: Preliminary design determined a 42-inch, ductile iron pipe and 1,700-horsepower pumping plant would be constructed. The pump station was assumed to be located near TC-01 and the pipeline was

assumed to follow the same plan and profile as the Truckee Canal from TC-01 to TC-13 (approximately 18.3 miles). A range in costs is reported to estimate a pipeline with and without a flexible acid-resistant liner. A flexible acid-resistant liner is needed if the inflow is treated effluent. Cost assumes no groundwater and significant underground conflicts will be present during construction. Cost also assumes no additional access road construction would be required.

Unit costs were developed as Advancement of Cost Engineering (AACE) Class 5 costs, equivalent to a preliminary-level estimate. Costs include allowances of 5 percent for mobilization, 15 percent for design contingency, and 25 percent for construction contingency. Non-contract costs are not included in the cost. In addition to these costs, IDC and escalation are required to determine a total capital cost.

Annual costs are based on a 4 percent discount rate, 20- to 30-year service lifes, and annual O&M costs equal to 1 percent of the field cost. The O&M percent assumption is based on pipeline O&M costs from Churchill County's *Final Water Resource Plan Update* (2007).

Source: Field and annual costs developed by MWH; O&M percentage from Churchill County 2007.

Additional Backup Information: A backup cost estimate worksheet for this measure is shown in Attachment: Cost Estimate Worksheets.

Increase Efficiency

Reduce Carson Division Seepage – Compact Soil Lining of Main Canals and Laterals

This measure considers vibratory compaction techniques to compress the upper two feet of soil in the Carson Division's earth-lined canals and laterals in order to reduce seepage losses. This measure only considers compacting the main canals and laterals, where seepage losses are greatest, according to the Newlands Project Efficiency Study (Reclamation 1994).

Option 1 Expanded This measure proposes compacting portions of the V, S, L, and A canals, and L1 lateral (44.9 miles).

Estimated Cost:

- Field Cost: $2.1 million to $4.2 million
- Annual Cost: $490,000 to $980,000
- Estimate Level: Preliminary
- Price Level: March 2012

Estimate Approach and Assumptions: Costs were estimated using approximate canal and lateral wetted surface areas. Wetted surface areas were estimated using canal widths reported in TCID's *Newlands Project Water Conservation Plan* (2010), aerial imagery, and lengths to be compacted from the Newlands Project Efficiency Study (Reclamation 1994). Costs include low to high range AACE Class 5 unit costs, equivalent to a preliminary-level estimate, for original ground scarification and compaction construction activities.

Costs include allowances of 5 percent for mobilization, 15 percent for design contingency, and 25 percent for construction contingency. Non-contract costs are not included in the cost. In addition to these costs, IDC and escalation are required to determine a total capital cost.

Annual costs are based on a 4 percent discount rate, 5-year service life, and annual O&M costs equal to 1 percent of the field cost.

Source: Field and annual costs developed by MWH.

Additional Backup Information: A backup cost estimate worksheet for this measure is shown in Attachment: Cost Estimate Worksheets.

Option 1 Expanded + T Canal This measure includes "Option 1 Expanded" and proposes compacting portions of the T canal (54.5 miles).

Estimated Cost:

- Field Cost: $2.2 million to $4.5 million
- Annual Cost: $510,000 to $1.05 million
- Estimate Level: Preliminary
- Price Level: March 2012

Estimate Approach and Assumptions: The same approach and assumptions as "Option 1 Expanded."

Source: Field and annual costs developed by MWH.

Additional Backup Information: A backup cost estimate worksheet for this measure is shown in Attachment: Cost Estimate Worksheets.

Reduce Carson Division Seepage – Line Main Canals and Laterals

This measure considers the installation of a 4-inch concrete lining with a geomembrane liner to prevent seepage. This measure only considers lining the main canals and laterals, where seepage losses are greatest, according to Newlands Project Efficiency Study (Reclamation 1994).

Option 1 Expanded This measure proposes lining portions of the V, S, L, and A canals, and L1 lateral (44.9 miles).

Estimated Cost:

- Field Cost: $165 million
- Annual Cost: $8 million
- Estimate Level: Preliminary
- Price Level: January 2012

Estimate Approach and Assumptions: Representative costs were used from the Newlands Project Efficiency Study (Reclamation 1994). The estimate level was assumed to be preliminary based on criteria discussed in Reclamation Manual Directives and Standards FAC 09-01. Costs were reported as construction costs and were adjusted to reflect field costs to make comparable with other cost estimates. Field costs were indexed to January 2012 price level using Reclamation's Construction Cost Trends (Reclamation 2012). Although the Directives and Standards state that cost indexes should not be applied to estimates over 5 years old, indexing is assumed to be appropriate for this stage in the planning process, and costs are not anticipated to vary significantly from current labor and materials pricing. Costs include allowances of 25 percent for mobilization, design, and construction contingencies. Cost escalation was not applied to the cost estimate because there has not been a definitive construction schedule. Non-contract costs are not included in the cost. In addition to these costs, IDC and escalation are required to determine a total capital cost.

Annual costs are based on a 4 percent discount rate, 50-year service life, and annual O&M costs reported in the Newlands Project Efficiency Study (Reclamation 1994) indexed to January 2012 price level.

Source: Construction and O&M costs developed by Reclamation 1994; costs adjusted to field costs, indexed, and annualized by MWH.

Option 1 Expanded + T Canal This measure includes “Option 1 Expanded” and proposes lining portions of the T canal (54.5 miles).

Estimated Cost:

- Field Cost: $195 million
- Annual Cost: $9.4 million
- Estimate Level: Preliminary
- Price Level: January 2012

Estimate Approach and Assumptions: The same approach and assumptions as "Option 1 Expanded."

Source: Construction and O&M costs developed by Reclamation 1994; costs adjusted to field costs, indexed, and annualized by MWH.

Reduce Truckee Division Seepage – Compact Soil Lining of the Truckee Canal

This measure considers vibratory compaction techniques to compress the upper two feet of soil in the earth-lined portions of the Truckee Canal to reduce seepage losses. This measure includes construction activities along the entire Truckee Canal.

Estimated Cost:

- Field Cost: $780,000 to $1.55 milion
- Annual Cost: $190,000 to $370,000
- Estimate Level: Preliminary
- Price Level: March 2012

Estimate Approach and Assumptions: Surface area of the Truckee Canal was estimated using available cross-sectional data and information from the *Corrective Action Study* (Reclamation 2011e). Costs were estimated low to high range AACE Class 5 unit costs, equivalent to a preliminary-level estimate, for original ground scarification and compaction construction activities. Costs include allowances of 5 percent for mobilization, 15 percent for design contingency, and 25 percent for construction contingency. Non-contract costs are not included in the cost. In addition to these costs, IDC and escalation are required to determine a total capital cost.

Annual costs are based on a 4 percent discount rate, 5-year service life, and annual O&M costs equal to 1 percent of the field cost.

Source: Field and annual costs developed by MWH.

Additional Backup Information: A backup cost estimate worksheet for this measure is shown in Attachment: Cost Estimate Worksheets.

Reduce Truckee Division Seepage – Line Truckee Canal

This measure considers lining the Truckee Canal with an impermeable geomembrane and covered by unreinforced concrete. In addition to reducing seepage losses, this measure would help resolve some of the canal's structural problems caused by animal burrowing.

600 and 350 cfs Flow-Stages
Estimated Cost:

- Field Cost: $15 million
- Annual Cost: $730,000
- Estimate Level: Appraisal
- Price Level: January 2012

Estimate Approach and Assumptions: Costs for this measure are discussed in "Truckee Canal Safey Measures for Potential Use in Preliminary Alternatives" measures under the concrete and geomembrane lining method. For alternatives with 600 cfs and 350 cfs Truckee Canal capacity, this measure would have an incremental cost of $15 million above the cost of the minimum safety requirement (i.e., HDPE cutoff wall).

Annual costs are based on a 4 percent discount rate, 50-year service life, and annual O&M costs equal to 0.2 percent of the field cost. The O&M percent assumption is based on canal O&M costs from the Newlands Project Efficiency Study (Reclamation 1994).

Source: Field costs from Reclamation 2011e; O&M percentage from Reclamation 1994; costs indexed and annualized by MWH.

250 cfs Flow-Stage
Estimated Cost:

- Field Cost: $14 million
- Annual Cost: $680,000
- Estimate Level: Appraisal
- Price Level: January 2012

Estimate Approach and Assumptions: This cost includes the same approach as the previous measure.

Source: Field costs from Reclamation 2011e; O&M percentage from Reclamation 1994; costs indexed and annualized by MWH.

Reduce Agricultural Demand

Modify Land Uses – Acquire and Retire Water Rights

This measure seeks to retire a sufficient volume of water rights that the remaining Newlands Project water rights can be considered reliable. Water

rights would be obtained from willing sellers and would then be retired from production thereby reducing the volume of shortage experienced by the Project's remaining water rights holders.

Estimated Cost:

- Acquisition Cost: $1,285 per acre-foot
- Annual Cost: $74 per acre-foot
- Estimate Level: Preliminary
- Price Level: March 2012

Estimate Approach and Assumptions: The estimated costs associated with the water rights acquisition program was estimated by considering the prices paid for water rights purchased separately from land under ongoing water right acquisition programs in the Carson Division. The USFWS is actively purchasing land and water rights to benefit regional wetlands. Based upon the experience of this program, the current cost of acquiring water rights in the Carson Division is approximately $1,285 per acre-foot. These costs may not represent all non-contract costs associated with acquisition, including administrative and relocation assistance costs. Annual costs are based on a 4 percent discount rate and 30-year loan.

Source: Acquisition costs developed by WestWater Research; costs annualized by MWH.

Reduce Dry -Year Demand – Crop Insurance/Fallowing

This measure considers compensating water rights holders who agree not to exercise their rights during drier years

Estimated Cost:

- Annual Acquisition Cost: $65 to $100 per acre-foot
- Estimate Level: Preliminary
- Price Level: March 2012

Estimate Approach and Assumptions: This analysis assumes that water right owners that choose to participate in the program are compensated to forgo irrigation for the season. It is likely that the annual cost per acre of land enrolled in the program will vary according to hydrologic conditions and crop prices, among other factors. Annual program payments must be at least equal to the foregone net income associated with agricultural production. As a result, higher crop prices will likely require higher program payments to compensate participating water right owners that are actively irrigating hay and grain crops.

Hydrologic conditions may affect program payments by affecting water supply and associated crop production under both the action and no-action alternatives. As a result of these factors, annual program payments to participating agricultural producers may vary significantly from year to year. As a simplifying assumption, this analysis assumes that, on average, the annual cost of operating the program can be represented as 5 percent to 8 percent of the cost of permanently acquiring the water right ($1,285 per acre-foot in recent transactions, based on diversion volume). Following this assumption, the annual cost is estimated to range from approximately $65 to $100 per acre-foot. These costs may not represent all non-contract costs associated with acquisition.

