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Technical Proposal

(1) Executive Summary

Date, Applicant Name, City, County and State

- **Date:** January 19, 2012
- **Applicant name:** Moon Lake Water Users Association (MLWUA)
- **City, County, State:** Roosevelt, Duchesne County, Utah
- **Project Manager:**

  Name: Tracy Allen, P.E.

  Title: Project Manager

  Telephone: (801) 547-0393

  E-mail: tla@jub.com
- **Project funding request: $300,000**

Project Summary and Task Areas

Moon Lake Users Association (MLWUA) wants to conserve water through better management practices. This Project will reduce significant open canal water losses and by preserving storage in the Moon Lake Reservoir at the top of the Lake Fork River canal system for times of drought. Presently MLWUA operates the Lake Fork system by regulating a head gate below the Moon Lake Reservoir that is approximately 25 miles upstream from the existing 3,580 irrigated acres which the system serves. With the distance that the water travels in the open, unlined channel and the significan t seepage losses, it is very difficult to deliver the required amount of water to the irrigated land and still be able to make quick adjustments to ensure efficiency. To make up for the difficulty in the accurate delivery of the required, extra water is released at the head gate. Most of the extra water released is not used to its fullest potential and often, much of that water is wasted.

This project will conserve over 4,000 acre feet of water per year within Moon Lake Reservoir and save hundreds of acre-feet of water each year lost due to seepage in the earthen ditches as well as reducing high amounts of salt.

MLWUA plans to install 6,100 feet of HDPE pipeline varying in size from 36-inch to 22-inch diameter. This pipeline will deliver water out of the Sand Wash Reservoir which is much closer to the 3,580 acres of existing agriculture land being served. By installing the pipeline, it will be possible to control the required water at a head gate just one mile away, thus making it easier to make minor adjustments at the head gate to improve efficiency, creating better management practices.

Task A – Water Conservation

This project will design and construct a pipeline to more efficiently carry 50 cfs of water to 3,580 acres of agriculture land and replace an existing diversion structure. The project will consist of installing 6,100 feet of HDPE pipe with varying sizes from 36 to 22 inches, which will carry water from the Sand Wash Reservoir to the Uteland, Purdy, and Red Cap canals. The Red Cap Canal is owned by the Uintah and Ouray Agency of the Bureau of Indian Affairs which serves 3,130 acres of the 3,580 acres of agricultural land benefited by this project. This project will conserve over 4,000 acre feet of water per year within Moon Lake Reservoir and save hundreds of acre-feet of water each year lost due to seepage in the earthen ditches as well as reducing high amounts of salt. This project will strengthen the capabilities of the Moon Lake Water Users by improving water conservation, reducing salinity, supplementing existing irrigated acres with water, and boosting water quality for the surrounding and downstream areas.

To make up for the difficulty in the accurate delivery of the required, extra water is released at the head gate. Most of the extra water released is not used to its fullest potential and often, much of that water is wasted.

Task B – Energy-Water Nexus

Energy efficiency has always been a priority of MLWUA. They operate an energy-efficient, gravity-fed system. This project will also result in energy consumption by significantly reducing the amount of driving necessary by MLWUA personnel. Presently, MLWUA operates the Lake Fork system by regulating a head gate below the Moon Lake Reservoir. To open the gate, monitor how it is functioning, and check for potential problems, MLWUA personnel must drive 2 hours and 15 minutes every day during the irrigation season. This project will result in a 63% reduction in energy use.

(2) Background Data

For decades, irrigators in this region operated and maintained high storage in mountain lakes in the Uintah Mountain Range. Moon Lake Water Users Association was formed in 1934 as a cooperative of eight (8) private irrigation companies. The formation of MLWUA

created an entity that manages water resources for approximately 75,000 acres of irrigated ground in Duchesne and Uintah Counties in northeastern Utah.

At the same time as their formation, MLWUA greatly increased their storage capacity through the construction of the Moon Lake Reservoir, a Bureau of Reclamation project. Years later, the Sand Wash Reservoir, also a Bureau of Reclamation project, was constructed at a site approximately 25 miles downstream of Moon Lake. More recently, Sand Wash Reservoir was enlarged by 6,000 acre-feet and the MLWUA moved their storage rights in the high mountain lakes to the expanded Sand Wash Reservoir and the high mountain lakes were given to the U.S. Forest Service. The challenge that MLWUA faces now is getting the storage water from Sand Wash Reservoir to the irrigated land where it has historically been used. MLWUA now owns, operates and maintains the Moon Lake Reservoir and the Sand Wash Reservoir.

Moon Lake Reservoir

The Moon Lake Reservoir is capable of delivering water to 75,000 irrigated acres, while the Sand Wash Reservoir can deliver to 18,000 irrigated acres. This makes the water in the Moon Lake Reservoir more critical in times of low water or drought because of its larger potential for benefit and also because of its location at the top of the Lake Fork River system. Most years during snowmelt in the spring, Sand Wash Reservoir fills completely. At the end of the irrigation season when Moon Lake has been nearly drained, there are still thousands of acre-feet of water remaining in Sand Wash Reservoir not being utilized. There is not enough irrigable acreage below Sand Wash to use all of its expanded storage volume and there is no means to deliver the excess stored water nearby existing irrigated acreage being served currently by Moon Lake Reservoir. The proposed pipeline will help MLWUA keep storage water in Moon Lake Reservoir by utilizing the excess stored water in Sand Wash Reservoir. The storage water in Moon Lake will help significantly with recreation as this is a popular summer camping and fishing area, and will reduce water shortages in times of drought. It is estimated that the proposed pipeline will conserve over 4,000 acre-feet of storage water in Moon Lake and save hundreds of acre-feet of water each year lost due to seepage and inefficient water management. Reducing the amount of seepage in unlined, earthen channels also reduces the amount of salinity that enters the Colorado River, reducing water treatment cost to downstream users. This project will strengthen the capabilities of the MLWUA by improving water conservation, reducing salinity, and boosting water quality for the surrounding and downstream users.

As stated above, MLWUA recently increased the capacity of the Sand Wash Reservoir and since this time they have not been able to use the full storage capacity of the reservoir. From past records it is estimated that, on average, 5,000 acre-ft of water is not used out of Sand Wash Reservoir. This Project will allow them to use the 4,000 acre-ft from the Sand Wash Reservoir by now holding the water up in Moon Lake and discharging as needed.

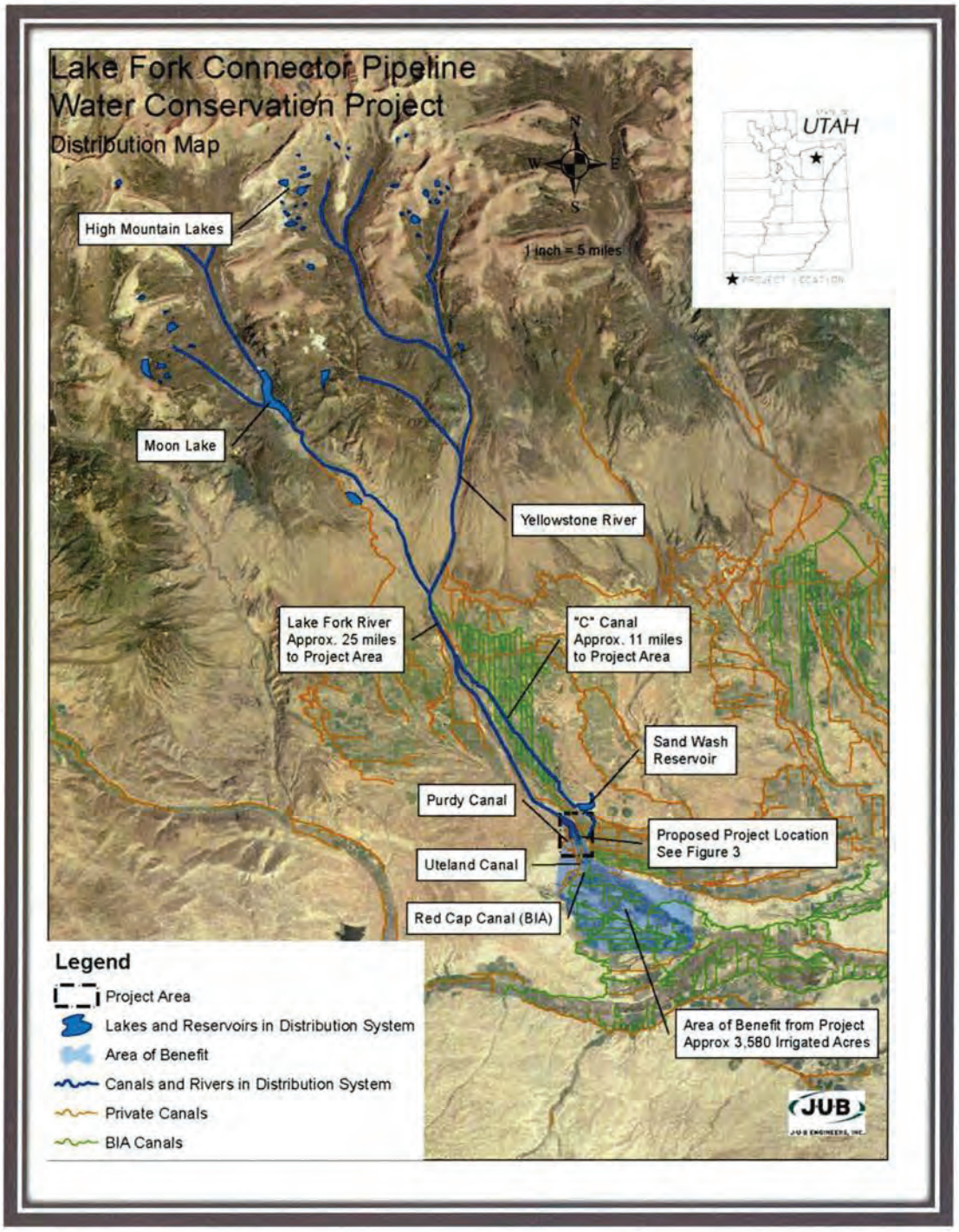
The water delivery time will be reduced from 48 hours to two hours.

By installing the proposed pipeline, water delivered to the Uteland, Purdy, and Red Cap Canals occurs only one mile from the proposed turnout, as opposed to 25 miles downstream of Moon Lake Reservoir. Thus, delivery time will be reduced from 48 hours to two hours. It is difficult to quantify how much water is lost due to the extensive unlined existing delivery system. By improving the existing delivery system as stated, it is firmly believed that there will be significant water savings.

The seepage losses were calculated based upon reduction in flows of 50 cfs in the Lake Fork River channel and combining the 50 cfs with the 250 cfs in the Class C Canal which is diverted from the river to feed Sand Wash Reservoir. This equates to 240 acre-feet per year and is a very conservative estimate

Geographic Location

The project area is located in Duchesne County in northeastern Utah about 140 miles east of Salt Lake City. Please see Attachment A - Project Location Maps



Source of Water Supply

The source of the water is direct flow from the Lake Fork River with reservoir storage in Moon Lake Reservoir, Sand Wash Reservoir and other small storage reservoirs. The Moon Lake Reservoir services the Uteland, Purdy, and Red Cap Canals by exchange and is located approximately 25 miles upstream from these canals. Currently, the water is released from Moon Lake Reservoir through the Lake Fork River and earthen ditches.

Water Rights Involved

Involved Water Rights include: 13-11997, 43-10375, 43-10450, 43-11107, 43-11108, 43-10375, 43-10450, 43-12342, 43-3151, 43-3152, 41-3155, 43-3168, 43-3169, 43-3172, 43-3175, 43-3176, 43-3179, 43-3180, 43-3188, 43-3225, 43-3229, 43-3721, 43-3823, 43-3824, 43-11748, and 43-3082

Current Water Uses and Number of Users Served

The water is currently used for agricultural irrigation and serves approximately 625 producers.

Current and Projected Water Demand

The proposed pipeline will be designed to carry 50 cfs to 3,580 acres of agricultural land of which 3,130 acres are served by the BIA's Red Cap Canal and 450 acres through other canals. The water this is flowing in 25 miles of open earthen channel will be eliminated, thus conserving water. Every year at the end of the irrigation season, water is left in Sand Wash Reservoir. This project will allow 3,580 irrigated acres to be served more efficiently below Sand Wash Reservoir making it possible to save 4,000 more acre-feet of water in Moon Lake Reservoir every year.

Potential Shortfalls in Water Supply

MLWUA faces water supply shortfalls in three main areas:

1. **Excessive water seepage and losses** - Hundreds of acre-feet of water are lost from seepage and evaporation as irrigation water travels in earthen channels. An estimated savings of 240 acre-feet of water per year will be realized due to the reduction in flows of 25 miles of open, unlined channel. This a very conservative estimate based upon 1% of the total flow at high flow periods and assuming that the channels are fully saturated. Late in the irrigation season as flows are lower and there is still water demand from Moon Lake Reservoir which must travel 25 miles to the heading of the Uteland, Purdy and Red Cap Canals, losses will be much greater.