Source: Acquisition costs developed by WestWater Research.

Reduce Dry-Year Demand – Partial Season Forbearance Agreements

In dryer years, farmers would be paid a sum to end irrigation and crop production earlier than they ordinarily would. This effectively shortens the irrigation season for many farmers. The terms, conditions, and payment for exercising this option would be preestablished in individual forbearance agreements.

Estimated Cost:

- Annual Acquisition Cost: $65 to $100 per acre-foot
- Estimate Level: Preliminary
- Price Level: March 2012

Estimate Approach and Assumptions: As with the "Crop Insurance or Fallowing" measure, payments to participating water right owners would be based, in part, upon the foregone net income associated with crop production. Consequently, the annual payments would be related to crop prices, crop production costs, and hydrologic conditions, among other factors. This analysis assumes the cost to acquire water through partial season agreements ranges from $65 to $100 per acre-foot.

Source: Acquisition costs developed by WestWater Research.

Water Supply Measures Not Retained for Potential Use in Preliminary Alternatives

Table E2-3 summarizes the range of field and annual costs for water supply measures not retained for potential use in preliminary alternatives, which are described in the following sections.

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Table E2-3: Water Measures Not Retained for Potential Use in Preliminary Alternatives

Category	**Develop Alternative Sources**				**Improve Carson River Supplies**	**Increase Efficiency**		**Reduce Demand**
Subcategory	**Establish New Truckee Division Points of Diversion and Delivery**				**Reduce Diversions from Upper Carson Basin**	**Reduce Carson Division Seepage**		**Improve On-farm Efficiency**
Measure	Construct Truckee River Intake and Pipeline to City of Fernley	Deliver from Relocated TC-1: 600, 350, and 250 cfs	Deliver from Relocated TC-1: 150 cfs	Deliver from Relocated TC-1: 0 cfs	Purchase and Retire Upper Carson River Rights	Compact Regulating Reservoir Beds	Line Regulating Reservoirs	Transition to Sprinkler Technology
Estimate Level	*Preliminary*[1]	*Appraisal*	*Appraisal*	*Appraisal*	*Preliminary*	*Preliminary*	*Preliminary*	*Preliminary*
Price Level	*2011*	*October 2010*	*October 2010*	*October 2010*	*March 2012*	*March 2012*	*March 2012*	*March 2012*
Estimate Type	*Field Cost*	*Field Cost*	*Field Cost*	*Field Cost*	*Acquisition Cost*	*Field Cost*	*Field Cost*	*Field Cost*
Estimate Source	*City of Fernley 2011a; MWH*	*Reclamation 2011e; MWH*	*Reclamation 2011e; MWH*	*Reclamation 2011e; MWH*	*MWH*	*MWH*	*MWH*	*MWH*
Field Cost[2] ($ million, not indexed)	**$8.7 - $14**	**$0**	**$1.2**	**$-0.9**	**$0.00125 - $0.0015 per acre-foot[9]**	**$14.5 - $29**	**$58 - $100**	**$52**
Index Category[3]	*Pumping plants*	*Canal structures*	*Canal structures*	*Canal structures*	N/A	N/A	N/A	N/A
Original Price-Level Index[4]	*337*	*336*	*336*	*336*	N/A	N/A	N/A	N/A
January 2012 Index[4]	*344*	*352*	*352*	*352*	N/A	N/A	N/A	N/A
Escalation	*2%*	*5%*	*5%*	*5%*	N/A	N/A	N/A	N/A
Field Cost[2 5] ($ million, indexed)	**$8.9 - $14**	**$0**	**$1.25**	**$-0.94**	**$0.00125 - $0.0015 per acre-foot[9]**	**$14.5 - $29**	**$58 - $100**	**$52**
Service-Life (years)	*Varies 65-30 years*	*50*	*50*	*50*	*30*	*5*	*50*	*15*
Federal Discount Rate	*4.0%*	*4.0%*	*4.0%*	*4.0%*	*4.0%*	*4.0%*	*4.0%*	*4.0%*
Interest and Ammoritzation[6] ($ million)	$0.41 - $0.63	$0	$0.06	($0.044)	$0.000072 - $0.000087 per acre-foot	$3.3 - $6.5	$2.7 - $4.7	$4.7
O & M Percent	*5.00%*	*0.20%*	*0.20%*	*0.20%*	*N/A*	*0.50%*	*0.20%*	*1.00%*
O & M Allowance Reference	*MWH*	*Reclamation 1994*	*Reclamation 1994*	*Reclamation 1994*	*N/A*	*MWH*	*Reclamation 1994*	*MWH*
O & M Costs[7] ($ million)	$0.45 - $0.7	$0	$0.0025	($0.0019)	*N/A*	$0.073 - $0.15	$0.12 - $0.2	$0.52
Annual Cost[8] ($ million)	**$0.86 - $1.35**	**$0**	**$0.061**	**($0.046)**	**$0.000072 - $0.000087 per acre-foot**	**$3.4 - $6.7**	**$2.8 - $4.9**	**$5.2**

Note:
Cost estimates may have discrepancies due to rounding.
[1] Estimate level assumed to be preliminary based on criteria discussed in Reclamation Manual Directives and Standards FAC 09-01.
[2] Field cost is an estimate of capital costs of a feature or project from award to construction closeout. Allowances for mobilization, design contingencies, procurement strategies, and construction contingencies are included in field cost. Non-contract costs are not included in the field cost; some cost estimate sources reported construction costs and were adjusted to reflect field costs by removing non-contract costs outlined in the cost estimate.
[3] From Reclamation's Construction Cost Trends (Reclamation 2012). Cost index category is based on majority of line item costs and assumed to represent the estimate as a whole. Costs are not anticipated to vary significantly from current labor and materials pricing.
[4] From Reclamation's Construction Cost Trends (Reclamation 2012).
[5] Costs not developed by MWH were indexed to January 2012 using Reclamation indices.
[6] 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. Typically interest and amortization is determined using total capital costs; however, total capital costs were not available.
[7] Operation and maintenance (O&M) costs are included in the annual costs and are typically expressed as a percentage of the field or construction cost for preliminary- and appraisal-level estimates. O&M costs estimated at source price level were indexed to January 2012.
[8] Annual costs do not include non-contract costs, such as facilitating services, investigations, design and specifications, construction management, environmental compliance, and archeological considerations. Interest during construction and escalation to mid-point of construction are also not included.
[9] These costs are only acquisition costs, representing a portion of non-contract costs related to land acquisition, and are not considered field costs.
Key:
cfs = cubic feet per second N/A = not applicable O & M = operations and maintenance

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Develop Alternative Sources

Establish New Truckee Division Points of Diversion and Delivery – Construct Truckee River Intake and Pipeline to City of Fernley

This measure serves the water rights held by City of Fernley and agricultural area within the Truckee Division, through a consolidated diversion located on the Truckee River. The on-river intake and pipeline would deliver surface water to the Fernley Water Treatment Facility and then to the existing distribution network capable of delivering these surface water rights. For alternatives where the Truckee Canal capacity is limited, this measure increases the capacity available for making deliveries to Lahontan Reservoir. For alternatives where Truckee Canal capacities are zero, this measure satisfies water rights within the area.

Estimated Cost:

- Field Cost: $8.9 million to $14 million
- Annual Cost: $860,000 to $1.35 million
- Estimate Level: Preliminary
- Price Level: January 2012

Estimate Approach and Assumptions: Representative costs were used from City of Fernley's *Truckee River Surface Water Diversion Infrastructure Preliminary Engineering Report* (2011), which studied various on-river intake locations and technologies (direct surface diversion, shallow aquifer wells, horizontal collection wells, or full river diversion), and pipeline routes designed to divert 10,000 acre-feet/year of Truckee River water rights currently held by the City of Fernley. The estimate includes costs for construction of the intake and pumping facilities, water distribution pipelines, electrical transmission lines, and rights-of-way crossings for public infrastructure. Costs are not included for additional treatment costs at the Fernley Water Treatment Facility. Costs reported were assumed to be field costs because non-contract costs, including any permitting, NEPA compliance studies, or other right-of-way permits were not included in the cost. The estimate level was assumed to be preliminary based on criteria discussed in Reclamation Manual Directives and Standards FAC 09-01. Estimate assumes no additional treatment upgrades for the Fernley Municipal Water Treatment Plant would be required. Contingency costs for mobilization, design, and construction were not shown in the reference and are unknown. In addition to these unknown costs, non-contract costs, IDC, and escalation are required to determine a total capital cost. Field costs were indexed to January 2012 price level using Reclamation's Construction Cost Trends (Reclamation 2012).

Annual costs are based on a 4 percent discount rate, 30- to 65-year service lifes, and annual O&M costs equal to 5 percent of the field cost.

Source: Field costs from City of Fernley 2011a; costs indexed and annualized by MWH.

Establish New Truckee Division Points of Diversion and Delivery – Deliver from TC-1

This measure serves the water rights held by City of Fernley and Truckee Division through a consolidated diversion from the Truckee Canal, located at TC-1. The Truckee Canal's TC-1 turnout would be relocated to an area outside of the Fernley Reach (where canal safety concerns exist), and provides convenient access to the City of Fernley's water treatment plant and surface water delivery from agricultural users within the Fernley area. A check structure and wasteway would be constructed at the new location for safe operation of the Truckee Canal. Costs for this measure vary, based on the flow-stage condition for the Truckee Canal specified by each alternative.

600, 350, and 250 cfs Flow-Stages Alternatives with flow-stages between 600 and 250 cfs have costs for this measure already included in the cost for providing for the safety objective.

150 cfs Flow-Stage Alternatives with a flow-stage of 150 cfs, which does not necessarily include actions to refurbish the canal outside of this measure, would require the costs of relocating the TC-1 check structure.

Estimated Cost:

- Field Cost: $1.25 million
- Annual Cost: $61,000
- Estimate Level: Appraisal
- Price Level: January 2012

Estimate Approach and Assumptions: Representative unit costs were used from the *Corrective Action Study* (Reclamation 2011e) for a new check structure and wasteway at TC-1. Field costs were indexed to January 2012 price level using Reclamation's Construction Cost Trends (Reclamation 2012). Costs include allowances of 5 percent for mobilization, 15 percent for design contingency, and 25 percent for construction contingency. Non-contract costs, including any permitting or NEPA compliance studies, are not included in the cost. In addition to these costs, IDC and escalation are required to determine a total capital cost.