2. **Inefficient use of storage water** – Recently, MLWUA increased the capacity of the Sand Wash Reservoir in exchange for the high mountain lakes located in designated wilderness on U.S. Forest Service property. Since the time that Sand Wash has been

enlarged, MLWUA has not been able to use the full storage capacity of that reservoir. From past records it is estimated that on average 5,000 acre-ft of water is left unused in Sand Wash Reservoir. The proposed pipeline will allow Sand Wash Reservoir to deliver 4,000 acre-feet of water each year to 3,580 acres of existing cropland which currently receives water from the Moon Lake Reservoir. This will allow the MLWUA to leave valuable storage in the Moon Lake Reservoir.

3. **Inefficient water management** – It takes 2 hours and 15 minutes for the Manager of MLWUA to drive from his office to the Moon Lake Reservoir to change the amount of water released below the dam each day to meet the "water calls" of the Uteland, Purdy and Red Cap Canals. By installing the proposed pipeline, controlling water released to the Uteland, Purdy, and Red Cap Canals would occur at the Sand Wash Reservoir which is only a 15-minute drive from MLWUA's office. The water from Moon Lake Reservoir travels 25 miles down the Lake Fork River to the head of the Uteland, Purdy and Red Cap Canals. It can take almost 48 hours to know how the change in water turned out at Moon Lake will affect the amount of water available at the head of the canals. It is very difficult to get a steady, efficient delivery of water to the canals. To make up for the difficulty and inefficiency of delivering the water as called each day, extra water is released. Most of the extra water released is not used to its greatest potential or is eventually wasted. The proposed pipeline would reduce the time to deliver the water to the Uteland, Purdy and Red Cap Canals from 48 hours to just a few hours, thus reducing employees' time and travel as well as helping to conserve water and energy.

It takes 2 hours and 15 minutes to drive to the Moon Lake Reservoir each day.

Major Crops and Total Acres Served

The entire area served by MLWUA is 75,000 acres, of which 57,000 acres are irrigated cropland associated with Moon Lake Reservoir. The Sand Wash Reservoir currently serves 18,000 acres. Major crops include alfalfa, grass hay and pasture, small grains, and corn.

Water Delivery System

MLWUA serves the Uteland, Purdy, and Red Cap Canals through exchange agreements. The head of these canals is located approximately 25 miles upstream from the proposed pipeline. The water which feeds these canals is released from Moon Lake Reservoir into the Lake Fork River and eventually into unlined, earthen ditches. Water released from Moon Lake can take up to 48 hours to reach the irrigated crops. There are approximately 625 eligible producers irrigating rotations of alfalfa, grass hay and pasture, small grains, and corn in the project area with an average farm size of 120 acres. MLWUA is made up of

eight private irrigation companies that manage water resources for approximately 75,000 acres of irrigated ground in Duchesne and Uintah Counties in northeastern Utah.

Energy Efficiency Elements

MLWUA currently uses an entirely gravity-fed system and will continue to do so upon completion of this project. Energy savings will also be realized in the better management of water. This project will significantly reduce the amount of driving necessary by MLWUA personnel. Presently, MLWUA operates the Lake Fork system by regulating a head gate below the Moon Lake Reservoir. To open the gate, monitor how it is functioning, and check for potential problems, MLWUA personnel must drive 2 hours and 15 minutes every day during the irrigation season.

Savings from no longer having to drive the top of the Lake Fork system daily, five months of the year:

Gasoline savings: One-way Daily 25 miles/40 miles = 63% reduction in fuel consumption.

Pollution savings: A similar 63% reduction in CO^2 emissions should be realized.

Past Working Relationship with Reclamation

Moon Lake Water Users Association was formed in 1934 as a cooperative group of eight (8) private irrigation companies. The formation of MLWUA created an entity that manages water resources for approximately 75,000 acres of irrigated ground in Duchesne and Uintah Counties in northeastern Utah. MLWUA, in cooperation with Reclamation, has been responsible for significant water resource projects including Moon Lake Dam and Reservoir (36,000 acre-feet), the Big Sand Wash Dam and Reservoir (12,000 acre-feet), and numerous canal, pipeline and structural projects. Several private irrigation projects have been completed by the private companies within MLWUA in partnership with Reclamation under the Colorado River Basin Salinity Reduction Program.

(3) Technical Project Description

The proposed project will include:

- Installation of 6,100 feet of 36-inch to 22- inch diameter of solid wall high density polyethylene pipe (HDPE) from the Class C Canal below Sand Wash Reservoir to the head of the Uteland, Purdy and Red Cap Canals.
- Installation of an energy dissipation structure on the end of the pipeline. This structure will be used to control the velocity and force of water from the end of the pipeline as it joins back into the canal system. This structure is necessary in order to

prevent erosion of existing earthen channels and to provide a safe location for operation and maintenance of the water as it exits the pipeline.

- Installation of a new splitter box out of the Class C Canal below Sand Wash Reservoir to divert water into the proposed HDPE pipeline.

(4) Evaluation Criteria

Evaluation Criterion A: Water Conservation

Subcriterion No. 1(a) – Quantifiable Water Savings

- **Estimated water to be conserved (in acre feet/year) as a direct result of this project.**
    - **How was this estimated/ determined, supporting calculations**

Currently, approximately 5,000 acre-feet of water are unused in the Sand Wash Reservoir. By diverting water directly from Sand Wash Reservoir, that excess water can be used on existing irrigated acreage approximately one mile away and will not need to be diverted from Moon Lake Reservoir 25 miles upstream. This project will conserve over 4,000 acre-feet of water per year within Moon Lake Reservoir and save 240 acre-feet of water per year from seepage loss in the earthen ditches.

Hundreds of acre-feet of water are lost from seepage and evaporation as irrigation water travels in earthen channels. An estimated savings of 240 acre-feet of water per year will be realized due to the reduction in flows of 25 miles of open, unlined channel.

This a very conservative estimate based upon 1% of the total flow at high flow periods and assuming that the channels are fully saturated. Late in the irrigation season as flows are lower and there is still water demand from Moon Lake Reservoir which must travel 25 miles to the heading of the Uteland, Purdy and Red Cap Canals, losses will be much greater.

- **Average annual acre-feet of water supply**

Annually, the MLWUA delivers on average 165,000 acre feet of water per year.

- **Where is the water currently going?**

The Moon Lake Reservoir services the Uteland, Purdy, and Red Cap Canals by exchange and is located approximately 25 miles upstream from the head of these canals. The water is released through the Lake Fork River and, at times, can take 48 hours for water turned out of the Moon Lake to reach the irrigated acreage.

Hundreds of acre-feet of water are lost from seepage and evaporation. As a result, more water has to be released in order to make sure the proper amount of water is available to the user.

- **Where will the conserved water go?**

  The Sand Wash Reservoir has up to 5,000 acre-feet of available water not being utilized at the end of each year and the MLWUA is consequently spilling this excess water at the beginning of the next irrigation season. The intent of the project is to allow 3,580 of the acres currently being irrigated by Moon Lake Reservoir to be served by the Sand Wash Reservoir, allowing the valuable storage water in Moon Lake to remain unused and stored for use during the following year. It is estimated that Moon Lake will be able to store an additional 4,000 acre-feet through the winter every year. This 4,000 acre-feet saved per year, accumulated over a series of years, will allow the reservoir to fill higher for a longer period of time, resulting in vital water storage that could be available during times of drought and would be essential for expanding recreational opportunities on Moon Lake.

Project Specific Questions

- **How have average annual water savings estimates been determined? This should include a detailed description of the rationale and methodologies used to develop the estimates. Please provide all relevant calculations, assumptions, and supporting data. Reference relevant studies or past project documentation that support the water saving estimates.**

  This project will provide better and more efficient management of 4,000 acre-feet of water by providing a means to deliver water to existing irrigated acreage through a pipeline just over one mile away rather than in open channels for a distance of 25 miles. MLWUA keeps accurate records of the storage conditions in the Moon Lake and Sand Wash Reservoirs on a continual basis and they know from those records that Sand Wash Reservoir typically has 5,000 acre-feet of unused water in storage at the end of the irrigation season. By determining the size of the irrigated acreage and the nature of the crops in the area that would receive the most benefit from the Lake Fork Connector Pipeline, an average water consumptive demand was applied to the acreage and it was calculated that approximately 4,000 acre-feet of excess Sand Wash water would be adequate for this area.

  Hundreds of acre-feet of water are lost from seepage and evaporation as irrigation water travels in earthen channels. An estimated savings of 240 acre-feet of water per year will be realized due to the reduction in flows of 25 miles of open, unlined channel. This a very conservative estimate based upon 1% of the total flow at high

flow periods and assuming that the channels are fully saturated. Late in the irrigation season as flows are lower and there is still water demand from Moon Lake Reservoir which must travel 25 miles to the heading of the Uteland, Purdy and Red Cap Canals, losses will be much greater.

The most significant benefit of this project is the better management of water, so there was no attempt to overstate the seepage loses in order to make the project more attractive. There are great annual water savings in the more efficient delivery of water by modifying the system as proposed.

- **If new technologies or devices are proposed, how will the savings occur? Please provide detailed descriptions that will enable the reviewer to understand function and how savings occur.**

  The function and savings from this project come from a more direct and much more efficient delivery of water to its historical service area. Following the completion of this project, water that for decades has been delivered down a 25-mile open, unlined earthen channel will be able to be delivered to the same location using a 6,100 foot long pipeline with a few appurtenances. This ability to "short circuit" the antiquated delivery method will result in water savings, better water management and more effective use of the water.

- **How will actual water savings be verified upon completion of the project? Please explain the calculations and the analyses for this verification.**

  Through existing level and flow monitoring equipment, MLWUA will be able to readily identify improvements in their storage volume in Moon Lake Reservoir. Although flow measuring devices do not currently exist everywhere in the system, this is planned in upcoming years. The real verification will come as a result of increase personnel efficiency and better control over the water due to its new delivery pipeline. Savings will come in terms of time, fuel, and water conservation for the end users.

Subcriterion No. A.1(b) – Improved Water Management

- **Describe the amount of water better managed**

  Currently, approximately 5,000 acre-feet of water are unused in the Sand Wash Reservoir. By diverting water directly from Sand Wash Reservoir, that excess water can be used on existing irrigated acreage approximately one mile away and not diverted from Moon Lake Reservoir 25 miles upstream. This project will conserve over 4,000 acre-feet of water per year within Moon Lake Reservoir and save 240

acre-feet of water per year from seepage loss in the earthen ditches. Resulting in a total amount of 4,240 acre feet better managed.

- **The amount of water expected to be better management in acre-feet per year and as a percentage of the average annual water supply. Use this equation:**

$$\frac{\textit{4,250 acre feet of Water Better Managed}}{\textit{165,000 acre feet of Average Annual Water Supply}}$$

= 2.6%

Subcriterion No.A.2 – Percentage of Total Supply

- **Describe the percentage of total water supply conserved.**

$$\frac{\text{4,250 acre feet conserved}}{\text{165,000 acre feet avg. annual water supply}}$$

= 2.6% of total water supply conserved

The MLWUA obtained this data from capacity charts, water reports, reservoir capacities, and annual reports.

Subcriterion No. A.3 – Reasonableness of Costs

- **Total project cost:**
  $637,654.58
- **Annual acre-feet conserved (or better managed)**

Completion of this project will result in an estimated annual amount of water conserved and better managed of 4,240 acre feet.

- **Expected life of the improvement:**

Based on industry standards and manufacturer guarantees, the HDPE pipe that will be used in this project has a service life of 100 years. Please see Attachment B for manufacturer information.

$$\frac{\$637{,}654.58}{\text{4,240 acre feet conserved x 100 years}}$$

= 1.50

Evaluation Criterion B: Energy-Water Nexus

Subcriterion No.B.1 – Implementing Renewable Energy Projects Related to Water Management and Delivery

This project will not include the construction or installation of renewable energy components. However, even though it is not directly related to this project, the additional storage in Moon Lake Reservoir does make the feasibility of a future hydroelectric facility more attractive. There is sufficient head and flow at the Moon Lake Dam for a hydroelectric facility of close to 1 megawatt of generating capacity.

Subcriterion No.B.2 – Increasing Energy Efficiency in Water Management

- **Describe any energy efficiencies that are expected to result from implementation of the water conservation or water management project.**
- **Describe any renewable energy components that will result in a minimal energy savings/production (e.g. installing small-scale solar as part of a SCADA system)**

The MLWUA has always considered energy efficiency as a high priority and currently operates an energy efficient gravity-fed water system that does not require pumping. Their commitment to energy efficiency is also demonstrated by the fact they now use solar-powered SCADA and telemetry technology. Although the proposed Lake Fork Connector Pipeline project does not include funds for additional SCADA equipment, it is anticipated that solar-powered SCADA equipment will be added within a year following completion of this project.