Annual costs are based on a 4 percent discount rate, 50-year service life, and annual O&M costs equal to 0.2 percent of the field cost. The O&M percent

assumption is based on canal O&M costs from Newlands Project Efficiency Study (Reclamation 1994).

Source: Field costs developed by MWH and Reclamation 2011e; O&M percentage from Reclamation 1994; costs indexed and annualized by MWH.

Additional Backup Information: A backup cost estimate worksheet for this measure is shown in Attachment: Cost Estimate Worksheets.

O cfs Flow-Stage Alternatives considering decommissioning the canal would receive a cost savings through the implementation of this measure, as the cost of relocating TC-1, and refurbishing both Derby Dam and the Derby Reach would be less than the cost of decommissioning them.

Estimated Cost:

- Field Cost: $940,000 savings
- Annual Cost: $46,000 savings
- Estimate Level: Appraisal
- Price Level: January 2012

Estimate Approach and Assumptions: The same representative costs discussed in the 150 cfs flow-stage alternative were used; however, the measure would have a cost savings of $4,900,000 for not abandoning the Derby Reach of the Truckee Canal and an additional cost of $2,800,000 for rehabilitation of the Derby Reach with an HDPE cutoff wall. The costs were also developed by the *Corrective Action Study* (Reclamation 2011), using the same cost assumptions in the 150 cfs flow-stage.

Source: Field costs developed by MWH and Reclamation 2011e; O&M percentage from Reclamation 1994; costs indexed and annualized by MWH.

Improve Carson River Supplies

Reduce Diversions from Upper Carson Basin – Purchase and Retire Upper Carson River Rights

This measure considers purchasing and retiring water-righted properties from willing sellers in the lower segments of the Carson River, starting with Segment 7 above Lahontan Dam. The water rights would go unexercised and thus flow into Lahontan Reservoir, adding to the available supply for Project use.

Estimated Cost:

- Acquisition Cost: $1,250 to $1,500 per acre-foot

- Annual Cost: $72 to $87 per acre-foot
- Estimate Level: Preliminary
- Price Level: March 2012

Estimate Approach and Assumptions: Carson River water right sales have been limited in recent years. In 2007 and 2008, Vidler Water Company was actively purchasing Carson River water rights above Segment 7 in an effort to develop water supplies for use by Carson City. Nearly all transactions were negotiated at a price of $2,500 per acre-foot. Carson Water Subconservancy District and Carson City have also purchased a limited volume of surface water rights above Segment 7. Due to constraints imposed by the Alpine Decree, water rights located within Segment 7 cannot be transferred upstream to a point of diversion above Segment 7. As a result, prior sales of Carson River water rights above Segment 7 have limited applicability to the value of Segment 7 water rights. The only known water right transactions within Segment 7 were completed by U.S. Fish and Wildlife Service (USFWS) from 1999 through 2002 at prices between $650 and $1,150 per acre-foot. Due to limited transferability, recent water right acquisition prices within the Carson Division provide the best approximation of value. Based upon recent purchases by USFWS, the cost of Carson River water rights within Segment 7 is estimated to range from $1,250 to $1,500 per acre-foot, assuming a duty of 4.5 acre-feet per acre. These costs may not represent all non-contract costs associated with acquisition, including administrative and relocation assistance costs. Annual costs are based on a 4 percent discount rate and 30-year loan.

Source: Acquisition costs developed by WestWater Research; costs annualized by MWH.

Increase Efficiency

Reduce Carson Division Seepage – Compact Regulating Reservoir Beds

This measure considers vibratory compaction techniques to compress the upper two feet of soil in the Carson Division's regulating reservoirs in order to reduce seepage losses. This measure considers compacting up to the total 1,910 acres from the Project's four regulating reservoir beds (Reclamation 1994).

Estimated Cost:

- Field Cost: $14.5 million to $29 million
- Annual Cost: $3.4 million to $6.7 million
- Estimate Level: Preliminary
- Price Level: March 2012

Estimate Approach and Assumptions: Costs were estimated using acreage to be compacted for regulating reservoirs from the Newlands Project Efficiency Study (Reclamation 1994), and low to high range AACE Class 5 unit costs, equivalent to a preliminary-level estimate, for original ground scarification and compaction construction activities. Costs include allowances of 5 percent for mobilization, 15 percent for design contingency, and 25 percent construction contingency. Non-contract costs are not included in the cost. In addition to these costs, IDC and escalation are required to determine a total capital cost.

Annual costs are based on a 4 percent discount rate, 5-year service life, and annual O&M costs equal to 0.5 percent of the field cost.

Source: Field and annual costs developed by MWH.

Additional Backup Information: A backup cost estimate worksheet for this measure is shown in Attachment: Cost Estimate Worksheets.

Reduce Carson Division Seepage – Line Regulating Reservoirs

This measure considers application of clay and/or geotextile liners at the Carson Division's regulating reservoirs in order to reduce seepage losses. This measure considers lining up to the total 1,910 acres from the Project's four regulating reservoir beds (Reclamation 1994).

Estimated Cost:

- Field Cost: $58 million to $100 million
- Annual Cost: $2.8 million to $4.9 million
- Estimate Level: Preliminary
- Price Level: March 2012

Estimate Approach and Assumptions: Costs were estimated using acreage to be compacted for regulating reservoirs from the Newlands Project Efficiency Study (Reclamation 1994), and AACE Class 5 unit costs, equivalent to a preliminary-level estimate, for preparation and application of clay or geotextile liner construction activities.

Costs include allowances of 5 percent for mobilization, 15 percent for design contingency, and 25 percent for construction contingency. Non-contract costs are not included in the cost. In addition to these costs, IDC and escalation are required to determine a total capital cost.

Annual costs are based on a 4 percent discount rate, 50-year service life, and annual O&M costs equal to 0.2 percent of the field cost.

Source: Field and annual costs developed by MWH.

Additional Backup Information: A backup cost estimate worksheet for this measure is shown in Attachment: Cost Estimate Worksheets.

Reduce Agricultural Demand

Improve On-farm Efficiency – Transition to Sprinkler Technology

This measure considers converting current flood irrigation systems to sprinkler irrigation systems through the use of overhead devices such as center pivot, linear, or wheeline sprinkler system.

Estimated Cost:

- Field Cost: $52 million
- Annual Cost: $5.2 million
- Estimate Level: Preliminary
- Price Level: March 2012

Estimate Approach and Assumptions: This estimated cost assumes all of the irrigated land in the Carson Division would be converted to sprinkler irrigation systems. Total irrigated land is estimated to be 34,363, acres based on the estimated future agricultural water rights described in Appendix C. This assumes that sprinkler irrigation systems are appropriate for most of the crops in the Carson Division. Line item costs for the sprinkler irrigation systems were assumed to be $1,000 per acre; however, this will vary, depending on the preferred sprinkler irrigation technology.

Costs include allowances of 5 percent for mobilization, 15 percent for design contingency, and 25 percent for construction contingency. Non-contract costs are not included in the cost. In addition to these costs, IDC and escalation are required to determine a total capital cost. Annual costs are based on a 4 percent discount rate, 15-year service life, and annual O&M costs equal to 1 percent of the field cost.

Source: Field costs developed by MWH and WestWater Research; costs annualized by MWH.

Appendix E2
Initial Cost Estimates for Screening of Measures

Attachment: Cost Estimate Worksheets

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

Reduce Agricultural Demand

Appendix E2
Initial Cost Estimates for Screening of Measures

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

BUREAU OF RECLAMATION

ESTIMATE WORKSHEET

SHEET 1 OF 1

FEATURE:
Truckee Canal Safety Measures
Risk Rating 3
600 cfs and 350 cfs
Potential Cost Savings

PROJECT:
Newlands Project Planning Study Special Report

REGIO	**AF485**	**ESTIMATE LEVEL:**	**Appraisal**
WOID:	**Mid-Pacific**	**PRICE LEVEL:**	**Jan - 2012**

Summary

PLANT ACCOUNT	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
		Demolition/removal of 10 Turnout Structions		1	LS	$59,382.35	$59,382.35
		(Reclamation 2011e)				October 2010	
		Replace 9 Turnout Structures		1	LS	$1,007,855.00	$1,007,855.00
		(Reclamation 2011e)				October 2010	
		Subtotal (October 2012)					**$1,067,237.35**
		Escalation to January 2012				7%	$74,000.00
		Subtotal (January 2012)					**$1,141,000.00**
		Mobilization/General Conditions				5%	$57,000.00
		Subtotal w/ Mobilization					**$1,198,000.00**
		Design Contingencies				15%	$182,000.00
		Allowance for Procurement Strategy				0%	$0.00
		CONTRACT COST					**$1,380,000.00**
		Construction Contingencies				25%	$320,000.00
		FIELD COST					**$1,700,000.00**

Note: Escalation from published price level to notice to proceed is excluded. Estimates may include discrepancies due to rounding.

Ref.: For appropriate use and terminology, see Reclamation Manual, Directives and Standards FAC; 09-01, 09-02 and 09-03.

QUANTITIES		PRICES	
BY	**CHECKED**	**BY**	**CHECKED**
DATE PREPARED	**PEER REVIEW**	**DATE PREPARED**	**PEER REVIEW**

BUREAU OF RECLAMATION

ESTIMATE WORKSHEET

FEATURE:
Truckee Canal Safety Measures
150cfs
Truckee Canal Additional Pumping

PROJECT:
Newlands Project Planning Study Special Report

REGION Mid-Pacific | **ESTIMATE LEVEL:** Preliminary
WOID: | **PRICE LEVEL:** March - 2012

Summary

PLANT ACCOUNT	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
		TC-1		3	HP	$2,000.00	$6,000.00
		TC-2		3	HP	$2,000.00	$6,000.00
		TC-5		15	HP	$2,000.00	$30,000.00
		TC-7		10	HP	$2,000.00	$20,000.00
		TC-9		3	HP	$2,000.00	$6,000.00
		TC-10		10	HP	$2,000.00	$20,000.00
		Subtotal					**$88,000.00**
		Mobilization/General Conditions				5%	$4,400.00
		Subtotal w/ Mobilization					**$92,000.00**
		Design Contingencies				15%	$14,000.00
		Allowance for Procurement Strategy				0%	$0.00
		CONTRACT COST					**$106,000.00**
		Construction Contingencies				25%	$24,000.00
		FIELD COST					**$130,000.00**
		Note: Escalation from published price level to notice to proceed is excluded. Estimates may include discrepancies due to rounding.					
		Ref.: For appropriate use and terminology, see Reclamation Manual, Directives and Standards FAC; 09-01, 09-02 and 09-03.					