This project will further the MLWUA's goal of reducing energy usage by helping them manage their water in a more efficient manner. Presently, MLWUA operates the Lake Fork Canal by regulating a head gate below the Moon Lake Reservoir. To open the gate, monitor how it functioning, and check for potential problems, MLWUA personnel must drive 2 hours and 15 minutes every day during the irrigation season.

Savings from no longer having to drive the system twice a day five months of the year:

Gasoline savings: One-way daily 25 miles/40 miles = 63% reduction in fuel consumption

Pollution savings: A similar 63% reduction in CO^2 emissions should be realized

Evaluation Criterion C: Benefits to Endangered Species

The US Fish and Wildlife Service identifies the species outlined in the following table as known or believed to occur in Duchesne County. While it is unknown whether this project

will benefit a particular species, the 4,000 acres of water that is conserved will remain in the Moon Lake Reservoir will benefit the fish and other species in that body of water.

Species/Critical Habitat	Status
Barneby Ridge-cress	Endangered
Black-footed Ferret (*Mustela nigripes*)	Endangered
Blowout Penstemon (*Penstemon haydenii*)	Endangered
Colorado River Fish Bonytail (*Gila elegans*), Colorado Pikeminnow (*Ptychocheilus lucius*), Humpback Chub (*Gila cypha*), Razorback Sucker (*Xyrauchen texanus*)	Endangered Endangered Endangered Endangered
Shrubby Reed-mustard (*Schoenocrambe suffrutescens*)	Endangered
Canada Lynx (*Lynx Canadensis*)	Threatened
Clay Reed Mustard (*Schoenocrambe argillacea*)	Threatened
Mexican Spotted Owl (*Strix occidentalis lucida*)	Threatened
Pariette Cactus (*Sclerocactus brevispinus*)	Threatened
Uinta Basin Hookless Cactus (*Sclerocactus wetlandicus*)	Threatened
Ute Ladies'-tresses (*Spiranthes diluvialis*)	Threatened
Greater Sage Grouse (*Centrocercus urophasianus*)	Candidate
White River Penstemon (*Penstemon scariosus albifluvis*)	Candidate
Yellow-billed Cuckoo (*Coccyzus americanus*)	Candidate
Graham's beardtongue (*Penstemon grahamii*)	Proposed

Evaluation Criterion D: Water Marketing

Currently, the State of Utah does not allow for water marketing. However, MLWUA is preparing for the possibility of water markets in the future, as bills including opportunities for water banking or marketing have come before the State Legislature and a pilot program has been initiated in one Utah City.

The water conserved may be used for water marketing if it were to become legal in Utah and MLWUA is in a good position to provide this water to other users in a water-short basin. The MLWUA service area includes other irrigation and water companies and the water could be shared within this basin. As it stands now, by developing this project, water is saved and made available for drought conditions or recreation purposes in the community with clear economic and conservation benefits to the area's critical water resources.

Evaluation Criterion E: Other Contributions to Water Supply Sustainability

(1) Will the project make water available to address a specific concern?

- **Will the project address water supply shortages due to climate variability and/or heightened competition for finite water supplies (e.g. population growth and drought)?**

  Yes, by allowing the existing irrigated acreage to be served by Sand Wash Reservoir, Moon Lake Reservoir will be able to retain 4,000 acre-feet of additional water every year, creating additional valuable storage that can be utilized by the local producers during times of drought.

- **Will the project market water to other users? If so, what is the significance of this?**
  Currently, the State of Utah does not allow water marketing.

- **Will the project make additional water available to Indian tribes?**

  Yes. A large percentage of the land to be served by this project is Ute Tribal Land. Of agricultural acres benefitted by this project, 81% are on Ute Tribal Land. In addition, 48% of the canals below Moon Lake and 87% of the canals serviced by the proposed pipeline are maintained and operated by the Bureau of Indian Affairs (BIA). The water that will be conserved and better managed by this project will have direct positive impacts to local Ute Indian Tribe.

  Utah is the second driest state in the nation. The water saved will be kept in the Moon Lake Reservoir to give a buffer during especially dry years.

- **Will the project help to address an issue that could potentially result in an interruption to the water supply if left unresolved?**
  Yes, the project can help to address an issue that could potentially result in an interruption to the water supply if left unresolved. Moon Lake Reservoir, with a storage capacity of 36,000 acre-feet, does not consistently fill every year. In fact, in five of the last eleven years, the reservoir has failed to reach its maximum level. Inadequate storage has the potential of leaving irrigators without water late in the irrigation season, or as has been the case regularly in past decade, leaving irrigators with reduced supply at the very least. The additional 4,000 acre-feet of storage water that could be saved in Moon Lake Reservoir represents over 11% of the reservoir's storage capacity. This can help eliminate the potential for an interruption in water supply in the future.

Even in normal years, Utah has a limited water supply. It is the second driest state in the nation. The MLWUA project area only receives 9.5 inches of total precipitation annually, making it even drier than the State average of 13 inches. The water saved will be kept in the Moon Lake Reservoir to give a buffer during especially dry years.

- **Will the project generally make more water available in the water basin where the proposed work is located?**

  Yes. The Sand Wash Reservoir currently has 5,000 acre-feet of available water that is not being utilized at the end of each year, and is being spilled at the beginning of the next irrigation season. The proposed pipeline will allow Sand Wash Reservoir to use 4,000 acre-feet of water more efficiently on the 3,580 acres of existing cropland, thereby conserving over 4,000 acre-feet of water within Moon Lake Reservoir per year. This project will also save 240 acre-feet of water lost due to seepage in the miles of open earthen ditches used just for the delivery of the water to the existing cropland.

(2) Does the project promote and encourage collaboration among parties?

- **Is there widespread support for the project?**

  Yes. Public meetings have already been held with shareholders and agricultural users impacted by this project and they have indicated that they support this project. In addition, the MLWUA is partnering with the Uintah & Ouray Agency BIA Project Bureau of Indian Affairs, and Duchesne County Conservation District (DCCD). Please see Attachment B for the Letter of Support from the Uintah Indian Irrigation Project Operation and Maintenance Company which manages the BIA's canals on behalf of the Ute Tribe.

  - **What is the significance of the collaboration/support?**
    The support from these various entities is significant in that this project directly affects the water management and efficiency of the irrigated acreage on Ute Tribal Land and other areas of Duchesne County.

- **Will the project help to prevent a water-related crisis or conflict?**

  Yes. There will be better delivery and access to the water for the "downstream" existing irrigated acres. This will prevent conflicts between "upstream" and "downstream" water users. There will also be additional storage water in the Moon Lake Reservoir which will reduce the conflict

between irrigators and recreational users late in the water season each year. In this desert region, water is a precious commodity and if the supply is limited, but demand is high it could cause conflict among water users. Much of the land being irrigated below the Sand Wash Reservoir which will benefit from this project is Ute Tribal land. Improving water delivery to that existing cropland will help prevent future potential conflicts with the Ute Tribe as well.

(3) Will the proposed WaterSMART Grant project help to expedite future on-farm irrigation improvements, including future on farm improvements that may be eligible for Natural Resources Conservation Service (NRCS) funding?

While portion of MLWUA's water system does not directly service any farms, as canals are piped, on-farm sprinkler systems could then made available through the NRCS EQIP program for more efficient on-farm irrigation. The Lake Fork Pipeline will provide more efficient delivery for the on-farm systems as well.

(4) Will the project increase awareness of water and/or energy conservation and efficiency efforts?

- **Will the project serve as an example of water and/or energy conservation and efficiency within a community?**
  The MLWUA is an association of several different water management entities. Because of MLWUA's relationship with the other water/irrigation companies in the area, efforts taken by MLWUA can serve as an example to the other entities and surrounding tribal governments of how they can conserve water and energy in their own water systems.

- **Will the project increase the capability of future water conservation or energy efficiency efforts for use by others?**

  The Uintah Basin has been an active area for Reclamation's Colorado River Salinity Reduction projects. The BIA's Red Cap Canal has been piped under that program and is ready for delivery of water from the proposed Lake Fork Connector pipeline. As canals are piped through the Salinity program, on-farm sprinkler systems are then made available through the NRCS EQIP program for more efficient on-farm irrigation. The Lake Fork Pipeline will provide more efficient delivery for the on-farm systems as well.

- **Does the project integrate water and energy components?**

Historically, MLWUA has kept extensive records on their system. More recently, they have installed a system-wide SCADA system to record and transmit flow data and other water management data. The SCADA system is almost entirely operated using solar energy. Although the proposed Lake Fork Connector Pipeline project does not include funds for additional SCADA equipment, it is anticipated that solar-powered SCADA equipment will be added within a year of completing this project.

Evaluation Criterion F: Implementation and Results

Subcriterion No.F.1 – Project Planning

(1) Identify any district-wide, or system-wide, planning that provides support for the proposed project (SOR, Water Conservation Plan) to determine priority of this project in relation to other potential projects.

Every year MLWUA produces an Annual Report that identifies current needs of the distribution system. The last two years this project has been the highest ranking project in the report. MLWUA is in the process of creating their most recent Annual Report and this project is once again the priority. MLWUA has outlined the following objectives to improve their water system:

- **Increase amount of stored water in Moon Lake.** By allowing the acres to be served by Sand Wash Reservoir, Moon Lake Reservoir will be able to retain 4,000 acre-feet every year, giving valuable water during times of drought.
- **Improve delivery time and reduce operation and maintenance.** By installing the proposed pipeline, water delivered to the Uteland, Purdy, and Red Cap Canals occurs only one mile from the proposed turnout, as opposed to 25 miles downstream of Moon Lake Reservoir. Thus, delivery time will be reduced from 48 hours to two hours.
- **Decrease water losses to producers.** A very conservative estimated savings of 240 acre-feet of water per year will be realized due to the reduction in flows of miles of open, unlined channel.
- **Reduce salinity in water to producers and other downstream users.** Reducing water in the long sections of open canal greatly reduces seepage and deep percolation into the ground water in the area. The ground water has a large amount of salt, which is carried with the water as it surfaces, thus becoming a pollutant to the irrigated acres and the downstream users.

- **Improve recreational activity on Moon Lake**. Moon Lake is a very popular recreation site in the area. The additional 4,000 acre-feet of storage every year will benefit the fishery and the recreation activities on the lake.

(2) Identify and describe any engineering or design work performed specifically in support of the proposed project.

Preliminary design of the proposed project has been completed in order to size piping and structures so that a reasonable cost estimate could be generated. Detailed design will follow funding approval. An environmental and cultural review has been started.

(3) Describe how the project conforms to and meets the goals of any applicable State or regional water plans, and identify any aspect of the project that implements a feature of an existing water plan.

While MLWUA is not specifically mentioned in the Utah State Water Plan, the plan does recommend correctly inefficiencies in water delivery systems through piping and measurement technologies. Relevant pages from this plan are included in Attachment C.

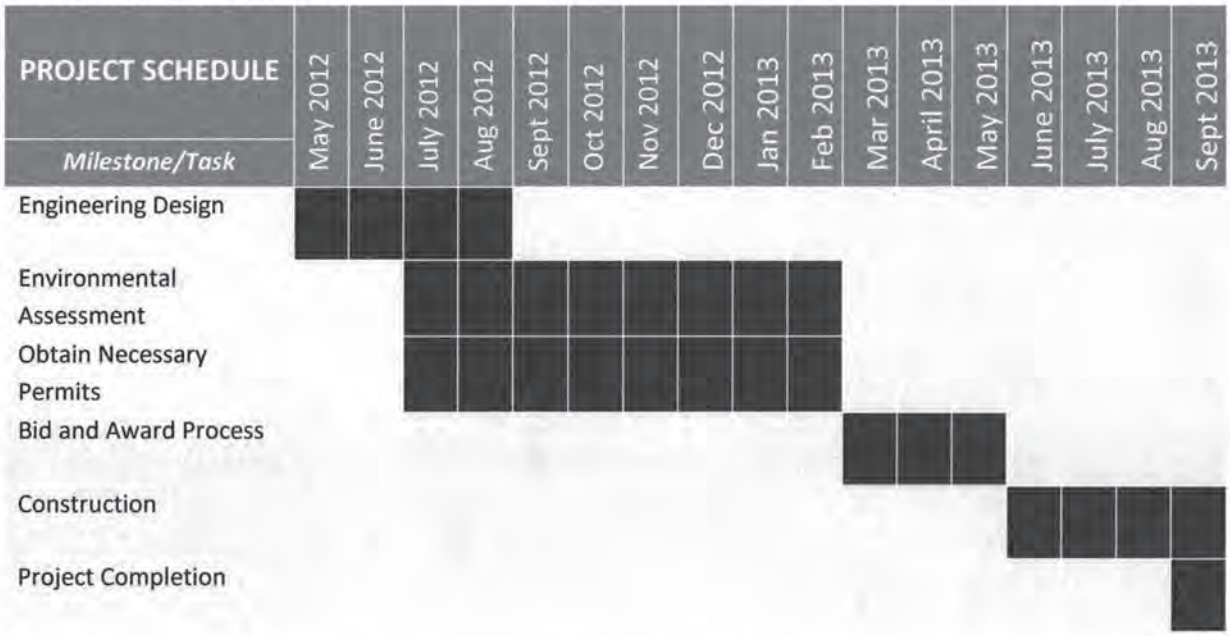
In addition to the needs assessment provided by the MLWUA Annual Report, Reclamation is in the process of selecting a consultant to complete a Salinity Project Master Plan of the entire Uintah Basin for the purpose of understanding more fully that salinity reduction potential for the Basin.