QUANTITIES		PRICES	
BY Ian Buck, MWH	**CHECKED** Khalid Talaat, MWH	**BY** Ian Buck, MWH	**CHECKED** Khalid Talaat, MWH
DATE PREPARED 5/17/2012	**PEER REVIEW**	**DATE PREPARED** 5/17/2012	**PEER REVIEW**

Opinion of Probable Construction Cost Disclaimer

The Study team has no control over the costs of labor, materials, competitive bidding environments, unidentified field conditions, financial and/or commodity market conditions, or any other factors likely to affect the OPCC of the Study measures, all of which are and will unavoidably remain in a state of change, especially in light of high market volatility attributable to Acts of God and other market forces or events beyond the control of the parties. As such, this OPCC deliverable is based on normal market conditions, defined by stable resource supply/demand relationships, and does not account for extreme inflationary or deflationary market cycles. This OPCC is a "snapshot in time" and the reliability of this OPCC will degrade over time. No warranty, promise, guarantee or representation, either express or implied that proposals, bids, project construction costs, or cost of O&M functions will not vary significantly from this good faith estimate.

BUREAU OF RECLAMATION

ESTIMATE WORKSHEET

FEATURE:
Develop Alternative Sources
Supplement Truckee Division Supply
Treat Effluent and Deliver for Agricultural Use
Low Estimate

PROJECT:
Newlands Project Planning Study Special Report

REGION: Mid-Pacific | **ESTIMATE LEVEL: Preliminary**
WOID: | **PRICE LEVEL: Mar - 2012**

Summary

PLANT ACCOUNT	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
		City of Fernley's East Wastewater Treatment Facility					
		Upgrade from Secondary to Tertiary Treatment					
		Title 22 requirements for unrestricted use					
		Microfiltration/Ultrafiltration Treatment System		1.5	MGD	$1,420,000.00	$2,130,000.00
		Subtotal					**$2,130,000.00**
		Mobilization/General Conditions (included in unit price)				0%	$0.00
		Subtotal w/ Mobilization					**$2,130,000.00**
		Design Contingencies				15%	$320,000.00
		Allowance for Procurement Strategy				0%	$0.00
		CONTRACT COST					**$2,450,000.00**
		Construction Contingencies				25%	$650,000.00
		FIELD COST					**$3,100,000.00**

Note: Escalation from published price level to notice to proceed is excluded. Estimates may include discrepancies due to rounding.
Ref.: For appropriate use and terminology, see Reclamation Manual, Directives and Standards FAC; 09-01, 09-02 and 09-03.

QUANTITIES		PRICES	
BY Ian Buck, MWH	**CHECKED**	**BY** Khalid Talaat, MWH	**CHECKED**
DATE PREPARED 3/19/2012	**PEER REVIEW**	**DATE PREPARED** 3/19/2012	**PEER REVIEW**

Opinion of Probable Construction Cost Disclaimer

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BUREAU OF RECLAMATION

ESTIMATE WORKSHEET

FEATURE:
Develop Alternative Sources
Supplement Truckee Division Supply
Treat Effluent and Deliver for Agricultural Use
High Estimate

PROJECT:
Newlands Project Planning Study Special Report

REGION	**Mid-Pacific**	**ESTIMATE LEVEL:**	**Preliminary**
WOID:		**PRICE LEVEL:**	**Mar - 2012**

Summary

PLANT ACCOUNT	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
		City of Fernley's East Wastewater Treatment Facility					
		Upgrade from Secondary to Tertiary Treatment					
		Title 22 requirements for unrestricted use					
		Membrane Bioreactor treatment system		1.5	MGD	$6,150,000.00	$9,225,000.00
		Subtotal					**$9,225,000.00**
		Mobilization/General Conditions (included in unit price)				0%	$0.00
		Subtotal w/ Mobilization					**$9,225,000.00**
		Design Contingencies				15%	$1,375,000.00
		Allowance for Procurement Strategy				0%	$0.00
		CONTRACT COST					**$10,600,000.00**
		Construction Contingencies				25%	$2,400,000.00
		FIELD COST					**$13,000,000.00**

Note: Escalation from published price level to notice to proceed is excluded. Estimates may include discrepancies due to rounding.
Ref.: For appropriate use and terminology, see Reclamation Manual, Directives and Standards FAC; 09-01, 09-02 and 09-03.

QUANTITIES		**PRICES**	
BY Ian Buck, MWH	**CHECKED**	**BY** Khalid Talaat, MWH	**CHECKED**
DATE PREPARED 3/19/2012	**PEER REVIEW**	**DATE PREPARED** 3/19/2012	**PEER REVIEW**

Opinion of Probable Construction Cost Disclaimer

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BUREAU OF RECLAMATION

ESTIMATE WORKSHEET

FEATURE:
Develop Alternative Sources
Establish New Truckee Division Points of Diversion and Delivery
Construct Pipeline to Agricultural Users
Unlined

Summary

PROJECT:
Newlands Project Planning Study Special Report

REGION	**Mid-Pacific**	**ESTIMATE LEVEL:**	**Preliminary**
WOID:		**PRICE LEVEL:**	**Mar - 2012**

PLANT ACCOUNT	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
		New Pump Station (50 CFS)		1	LS	$18,000,000.00	$18,000,000.00
		42" Steel Pipeline ANSI C-151 - Class 150 (unlined)		96,680	LF	$584.00	$56,461,120.00
							$0.00
							$0.00
							$0.00
							$0.00
							$0.00
							$0.00
							$0.00
							$0.00
							$0.00
							$0.00
							$0.00
							$0.00
							$0.00
							$0.00
							$0.00
		Subtotal					**$74,461,120.00**
		Mobilization/General Conditions				5%	$3,720,000.00
		Subtotal w/ Mobilization					**$78,181,000.00**
		Design Contingencies				15%	$11,729,000.00
		Allowance for Procurement Strategy				0%	$0.00
		CONTRACT COST					**$89,910,000.00**
		Construction Contingencies				25%	$20,090,000.00
		FIELD COST					**$110,000,000.00**
		Note: Escalation from published price level to notice to proceed is excluded. Estimates may include discrepancies due to rounding.					
		Ref.: For appropriate use and terminology, see Reclamation Manual, Directives and Standards FAC; 09-01, 09-02 and 09-03.					

QUANTITIES		**PRICES**	
BY Ian Buck, MWH	**CHECKED** Khalid Talaat, MWH	**BY** Paul Smith, MWH	**CHECKED** Roger Schiller, MWH
DATE PREPARED 3/28/2012	**PEER REVIEW** Paul Smith, MWH	**DATE PREPARED** 03/28/12	**PEER REVIEW**

Opinion of Probable Construction Cost Disclaimer

The Study team has no control over the costs of labor, materials, competitive bidding environments, unidentified field conditions, financial and/or commodity market conditions, or any other factors likely to affect the Opinion of Probably Construction Cost (OPCC) of the Study measures, all of which are and will unavoidably remain in a state of change, especially in light of high market volatility attributable to Acts of God and other market forces or events beyond the control of the parties. As such, this OPCC deliverable is based on normal market conditions, defined by stable resource supply/demand relationships, and does not account for extreme inflationary or deflationary market cycles. This OPCC is a "snapshot in time" and the reliability of this OPCC will degrade over time. No warranty, promise, guarantee or representation, either express or implied that proposals, bids, project construction costs, or cost of O&M functions will not vary significantly from this good faith, Class 5 OPCC.

AACE International CLASS 5 Cost Estimate – Class 5 estimates are generally prepared based on very limited information, and subsequently have wide accuracy ranges. Typically, engineering is from 2% to 10% complete. They are often prepared for strategic planning purposes, market studies, assessment of viability, project location studies, and long range capital planning. Virtually all Class 5 estimates use stochastic estimating methods such as cost curves, capacity factors, and other parametric techniques. Expected accuracy ranges are from –20% to –50% on the low side and +30% to 100% on the high side, depending on technological complexity of the project, appropriate reference information, and the inclusion of an appropriate contingency determination. Ranges could exceed those shown in unusual circumstances. As little as 1 hr or less to perhaps more than 200 hours may be spent preparing the estimate based on the project and estimating methodology.

BUREAU OF RECLAMATION

ESTIMATE WORKSHEET

FEATURE:
Develop Alternative Sources
Establish New Truckee Division Points of Diversion and Delivery
Construct Pipeline to Agricultural Users
Acid Resistant Lining

PROJECT:
Newlands Project Planning Study Special Report

REGION	**Mid-Pacific**	**ESTIMATE LEVEL:**	**Preliminary**
WOID:		**PRICE LEVEL:**	**Mar - 2012**

Summary

PLANT ACCOUNT	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
		New Pump Station (50 CFS)		1	LS	$18,000,000.00	$18,000,000.00
		42" Steel Pipeline ANSI C-151 - Class 150 (w/acid resistant lining)		96,680	LF	$652.00	$63,035,360.00
							$0.00
							$0.00
							$0.00
							$0.00
							$0.00
							$0.00
							$0.00
							$0.00
							$0.00
							$0.00
							$0.00
							$0.00
							$0.00
							$0.00
							$0.00
		Subtotal					**$81,035,360.00**
		Mobilization/General Conditions				5%	$4,050,000.00
		Subtotal w/ Mobilization					**$85,085,000.00**
		Design Contingencies				15%	$12,765,000.00
		Allowance for Procurement Strategy				0%	$0.00
		CONTRACT COST					**$97,850,000.00**
		Construction Contingencies				25%	$22,150,000.00
		FIELD COST					**$120,000,000.00**
		Note: Escalation from published price level to notice to proceed is excluded. Estimates may include discrepancies due to rounding.					
		Ref.: For appropriate use and terminology, see Reclamation Manual, Directives and Standards FAC; 09-01, 09-02 and 09-03.					

QUANTITIES		**PRICES**	
BY	**CHECKED**	**BY**	**CHECKED**
Ian Buck, MWH	Khalid Talaat, MWH	Paul Smith, MWH	Roger Schiller, MWH
DATE PREPARED	**PEER REVIEW**	**DATE PREPARED**	**PEER REVIEW**
3/28/2012	Paul Smith, MWH	03/28/12	

Opinion of Probable Construction Cost Disclaimer

The Study team has no control over the costs of labor, materials, competitive bidding environments, unidentified field conditions, financial and/or commodity market conditions, or any other factors likely to affect the OPCC of the Study measures, all of which are and will unavoidably remain in a state of change, especially in light of high market volatility attributable to Acts of God and other market forces or events beyond the control of the parties. As such, this OPCC deliverable is based on normal market conditions, defined by stable resource supply/demand relationships, and does not account for extreme inflationary or deflationary market cycles. This OPCC is a "snapshot in time" and the reliability of this OPCC will degrade over time. No warranty, promise, guarantee or representation, either express or implied that proposals, bids, project construction costs, or cost of O&M functions will not vary significantly from this good faith, Class 5 OPCC.