Subcriterion No.F.2 – Readiness to Proceed

- **Are all necessary plans/designs complete? Are there any delays expected to result from environmental compliance?**

Preliminary design has been completed and preliminary plans have been prepared. Final design will take place after funding is granted. The proposed schedule provides sufficient time for the final design to be completed. Public meetings have already been held with shareholders, who have shown support for the project. No delays are expected from environmental compliance.

- **Describe implementation plan. Include an estimated project schedule that shows the stages and duration of the proposed work, including major tasks, milestones and dates.**



- **Explain any permits that will be required, along with the process for obtaining such permits**

Moon Lake Water Users Association will need a Stream Alteration Permit from the Utah Division of Water Rights and a 404 Permit from the USACE to complete the proposed work. The Stream Alteration Permit requires an application which includes a detailed drawing of the proposed crossing. This application will be submitted as final plans are being developed to allow adequate time for the permit process to occur prior to the bidding and construction phase. The wetland delineation will occur immediately following the funding notification from Reclamation so that there is adequate time for the USACE to review the delineation and issue the 404 permit prior to the bidding and construction phase. MLWUA will submit the applications with the required documentation.

Subcriterion No.F.3 – Performance Measures

- **Performance measure that will be used to quantify actual benefits upon completion of the project.**

  Flow for the rivers and canals of the Lake Fork irrigation system for MLWUA from Moon Lake Reservoir down to the proposed pipeline site is continually monitored for flow using the MLWUA solar-powered SCADA system. The existing SCADA equipment will provide pre-construction data and post construction data which will be gathered and evaluated in order to quantify actual benefits upon completion of the project.

Evaluation Criterion G: Connection to Reclamation Project Activities

(1) How is project connected to Reclamation project activities?

The Moon Lake Dam and Reservoir and Sand Wash Dam and Reservoir were both Bureau of Reclamation projects built in conjunction with MLWUA. These projects have since been purchased by MLWUA and are being operated and maintained by MLWUA personnel.

(2) Does the applicant receive Reclamation project water?

There are 1,500 acre-feet of Reclamation project water in the Sand Wash Reservoir that is being delivered via pipeline to MLWUA canals in Roosevelt, Utah

(3) Is the project on Reclamation project lands or involving Reclamation facilities?

The project is not on Reclamation project lands. However, the project involves past Reclamation facilities because of the large reservoirs involved in the project. The reservoirs were constructed as Reclamation projects, but are now owned and operated by MLWUA. In addition, there are 1,500 acre feet of Reclamation water in the Sand Wash Reservoir that is being delivered via pipeline to MLWUA canals in Roosevelt, Utah.

(4) Is the project in the same basin as a Reclamation project or activity?

Yes, the Uintah Basin in northeastern Utah has long been an active area for Reclamation projects.

(5) Will the project work contribute water to a basin where a Reclamation project is located?

Yes, the existing irrigated cropland to be served by this project is located in the Uintah Basin, an area that has seen a lot of Reclamation projects. In addition, up to 4,000 acre-feet of storage water will be conserved in the Moon Lake Reservoir, a Reclamation project, located in the Uintah Basin.

Compliance

Environmental Compliance

(1) Will the project impact the surrounding environment (i.e. soil [dust], air, water [quality and quantity], animal habitat, etc.)? Please briefly describe all earth-disturbing work and any work that will affect the air, water, or animal habitat in the project area. Please also explain the impacts of such work on the surrounding environment and any steps that could be taken to minimize the impacts.

This project is not anticipated to have any long-term impacts to the surrounding environment. Construction activities will include trench excavation for pipe installation and clearing of vegetation in the immediate excavation zone. Excavation will be performed with the use of appropriately-sized construction equipment to minimize the disturbed area. All excavated material will be stockpiled and used for backfill after pipe installation. Short-term impacts associated with construction activities would likely result in minor impacts to air quality, noise, upland vegetation and the potential spread of noxious weeds. Best Management Practices, such as a dust control plan and spraying for noxious weeds, will be employed to mitigate for construction impacts. Existing easements and right-of-ways will be used for the project.

(2) Are you aware of any species listed or proposed to be listed as a Federal threatened or endangered species, or designated critical habitat in the project area? If so, would they be affected by any activities associated with the proposed project?

The U.S. Fish and Wildlife Service identify the following endangered, threatened, and candidate species within Duchesne County. It is highly unlikely that any of these species or their habitat exist within the project area. However, a full biological survey, including coordination with federal and state agencies, will be performed prior to the execution of the proposed project.

Species/Critical Habitat	Status
Barneby Ridge-cress	Endangered
Black-footed Ferret (*Mustela nigripes*)	Endangered
Blowout Penstemon (*Penstemon haydenii*)	Endangered
Colorado River Fish Bonytail (*Gila elegans*), Colorado Pikeminnow (*Ptychocheilus lucius*), Humpback Chub (*Gila cypha*), Razorback Sucker (*Xyrauchen texanus*)	Endangered Endangered Endangered Endangered

Species/Critical Habitat	Status
Shrubby Reed-mustard (*Schoenocrambe suffrutescens*)	Endangered
Canada Lynx (*Lynx Canadensis*)	Threatened
Clay Reed Mustard (*Schoenocrambe argillacea*)	Threatened
Mexican Spotted Owl (*Strix occidentalis lucida*)	Threatened
Pariette Cactus (*Sclerocactus brevispinus*)	Threatened
Uinta Basin Hookless Cactus (*Sclerocactus wetlandicus*)	Threatened
Ute Ladies'-tresses (*Spiranthes diluvialis*)	Threatened
Greater Sage Grouse (*Centrocercus urophasianus*)	Candidate
White River Penstemon (*Penstemon scariosus albifluvis*)	Candidate
Yellow-billed Cuckoo (*Coccyzus americanus*)	Candidate
Graham's beardtongue (*Penstemon grahamii*)	Proposed

(3) Are there wetlands or other surface waters inside the project boundaries that potentially fall under Federal Clean Water Act jurisdiction as "waters of the United States?" If so, please describe and estimate any impacts the project may have.

The proposed project would require a crossing of the Lake Fork River. While there are no known wetlands in the project area, it is likely that the crossing of Lake Fork River would result in a temporary impact to the surrounding riparian area. A wetland delineation, coordination with the USACE, and the completion of a 404 permit would be finalized prior to the execution of the proposed project.