AACE International CLASS 5 Cost Estimate – Class 5 estimates are generally prepared based on very limited information, and subsequently have wide accuracy ranges. Typically, engineering is from 2% to 10% complete. They are often prepared for strategic planning purposes, market studies, assessment of viability, project location studies, and long range capital planning. Virtually all Class 5 estimates use stochastic estimating methods such as cost curves, capacity factors, and other parametric techniques. Expected accuracy ranges are from –20% to –50% on the low side and +30% to 100% on the high side, depending on technological complexity of the project, appropriate reference information, and the inclusion of an appropriate contingency determination. Ranges could exceed those shown in unusual circumstances. As little as 1 hr or less to perhaps more than 200 hours may be spent preparing the estimate based on the project and estimating methodology.

BUREAU OF RECLAMATION

ESTIMATE WORKSHEET

FEATURE:
Develop Alternative Sources
Establish New Truckee Division Points of Diversion and Delivery
Deliver from TC-1

PROJECT:
Newlands Project Planning Study Special Report

REGION: Mid-Pacific | **ESTIMATE LEVEL: Appraisal**
WOID: | **PRICE LEVEL: Oct - 2010**

Reference: Based on *Corrective Action Study* (Reclamation 2011e)

Summary

PLANT ACCOUNT	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
		Note: Line items taken directly from *Corrective Action Study* (Reclamation 2011e)					
		Check Structure in Derby Reach		1	LS	$430,335.00	$430,335.00
		Wasteway Turnout Structure		1	LS	$349,640.00	$349,640.00
		Subtotal					**$779,975.00**
		Mobilization/General Conditions				5%	$40,000.00
		Subtotal w/ Mobilization					**$820,000.00**
		Design Contingencies				15%	$120,000.00
		Allowance for Procurement Strategy				0%	$0.00
		CONTRACT COST					**$940,000.00**
		Construction Contingencies				25%	$260,000.00
		FIELD COST					**$1,200,000.00**

Note: Escalation from published price level to notice to proceed is excluded. Estimates may include discrepancies due to rounding.
Ref.: For appropriate use and terminology, see Reclamation Manual, Directives and Standards FAC; 09-01, 09-02 and 09-03.

QUANTITIES		PRICES	
BY	CHECKED	BY	CHECKED
DATE PREPARED	PEER REVIEW	DATE PREPARED	PEER REVIEW

BUREAU OF RECLAMATION

ESTIMATE WORKSHEET

FEATURE:
Increase Efficiency
Reduce Carson Division Seepage
Compact Soil Lining of Main Canals and Laterals
Option 1 Expanded
Low Estimate

PROJECT:
Newlands Project Planning Study Special Report

REGION: Mid-Pacific | **ESTIMATE LEVEL: Preliminary**
WOID: | **PRICE LEVEL: Mar - 2012**

Summary

PLANT ACCOUNT	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
		Note: Feature locations used from *Newlands Project Efficiency Study* (Reclamation 1994); Estimate developed by MWH					
		V Canal from the head works to the 26-foot drop (first 5.90 miles)					
		Original ground scarification and compaction		49	acre	$5,000.00	$245,000.00
		V Canal from 26-foot drop to terminus, and S Canal from V Canal terminus to S-line Reservoir (9.33 miles)					
		Original ground scarification and compaction		77	acre	$5,000.00	$385,000.00
		L Canal, from its headworks at V Canal to its terminus at the sixth and final check structure (first 9.37 miles)					
		Original ground scarification and compaction		54	acre	$5,000.00	$270,000.00
		A Canal, from headworks to A17 Lateral headworks (first 9.70 miles)					
		Original ground scarification and compaction		44	acre	$5,000.00	$220,000.00
		S Canal between S-line Reservoir and Harmon Reservoir (5.07 miles)					
		Original ground scarification and compaction		26	acre	$5,000.00	$130,000.00
		Unlined portion of L1 Lateral, from headworks to L1-10 Lateral (5.5 miles of the first 6 miles)					
		Original ground scarification and compaction		25	acre	$5,000.00	$125,000.00
		Subtotal					**$1,375,000.00**
		Mobilization/General Conditions				5%	$70,000.00
		Subtotal w/ Mobilization					**$1,445,000.00**
		Design Contingencies				15%	$215,000.00
		Allowance for Procurement Strategy				0%	$0.00
		CONTRACT COST					**$1,660,000.00**
		Construction Contingencies				25%	$440,000.00
		FIELD COST					**$2,100,000.00**
		Note: Escalation from published price level to notice to proceed is excluded. Estimates may include discrepancies due to rounding.					
		Ref.: For appropriate use and terminology, see Reclamation Manual, Directives and Standards FAC; 09-01, 09-02 and 09-03.					

QUANTITIES		PRICES	
BY Ian Buck, MWH	**CHECKED**	**BY** James Loucks, MWH	**CHECKED**
DATE PREPARED 3/21/2012	**PEER REVIEW**	**DATE PREPARED** 3/12/2012	**PEER REVIEW**

Opinion of Probable Construction Cost Disclaimer

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BUREAU OF RECLAMATION

ESTIMATE WORKSHEET

FEATURE:
Increase Efficiency
Reduce Carson Division Seepage
Compact Soil Lining of Main Canals and Laterals
Option 1 Expanded
High Estimate

PROJECT:
Newlands Project Planning Study Special Report

REGION	**Mid-Pacific**	**ESTIMATE LEVEL:**	**Preliminary**
WOID:		**PRICE LEVEL:**	**Mar - 2012**

Summary

PLANT ACCOUNT	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
		Note: Feature locations used from *Newlands Project Efficiency Study* (Reclamation 1994); Estimate developed by MWH					
		V Canal from the head works to the 26-foot drop (first 5.90 miles)					
		Original ground scarification and compaction		49	acre	$10,000.00	$490,000.00
		V Canal from 26-foot drop to terminus, and S Canal from V Canal terminus to S-line Reservoir (9.33 miles)					
		Original ground scarification and compaction		77	acre	$10,000.00	$770,000.00
		L Canal, from its headworks at V Canal to its terminus at the sixth and final check structure (first 9.37 miles)					
		Original ground scarification and compaction		54	acre	$10,000.00	$540,000.00
		A Canal, from headworks to A17 Lateral headworks (first 9.70 miles)					
		Original ground scarification and compaction		44	acre	$10,000.00	$440,000.00
		S Canal between S-line Reservoir and Harmon Reservoir (5.07 miles)					
		Original ground scarification and compaction		26	acre	$10,000.00	$260,000.00
		Unlined portion of L1 Lateral, from headworks to L1-10 Lateral (5.5 miles of the first 6 miles)					
		Original ground scarification and compaction		25	acre	$10,000.00	$250,000.00
		Subtotal					**$2,750,000.00**
		Mobilization/General Conditions				5%	$140,000.00
		Subtotal w/ Mobilization					**$2,890,000.00**
		Design Contingencies				15%	$430,000.00
		Allowance for Procurement Strategy				0%	$0.00
		CONTRACT COST					**$3,320,000.00**
		Construction Contingencies				25%	$880,000.00
		FIELD COST					**$4,200,000.00**
		Note: Escalation from published price level to notice to proceed is excluded. Estimates may include discrepancies due to rounding.					
		Ref.: For appropriate use and terminology, see Reclamation Manual, Directives and Standards FAC; 09-01, 09-02 and 09-03.					

QUANTITIES		PRICES	
BY Ian Buck, MWH	**CHECKED**	**BY** James Loucks, MWH	**CHECKED**
DATE PREPARED 3/21/2012	**PEER REVIEW**	**DATE PREPARED** 3/12/2012	**PEER REVIEW**

Opinion of Probable Construction Cost Disclaimer

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BUREAU OF RECLAMATION

ESTIMATE WORKSHEET

FEATURE:
Increase Efficiency
Reduce Carson Division Seepage
Compact Soil Lining of Main Canals and Laterals
Option 1 Expanded + T Canal
Low Estimate

Summary

PROJECT:
Newlands Project Planning Study Special Report

REGION: Mid-Pacific		**ESTIMATE LEVEL:**	**Preliminary**
WOID:		**PRICE LEVEL:**	**Mar - 2012**

PLANT ACCOUNT	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
		Note: Feature locations used from *Newlands Project Efficiency Study* (Reclamation 1994); Estimate developed by MWH					
		V Canal from the head works to the 26-foot drop (first 5.90 miles)					
		Original ground scarification and compaction		49	acre	$5,000.00	$245,000.00
		V Canal from 26-foot drop to terminus, and S Canal from V Canal terminus to S-line Reservoir (9.33 miles)					
		Original ground scarification and compaction		77	acre	$5,000.00	$385,000.00
		L Canal, from its headworks at V Canal to its terminus at the sixth and final check structure (first 9.37 miles)					
		Original ground scarification and compaction		54	acre	$5,000.00	$270,000.00
		A Canal, from headworks to A17 Lateral headworks (first 9.70 miles)					
		Original ground scarification and compaction		44	acre	$5,000.00	$220,000.00
		S Canal between S-line Reservoir and Harmon Reservoir (5.07 miles)					
		Original ground scarification and compaction		26	acre	$5,000.00	$130,000.00
		Unlined portion of L1 Lateral, from headworks to L1-10 Lateral (5.5 miles of the first 6 miles)					
		Original ground scarification and compaction		25	acre	$5,000.00	$125,000.00
		Unlined portion of T Canal, between headworks and T9 Lateral headworks (9.36 miles of the first 11.3 miles)					
		Original ground scarification and compaction		20	acre	$5,000.00	$100,000.00
		Subtotal					**$1,475,000.00**
		Mobilization/General Conditions				5%	$70,000.00
		Subtotal w/ Mobilization					**$1,545,000.00**
		Design Contingencies				15%	$235,000.00
		Allowance for Procurement Strategy				0%	$0.00
		CONTRACT COST					**$1,780,000.00**
		Construction Contingencies				25%	$420,000.00
		FIELD COST					**$2,200,000.00**
		Note: Escalation from published price level to notice to proceed is excluded. Estimates may include discrepancies due to rounding.					
		Ref.: For appropriate use and terminology, see Reclamation Manual, Directives and Standards FAC; 09-01, 09-02 and 09-03.					

QUANTITIES		PRICES	
BY Ian Buck, MWH	**CHECKED**	**BY** James Loucks, MWH	**CHECKED**
DATE PREPARED 3/21/2012	**PEER REVIEW**	**DATE PREPARED** 3/12/2012	**PEER REVIEW**

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BUREAU OF RECLAMATION

ESTIMATE WORKSHEET

FEATURE:
Increase Efficiency
Reduce Carson Division Seepage
Compact Soil Lining of Main Canals and Laterals
Option 1 Expanded + T Canal
High Estimate

Summary

PROJECT:
Newlands Project Planning Study Special Report

REGION: Mid-Pacific		**ESTIMATE LEVEL:**	**Preliminary**
WOID:		**PRICE LEVEL:**	**Mar - 2012**

PLANT ACCOUNT	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
		Note: Feature locations used from *Newlands Project Efficiency Study* (Reclamation 1994); Estimate developed by MWH					
		V Canal from the head works to the 26-foot drop (first 5.90 miles)					
		Original ground scarification and compaction		49	acre	$10,000.00	$490,000.00
		V Canal from 26-foot drop to terminus, and S Canal from V Canal terminus to S-line Reservoir (9.33 miles)					
		Original ground scarification and compaction		77	acre	$10,000.00	$770,000.00
		L Canal, from its headworks at V Canal to its terminus at the sixth and final check structure (first 9.37 miles)					
		Original ground scarification and compaction		54	acre	$10,000.00	$540,000.00
		A Canal, from headworks to A17 Lateral headworks (first 9.70 miles)					
		Original ground scarification and compaction		44	acre	$10,000.00	$440,000.00
		S Canal between S-line Reservoir and Harmon Reservoir (5.07 miles)					
		Original ground scarification and compaction		26	acre	$10,000.00	$260,000.00
		Unlined portion of L1 Lateral, from headworks to L1-10 Lateral (5.5 miles of the first 6 miles)					
		Original ground scarification and compaction		25	acre	$10,000.00	$250,000.00
		Unlined portion of T Canal, between headworks and T9 Lateral headworks (9.36 miles of the first 11.3 miles)					
		Original ground scarification and compaction		20	acre	$10,000.00	$200,000.00
		Subtotal					**$2,950,000.00**
		Mobilization/General Conditions				5%	$150,000.00
		Subtotal w/ Mobilization					**$3,100,000.00**
		Design Contingencies				15%	$470,000.00
		Allowance for Procurement Strategy				0%	$0.00
		CONTRACT COST					**$3,570,000.00**
		Construction Contingencies				25%	$930,000.00
		FIELD COST					**$4,500,000.00**
		Note: Escalation from published price level to notice to proceed is excluded. Estimates may include discrepancies due to rounding.					
		Ref.: For appropriate use and terminology, see Reclamation Manual, Directives and Standards FAC; 09-01, 09-02 and 09-03.					

QUANTITIES		**PRICES**	
BY Ian Buck, MWH	**CHECKED**	**BY** James Loucks, MWH	**CHECKED**
DATE PREPARED 3/21/2012	**PEER REVIEW**	**DATE PREPARED** 3/12/2012	**PEER REVIEW**

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BUREAU OF RECLAMATION

ESTIMATE WORKSHEET

FEATURE:
Increase Efficiency
Reduce Truckee Division Seepage
Compact Soil Lining of the Truckee Canal
Low Estimate

PROJECT:
Newlands Project Planning Study Special Report

REGION: Mid-Pacific | **ESTIMATE LEVEL: Preliminary**
WOID: | **PRICE LEVEL: Mar - 2012**

Summary

PLANT ACCOUNT	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
		Original ground scarification and compaction		102	acre	$5,000.00	$510,000.00
		Subtotal					**$510,000.00**
		Mobilization/General Conditions				5%	$30,000.00
		Subtotal w/ Mobilization					**$540,000.00**
		Design Contingencies				15%	$80,000.00
		Allowance for Procurement Strategy				0%	$0.00
		CONTRACT COST					**$620,000.00**
		Construction Contingencies				25%	$160,000.00
		FIELD COST					**$780,000.00**

Note: Escalation from published price level to notice to proceed is excluded. Estimates may include discrepancies due to rounding.
Ref.: For appropriate use and terminology, see Reclamation Manual, Directives and Standards FAC; 09-01, 09-02 and 09-03.

QUANTITIES		PRICES	
BY Ian Buck, MWH	**CHECKED**	**BY** James Loucks, MWH	**CHECKED**
DATE PREPARED 3/21/2012	**PEER REVIEW**	**DATE PREPARED** 3/12/2012	**PEER REVIEW**

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BUREAU OF RECLAMATION

ESTIMATE WORKSHEET

FEATURE:
Increase Efficiency
Reduce Truckee Division Seepage
Compact Soil Lining of the Truckee Canal
High Estimate

PROJECT:
Newlands Project Planning Study Special Report

REGION	**Mid-Pacific**	**ESTIMATE LEVEL:**	**Preliminary**
WOID:		**PRICE LEVEL:**	**Mar - 2012**

Summary

PLANT ACCOUNT	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
		Original ground scarification and compaction		102	acre	$10,000.00	$1,020,000.00
		Subtotal					**$1,020,000.00**
		Mobilization/General Conditions				5%	$50,000.00
		Subtotal w/ Mobilization					**$1,070,000.00**
		Design Contingencies				15%	$160,000.00
		Allowance for Procurement Strategy				0%	$0.00
		CONTRACT COST					**$1,230,000.00**
		Construction Contingencies				25%	$320,000.00
		FIELD COST					**$1,550,000.00**
		Note: Escalation from published price level to notice to proceed is excluded. Estimates may include discrepancies due to rounding.					
		Ref.: For appropriate use and terminology, see Reclamation Manual, Directives and Standards FAC; 09-01, 09-02 and 09-03.					

QUANTITIES		PRICES	
BY Ian Buck, MWH	**CHECKED**	**BY** James Loucks, MWH	**CHECKED**
DATE PREPARED 3/21/2012	**PEER REVIEW**	**DATE PREPARED** 3/12/2012	**PEER REVIEW**

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BUREAU OF RECLAMATION

ESTIMATE WORKSHEET

FEATURE:
Increase Efficiency
Reduce Carson Division Seepage
Compact Regulating Reservoir Beds
Low Estimate

PROJECT:
Newlands Project Planning Study Special Report

REGION: Mid-Pacific | **ESTIMATE LEVEL: Preliminary**
WOID: | **PRICE LEVEL: Mar - 2012**

Summary

PLANT ACCOUNT	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
		Note: Feature quantity used from *Newlands Project Efficiency Study* (Reclamation 1994); Estimate developed by MWH					
		Original ground scarification and compaction		1,910	acre	$5,000.00	$9,550,000.00
		Subtotal					**$9,550,000.00**
		Mobilization/General Conditions				5%	$480,000.00
		Subtotal w/ Mobilization					**$10,030,000.00**
		Design Contingencies				15%	$1,500,000.00
		Allowance for Procurement Strategy				0%	$0.00
		CONTRACT COST					**$11,530,000.00**
		Construction Contingencies				25%	$2,970,000.00
		FIELD COST					**$14,500,000.00**
		Note: Escalation from published price level to notice to proceed is excluded. Estimates may include discrepancies due to rounding.					
		Ref.: For appropriate use and terminology, see Reclamation Manual, Directives and Standards FAC; 09-01, 09-02 and 09-03.					

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BUREAU OF RECLAMATION

ESTIMATE WORKSHEET

FEATURE:
Increase Efficiency
Reduce Carson Division Seepage
Compact Regulating Reservoir Beds
High Estimate

PROJECT:
Newlands Project Planning Study Special Report

REGION	**Mid-Pacific**	**ESTIMATE LEVEL:**	**Preliminary**
WOID:		**PRICE LEVEL:**	**Mar - 2012**

Summary

PLANT ACCOUNT	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
		Note: Feature quantity used from *Newlands Project Efficiency Study* (Reclamation 1994); Estimate developed by MWH					
		Original ground scarification and compaction		1,910	acre	$10,000.00	$19,100,000.00
		Subtotal					**$19,100,000.00**
		Mobilization/General Conditions				5%	$960,000.00
		Subtotal w/ Mobilization					**$20,060,000.00**
		Design Contingencies				15%	$3,010,000.00
		Allowance for Procurement Strategy				0%	$0.00
		CONTRACT COST					**$23,070,000.00**
		Construction Contingencies				25%	$5,930,000.00
		FIELD COST					**$29,000,000.00**
		Note: Escalation from published price level to notice to proceed is excluded. Estimates may include discrepancies due to rounding.					
		Ref.: For appropriate use and terminology, see Reclamation Manual, Directives and Standards FAC; 09-01, 09-02 and 09-03.					

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DATE PREPARED 3/21/2012	**PEER REVIEW**	**DATE PREPARED** 3/12/2012	**PEER REVIEW**

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BUREAU OF RECLAMATION

ESTIMATE WORKSHEET

FEATURE:
Increase Efficiency
Reduce Carson Division Seepage
Line Regulating Reservoirs
Low Estimate

PROJECT:
Newlands Project Planning Study Special Report

REGION Mid-Pacific | **ESTIMATE LEVEL:** Preliminary
WOID: | **PRICE LEVEL:** Mar - 2012

Summary

PLANT ACCOUNT	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
		Note: Feature quantity used from *Newlands Project Efficiency Study* (Reclamation 1994); Estimate developed by MWH					
		Preparation and application of clay or geotextile liner		1,910	acre	$20,000.00	$38,200,000.00
		Subtotal					**$38,200,000.00**
		Mobilization/General Conditions				5%	$1,910,000.00
		Subtotal w/ Mobilization					**$40,110,000.00**
		Design Contingencies				15%	$6,020,000.00
		Allowance for Procurement Strategy				0%	$0.00
		CONTRACT COST					**$46,130,000.00**
		Construction Contingencies				25%	$11,870,000.00
		FIELD COST					**$58,000,000.00**
		Note: Escalation from published price level to notice to proceed is excluded. Estimates may include discrepancies due to rounding.					
		Ref.: For appropriate use and terminology, see Reclamation Manual, Directives and Standards FAC; 09-01, 09-02 and 09-03.					

QUANTITIES		PRICES	
BY Ian Buck, MWH	**CHECKED**	**BY** James Loucks, MWH	**CHECKED**
DATE PREPARED 3/21/2012	**PEER REVIEW**	**DATE PREPARED** 3/12/2012	**PEER REVIEW**

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BUREAU OF RECLAMATION

ESTIMATE WORKSHEET

FEATURE:
Increase Efficiency
Reduce Carson Division Seepage
Line Regulating Reservoirs
High Estimate

PROJECT:
Newlands Project Planning Study Special Report

REGION: Mid-Pacific | **ESTIMATE LEVEL: Preliminary**
WOID: | **PRICE LEVEL: Mar - 2012**

Summary

PLANT ACCOUNT	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
		Note: Feature quantity used from *Newlands Project Efficiency Study* (Reclamation 1994); Estimate developed by MWH					
		Preparation and application of clay or geotextile liner		1,910	acre	$35,000.00	$66,850,000.00
		Subtotal					**$66,850,000.00**
		Mobilization/General Conditions				5%	$3,340,000.00
		Subtotal w/ Mobilization					**$70,190,000.00**
		Design Contingencies				15%	$10,530,000.00
		Allowance for Procurement Strategy				0%	$0.00
		CONTRACT COST					**$80,720,000.00**
		Construction Contingencies				25%	$19,280,000.00
		FIELD COST					**$100,000,000.00**
		Note: Escalation from published price level to notice to proceed is excluded. Estimates may include discrepancies due to rounding.					
		Ref.: For appropriate use and terminology, see Reclamation Manual, Directives and Standards FAC; 09-01, 09-02 and 09-03.					

QUANTITIES		PRICES	
BY Ian Buck, MWH	**CHECKED**	**BY** James Loucks, MWH	**CHECKED**
DATE PREPARED 3/21/2012	**PEER REVIEW**	**DATE PREPARED** 3/12/2012	**PEER REVIEW**

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BUREAU OF RECLAMATION

ESTIMATE WORKSHEET

FEATURE:
Reduce Agricultural Demand
Improve On-farm Efficiency
Transition to Sprinkler Technology

PROJECT:
Newlands Project Planning Study Special Report

REGION: Mid-Pacific | **ESTIMATE LEVEL: Preliminary**
WOID: | **PRICE LEVEL: Oct - 2010**

Summary

PLANT ACCOUNT	PAY ITEM	DESCRIPTION	CODE	QUANTITY	UNIT	UNIT PRICE	AMOUNT
		Sprinkler Upgrades		34,363	acre	$1,000.00	$34,363,000.00
		Subtotal					**$34,363,000.00**
		Mobilization/General Conditions				5%	$1,720,000.00
		Subtotal w/ Mobilization					**$36,080,000.00**
		Design Contingencies				15%	$5,410,000.00
		Allowance for Procurement Strategy				0%	$0.00
		CONTRACT COST					**$41,490,000.00**
		Construction Contingencies				25%	$10,510,000.00
		FIELD COST					**$52,000,000.00**

Note: Escalation from published price level to notice to proceed is excluded. Estimates may include discrepancies due to rounding.
Ref.: For appropriate use and terminology, see Reclamation Manual, Directives and Standards FAC; 09-01, 09-02 and 09-03.

QUANTITIES		PRICES	
BY Ian Buck, MWH	**CHECKED**	**BY** Harry Seely, WestWater Research	**CHECKED**
DATE PREPARED 3/27/2012	**PEER REVIEW**	**DATE PREPARED** 3/27/2012	**PEER REVIEW**

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Appendix E3
Appraisal Cost Estimates for Alternatives

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

Abbreviations and Acronyms

IDC	interest during construction
O&M	operation and maintenance
Study	Newlands Project Planning Study

Appendix E3 – Appraisal Cost Estimates for Alternatives

This appendix summarizes appraisal cost estimate information for alternatives that were described and evaluated in Chapter 5 of the Special Report. Development of field costs for the alternatives is documented in Appendix E2, which are used in this appendix to develop appraisal level non-contract costs, construction costs, capital costs, and annualized costs for each alternative.

Cost Estimate Methodology

Cost estimates presented in this appendix are appraisal-level and at a January 2012 price level. Appraisal level cost estimates are used for comparison of alternatives, and intended for planning purposes only to determine whether more detailed investigations of a potential project are justified. Appraisal-level designs are based on standard practice with little analysis, and cost estimates may be prepared from cost graphs, simple sketches, or rough general designs, using available site-specific design data. Appraisal-level cost estimates are not suitable for requesting project authorization or construction fund appropriations.

In order to determine total construction cost for each alternative, non-contract costs were developed. Non-contract costs refer to costs of work or service provided in support of a project, and other work that can be attributed to the project as a whole, known as distributed costs, which include facilitating services, investigations, design and specifications, construction management, environmental compliance, and archaeological considerations. If non-contract costs are expressed as a percentage, it is applied to the field cost.

Non-contract costs were divided into five categories for the Newlands Project Planning Study (Study) and are as follows:

- **Planning and Environmental Compliance** – This includes collection, assembly, analysis of data, and preparation and review of additional planning studies, environmental impact reports, and environmental mitigation. This may also include preparation of feasibility design and cost estimates, surveying and design specifications, environmental oversight, and legal services. The planning and environmental compliance non-contract cost was estimated between 5 and 12 percent of the field cost depending on the alternative and the level of environmental compliance anticipated. This is based on previous appraisal-level estimates for similar projects.

- **Engineering and Design** – This includes preparation and review of final designs, construction drawings, specifications, and construction cost estimates. The engineering and design non-contract cost was estimated at 10 percent of the field cost, which is a typical allowance for this stage of cost estimate development.

- **Construction Management** – This includes engineering administration, management, coordination, and control of construction activities. Other costs such as temporary construction service facilities, general office salaries, supplies, general transportation, and security expenses are also included. The construction management non-contract cost is estimated at 10 percent of the field cost, which is a typical allowance for this stage of cost estimate development.

- **Easements** – This includes any temporary construction easement requirements. Typically this category is simply named lands and would also include needed permanent fee acquisition; however, non of these alternatives will require this. Easements non-contract cost was estimated at 1 percent of the field cost based on previous project experience. This estimate will need be refined to site specific easement requirements during the next stage of cost estimate development.

- **Cultural Resources** – This includes coordination with Nevada State Historic Preservation Office, compliance documentation, and mitigation. Cultural resources non-contract cost is estimated at 3 percent of the field cost, which is a typical allowance for this stage of cost estimate development.

In order to determine total capital costs, estimated interest during construction (IDC) for each alternative was developed. IDC is interest that accrues on a loan that finances the construction of an alternative. It is applied over the construction period and/or until the debt is begun to be served. For this Study, IDC was applied over the construction period, which varies from 2 to 8 years depending on the alternative, at the current Federal discount rate of 4 percent.

Total annual costs for each alternative were estimated by interest and amortization of the capital cost over 50 years and at the current Federal discount rate of 4 percent. Annual operations and maintenance (O&M) costs were also estimated at 0.2 percent of the field cost.

Allowances for escalation from published price levels through the construction contract were not included in these estimate because of the undefined schedule for alternative implementation. Escalation would need be determined prior to authorization of Federal funding. In addition, development of feasibility level non-contract costs will likely require moving from percentage based allowances to detailed line items.

All cost estimates, especially at this stage in the planning process, have inherent risks and uncertainties. In development of the appraisal cost estimates for the alternatives, the Study team has no control over the costs of labor, materials, competitive bidding environments, unidentified field conditions, financial and/or commodity market conditions, or any other factors likely to affect the initial cost estimates of the Study alternatives, all of which are and will unavoidably remain in a state of change, especially in light of high market volatility attributable to Acts of God and other market forces or events beyond the control of the parties. As such, these appraisal estimates are based on normal market conditions, defined by stable resource supply/demand relationships, and do not account for extreme inflationary or deflationary market cycles. These appraisal estimates are a "snapshot in time" and their reliability will degrade over time. No warranty, promise, guarantee or representation, either express or implied, is given that proposals, bids, project construction costs, or cost of O&M functions will not vary significantly from these good faith initial estimates.

Alternative Cost Estimate Summaries

The following tables are appraisal cost summaries of alternatives evaluated in Chapter 5. Each table identifies field costs, non-contract costs, construction costs, capital costs, and annualized costs. The details of the field costs are summarized in Appendix E2.

Table E3-1. Alternative 600 Cost Summary

Measure Selected for Meeting the Safety Objective	Additional Measure(s) Selected for Meeting the Water Supply Objective	Estimated Cost ($ Million)
HDPE Cutoff Wall		$44.0
	no additional measures selected	-
TOTAL FIELD COST		**$44.0**
Non-Contract Costs		
Planning and Environmental Compliance[1]		$4.40
Engineering and Design[2]		$4.40
Construction Management[3]		$4.40
Easements[4]		$0.45
Cultural Resources[5]		$1.35
TOTAL CONSTRUCTION COST		**$59.0**
Interest During Construction[6]		$2.00
TOTAL CAPITAL COST		**$61.0**
Interest and Amortization[7]		$2.80
Annual Operations and Maintenance[8]		$0.10
TOTAL ANNUAL COST		**$2.90**

Notes:

Cost estimate is appraisal-level and subject to change in the future. Appraisal-level cost estimates are not suitable for requesting project authorization and/or construction fund appropriations. Cost estimate is presented in January 2012 dollars, and may have discrepancies due to rounding.

[1] 10 percent of the field cost was estimated for Planning and Environmental Compliance non-contract costs.

[2] 10 percent of the field cost was estimated for Engineering and Design non-contract costs.

[3] 10 percent of the field cost was estimated for Construction Management non-contract costs.

[4] 1 percent of the field cost was estimated for Easements non-contract costs.

[5] 3 percent of the field cost was estimated for Cultural Resources non-contract costs.

[6] Interest During Construction was estimated over 2 years of construction at the current Federal discount rate of 4 percent.

[7] Interest and Amortization of the capital cost was estimated over 50 years at the current Federal discount rate of 4 percent.

[8] Annual Operations and Maintenance costs were estimated at 0.2 percent of the field cost.

Key:

$ million = million dollars

HDPE = high-density polyethylene

Table E3-2. Alternative 350.a Cost Summary

Measure Selected for Meeting the Safety Objective	Additional Measure(s) Selected for Meeting the Water Supply Objective	Estimated Cost ($ Million)
HDPE Cutoff Wall		$44.0
	no additional measures selected	-
TOTAL FIELD COST		**$44.0**
Non-Contract Costs		
Planning and Environmental Compliance[1]		$4.40
Engineering and Design[2]		$4.40
Construction Management[3]		$4.40
Easements[4]		$0.45
Cultural Resources[5]		$1.35
TOTAL CONSTRUCTION COST		**$59.0**
Interest During Construction[6]		$2.00
TOTAL CAPITAL COST		**$61.0**
Interest and Amortization[7]		$2.80
Annual Operations and Maintenance[8]		$0.10
TOTAL ANNUAL COST		**$2.90**

Notes:

Cost estimate is appraisal-level and subject to change in the future. Appraisal-level cost estimates are not suitable for requesting project authorization and/or construction fund appropriations. Cost estimate is presented in January 2012 dollars, and may have discrepancies due to rounding.

[1] 10 percent of the field cost was estimated for Planning and Environmental Compliance non-contract costs.

[2] 10 percent of the field cost was estimated for Engineering and Design non-contract costs.

[3] 10 percent of the field cost was estimated for Construction Management non-contract costs.

[4] 1 percent of the field cost was estimated for Easements non-contract costs.

[5] 3 percent of the field cost was estimated for Cultural Resources non-contract costs.

[6] Interest During Construction was estimated over 2 years of construction at the current Federal discount rate of 4 percent.

[7] Interest and Amortization of the capital cost was estimated over 50 years at the current Federal discount rate of 4 percent.

[8] Annual Operations and Maintenance costs were estimated at 0.2 percent of the field cost.

Key:
$ million = million dollars
HDPE = high-density polyethylene

Table E3-3. Alternative 350.b Cost Summary

Measure Selected for Meeting the Safety Objective	Additional Measure(s) Selected for Meeting the Water Supply Objective	Estimated Cost ($ Million)
HDPE Cutoff Wall		$44.0
	Line Main Canals and Laterals	$165.0
TOTAL FIELD COST		**$210.0**
Non-Contract Costs		
Planning and Environmental Compliance[1]		$10.0
Engineering and Design[2]		$21.0
Construction Management[3]		$21.0
Easements[4]		$2.00
Cultural Resources[5]		$6.00
TOTAL CONSTRUCTION COST		**$270.0**
Interest During Construction[6]		$50.0
TOTAL CAPITAL COST		**$320.0**
Interest and Amortization[7]		$14.5
Annual Operations and Maintenance[8]		$0.50
TOTAL ANNUAL COST		**$15.0**

Notes:

Cost estimate is appraisal-level and subject to change in the future. Appraisal-level cost estimates are not suitable for requesting project authorization and/or construction fund appropriations. Cost estimate is presented in January 2012 dollars, and may have discrepancies due to rounding.

[1] 5 percent of the field cost was estimated for Planning and Environmental Compliance non-contract costs.

[2] 10 percent of the field cost was estimated for Engineering and Design non-contract costs.

[3] 10 percent of the field cost was estimated for Construction Management non-contract costs.

[4] 1 percent of the field cost was estimated for Easements non-contract costs.

[5] 3 percent of the field cost was estimated for Cultural Resources non-contract costs.

[6] Interest During Construction was estimated over 8 years of construction at the current Federal discount rate of 4 percent.

[7] Interest and Amortization of the capital cost was estimated over 50 years at the current Federal discount rate of 4 percent.

[8] Annual Operations and Maintenance costs were estimated at 0.2 percent of the field cost.

Key:

$ million = million dollars

HDPE = high-density polyethylene

Table E3-4. Alternative 350.d Cost Summary

Measure Selected for Meeting the Safety Objective	Additional Measure(s) Selected for Meeting the Water Supply Objective	Estimated Cost ($ Million)
Concrete/ Geomembrane Lining		$59.0
	no additional measures selected	-
TOTAL FIELD COST		**$59.0**
Non-Contract Costs		
Planning and Environmental Compliance[1]		$7.00
Engineering and Design[2]		$5.80
Construction Management[3]		$5.80
Easements[4]		$0.60
Cultural Resources[5]		$1.80
TOTAL CONSTRUCTION COST		**$80.0**
Interest During Construction[6]		$7.00
TOTAL CAPITAL COST		**$87.0**
Interest and Amortization[7]		$4.10
Annual Operations and Maintenance[8]		$0.10
TOTAL ANNUAL COST		**$4.20**

Notes:

Cost estimate is appraisal-level and subject to change in the future. Appraisal-level cost estimates are not suitable for requesting project authorization and/or construction fund appropriations. Cost estimate is presented in January 2012 dollars, and may have discrepancies due to rounding.

[1] 12 percent of the field cost was estimated for Planning and Environmental Compliance non-contract costs.

[2] 10 percent of the field cost was estimated for Engineering and Design non-contract costs.

[3] 10 percent of the field cost was estimated for Construction Management non-contract costs.

[4] 1 percent of the field cost was estimated for Easements non-contract costs.

[5] 3 percent of the field cost was estimated for Cultural Resources non-contract costs.

[6] Interest During Construction was estimated over 4 years of construction at the current Federal discount rate of 4 percent.

[7] Interest and Amortization of the capital cost was estimated over 50 years at the current Federal discount rate of 4 percent.

[8] Annual Operations and Maintenance costs were estimated at 0.2 percent of the field cost.

Key:
$ million = million dollars
HDPE = high-density polyethylene

Table E3-5. Alternative 250.a Cost Summary

Measure Selected for Meeting the Safety Objective	Additional Measure(s) Selected for Meeting the Water Supply Objective	Estimated Cost ($ Million)
HDPE Cutoff Wall		$44.0
	Dry-Year Crop Insurance/Fallowing: see annual program cost below	
TOTAL FIELD COST		**$44.0**
Non-Contract Costs		
Planning and Environmental Compliance[1]		$4.40
Engineering and Design[2]		$4.40
Construction Management[3]		$4.40
Easements[4]		$0.40
Cultural Resources[5]		$1.40
TOTAL CONSTRUCTION COST		**$59.0**
Interest During Construction[6]		$2.00
TOTAL CAPITAL COST		**$61.0**
Interest and Amortization[7]		$2.80
Annual Operations and Maintenance[8]		$0.10
Dry-Year Crop Insurance/Fallowing Program[9] (25% demand reduction)		$3.60
TOTAL ANNUAL COST		**$6.50**

Note:
Cost estimate is appraisal-level and subject to change in the future. Appraisal-level cost estimates are not suitable for requesting project authorization and/or construction fund appropriations. Cost estimate is presented in January 2012 dollars, and may have discrepancies due to rounding.

[1] 10 percent of the field cost was estimated for Planning and Environmental Compliance non-contract costs.

[2] 10 percent of the field cost was estimated for Engineering and Design non-contract costs.

[3] 10 percent of the field cost was estimated for Construction Management non-contract costs.

[4] 1 percent of the field cost was estimated for Easements non-contract costs.

[5] 3 percent of the field cost was estimated for Cultural Resources non-contract costs.

[6] Interest During Construction was estimated over 2 years of construction at the current Federal discount rate of 4 percent.

[7] Interest and Amortization of the capital cost was estimated over 50 years at the current Federal discount rate of 4 percent.

[8] Annual Operations and Maintenance costs were estimated at 0.2 percent of the field cost.

[9] Dry-Year Crop Insurance/Fallowing Program annual cost is estimated at $100 per acre of land fallowing plus an administrative cost at 20 percent of the fee. This alternative would require 25 percent demand reduction in Truckee and Carson Division agriculture.

Key:
$ million = million dollars
HDPE = high-density polyethylene

Table E3-6. Alternative 250.b Cost Summary

Measure Selected for Meeting the Safety Objective	Additional Measure(s) Selected for Meeting the Water Supply Objective	Estimated Cost ($ Million)
HDPE Cutoff Wall		$44.0
	Line Main Canals and Laterals	$165.0
TOTAL FIELD COST		**$210.0**
Non-Contract Costs		
Planning and Environmental Compliance[1]		$10.0
Engineering and Design[2]		$21.0
Construction Management[3]		$21.0
Easements[4]		$2.00
Cultural Resources[5]		$6.00
TOTAL CONSTRUCTION COST		**$270.0**
Interest During Construction[6]		$50.0
TOTAL CAPITAL COST		**$320.0**
Interest and Amortization[7]		$14.5
Annual Operations and Maintenance[8]		$0.50
TOTAL ANNUAL COST		**$15.0**

Note:

Cost estimate is appraisal-level and subject to change in the future. Appraisal-level cost estimates are not suitable for requesting project authorization and/or construction fund appropriations. Cost estimate is presented in January 2012 dollars, and may have discrepancies due to rounding.

[1] 5 percent of the field cost was estimated for Planning and Environmental Compliance non-contract costs.

[2] 10 percent of the field cost was estimated for Engineering and Design non-contract costs.

[3] 10 percent of the field cost was estimated for Construction Management non-contract costs.

[4] 1 percent of the field cost was estimated for Easements non-contract costs.

[5] 3 percent of the field cost was estimated for Cultural Resources non-contract costs.

[6] Interest During Construction was estimated over 8 years of construction at the current Federal discount rate of 4 percent.

[7] Interest and Amortization of the capital cost was estimated over 50 years at the current Federal discount rate of 4 percent.

[8] Annual Operations and Maintenance costs were estimated at 0.2 percent of the field cost.

Key:
$ million = million dollars
HDPE = high-density polyethylene

Table E3-7. Alternative 250.d Cost Summary

Measure Selected for Meeting the Safety Objective	Additional Measure(s) Selected for Meeting the Water Supply Objective	Estimated Cost ($ Million)
Concrete/ Geomembrane Lining		$59.00
	Dry-Year Crop Insurance/Fallowing: see annual program cost below	
TOTAL FIELD COST		**$59.00**
Non-Contract Costs		
Planning and Environmental Compliance[1]		$7.00
Engineering and Design[2]		$5.80
Construction Management[3]		$5.80
Easements[4]		$0.60
Cultural Resources[5]		$1.80
TOTAL CONSTRUCTION COST		**$80.0**
Interest During Construction[6]		$7.00
TOTAL CAPITAL COST		**$87.0**
Interest and Amortization[7]		$4.00
Annual Operations and Maintenance[8]		$0.10
Dry-Year Crop Insurance/Fallowing Program[9]		$1.50
TOTAL ANNUAL COST		**$5.60**

Note:
Cost estimate is appraisal-level and subject to change in the future. Appraisal-level cost estimates are not suitable for requesting project authorization and/or construction fund appropriations. Cost estimate is presented in January 2012 dollars, and may have discrepancies due to rounding.

[1] 12 percent of the field cost was estimated for Planning and Environmental Compliance non-contract costs.

[2] 10 percent of the field cost was estimated for Engineering and Design non-contract costs.

[3] 10 percent of the field cost was estimated for Construction Management non-contract costs.

[4] 1 percent of the field cost was estimated for Easements non-contract costs.

[5] 3 percent of the field cost was estimated for Cultural Resources non-contract costs.

[6] Interest During Construction was estimated over 4 years of construction at the current Federal discount rate of 4 percent.

[7] Interest and Amortization of the capital cost was estimated over 50 years at the current Federal discount rate of 4 percent.

[8] Annual Operations and Maintenance costs were estimated at 0.2 percent of the field cost.

[9] Dry-Year Crop Insurance/Fallowing Program annual cost is estimated at $100 per acre of land fallowing plus an administrative cost at 20 percent of the fee. This alternative would require 10 percent demand reduction in Truckee and Carson Division agriculture.

Key:
$ million = million dollars
HDPE = high-density polyethylene