(4) When was the water delivery system constructed?

The delivery system was constructed 1910-1911. The Big Sand Wash Reservoir was originally constructed in 1965. Moon Lake is a large natural lake which was enlarge by an earth filled dam in 1938 to become Moon Lake Reservoir.

(5) Will the project result in any modification of or effects to, individual features of an irrigation system (e.g., headgates, canals, or flumes)? If so, state when those features were constructed and describe the nature and timing of any extensive alterations or modifications to those features completed previously.

No. This project will not modify any individual features of the irrigation system.

(6) Are any buildings, structures, or features in the irrigation district listed or eligible for listing on the National Register of Historic Places?

No. There are no known buildings, structures, or features in the irrigation district listed or eligible for listing on the National Register of Historic Places.

(7) Are there any known archeological sites in the proposed project area?

There are no known archeological sites in the project area.

(8) Will the project have a disproportionately high and adverse effect on low income or minority populations?

No, this project will not have any adverse effects on low income or minority populations.

(9) Will the project limit access to and ceremonial use of Indian sacred sites or result in other impacts on tribal lands?

No, this project will not limit access to any ceremonial use of Indian sacred sites or have any other impacts on tribal lands.

(10) Will the project contribute to the introduction, continued existence, or spread of noxious weeds or non-native invasive species known to occur in the area?

The construction of the proposed project has the potential to spread noxious weeds through earth-moving activities. Best Management Practices, such as the removing dirt and seeds from construction equipment, will be implemented throughout construction to prevent the introduction and spread of noxious weeds.

& Approval

Required Permits or Approvals

Moon Lake Water Users Association will need a Stream Alteration Permit from the Utah Division of Water Rights and a 404 Permit from the USACE to complete the proposed work. The Stream Alteration Permit requires an application which includes a detailed drawing of the proposed crossing. This application will be submitted as final plans are being developed to allow adequate time for the permit process to occur prior to the bidding and construction phase. The wetland delineation will occur immediately following the funding notification from Reclamation so that there is adequate time for the USACE to review the delineation and issue the 404 permit prior to the bidding and construction phase.

Funding Plan

Funding Plan and Letters of Commitment

Funding Plan

(1) How you will make your contribution to the cost share requirement, such as monetary and/or in-kind contributions and source funds contributed by the applicant (e.g., reserve account, tax revenue, and/or assessments).

The Moon Lake Water Users Association will meet their cost share requirements with a combination of funds from their reserve account and assessments.

(2) Describe and in-kind costs incurred before the anticipated project start date that you seek to include as your project costs.

N/A

(3) Provide the identity and amount of funding to be provided by funding partners, as well as the required letters of commitment.

N/A

(4) Describe any funding requested or received from other Federal partners. Note: Other sources of Federal funding may not be counted toward the applicant's 50 percent cost share unless otherwise allowed by statute.

N/A

(5) Describe any pending funding requests that have not yet been approved, and explain how the project will be affected if such funding is denied.
N/A

1: Table 2: Summary of non-Federal and Federal Funding Sources

Funding Sources	Funding Amount
Non-Federal Entities	
1. Moon Lake Water Users Association	$337,654.58
Non-Federal Subtotal:	$337,654.58
Other Federal Entities	$0.00
1.	
Other Federal Subtotal:	$0.00
Requested Reclamation Funding:	$300,000.00
Total Project Funding:	$637,654.58

Official Resolution

Official Resolution

The Official Resolution will be submitted within 30 days of the application. The Moon Lake Water Users Association Board of Directors will have their next meeting on February 1, 2012.

Budget Proposal

Budget Proposal

General Requirements

Include a project budget that estimates all costs (not just costs to be borne by Reclamation.) Include the value of in-kind contributions of good and services and sources of funds provided to complete the project. The proposal must clearly delineate between Reclamation and applicant contributions.

Budget Item Description	Computation		Recipient Funding	Reclamation Funding	Total Cost
	Unit	Quantity			
CONTRACTUAL/CONSTRUCTION					
Dissipation Structure Engineering	$1,823.16		$965.41	$857.75	$1,823.16
Construction Observation	$2,228.31		$1,179.95	$1,048.36	$2,228.31
Pipeline Engineering	$24,825.58		$13,145.79	$11,679.79	$24,825.58
Construction Observation	$30,342.37		$16,067.08	$14,275.29	$30,342.37
Splitter Box Engineering	$2,447.95		$1,296.25	$1,151.70	$2,447.95
Construction Observation	$2,991.94		$1,584.31	$1,407.63	$2,991.94
Headworks Engineering	$1,647.37		$872.33	$775.04	$1,647.37
Construction Observation	$2,013.45		$1,066.17	$947.28	$2,013.45
DISSIPATION STRUCTURE					
MOBILIZATION					
Materials	#				
Bond		1.50%	$24,706.55	$196.24	$370.60
Labor	#				
General Contractor	1	$51.39/HR	5	$136.06	$120.89	$256.95
Senior Project Manager	1	$51.39/HR	5	$136.06	$120.89	$256.95
Truck Driver	2	$21.25/HR	5	$112.52	$99.98	$212.50
Equipment Operator	1	$21.25/HR	5	$56.26	$49.99	$106.25
Equipment	#					
Delivery Truck	2	$40.00/HR	5	$211.81	$188.19	$400.00
Delivery Truck Fuel	2	$3.50/Gal	100	$370.67	$329.33	$700.00
SITE PREPARATION						
Labor	#					
Senior Project Manager	1	$51.39/HR	5	$136.06	$120.89	$256.95
Equipment Operator	2	$21.25/HR	5	$112.52	$99.98	$212.50
Truck Driver	1	$21.25/HR	5	$56.26	$49.99	$106.25
General Labor	3	$11.12/HR	5	$88.32	$78.48	$166.80
Equipment	#					

Budget Item Description		Computation		Recipient	Reclamation	Total Cost
Excavator	1	$60.00/HR	5	$158.86	$141.14	$300.00
Front End Loader	1	$60.00/HR	5	$158.86	$141.14	$300.00
Hauling Truck	1	$40.00/HR	5	$105.91	$94.09	$200.00
Pick-up Truck	1	$12.00/HR	5	$31.77	$28.23	$60.00
Other	#					
Excavator Fuel	1	$3.50/Gal	100	$185.33	$164.67	$350.00
Front End Loader Fuel	1	$3.50/Gal	100	$185.33	$164.67	$350.00
Hauling Truck Fuel	1	$3.50/Gal	100	$185.33	$164.67	$350.00
Pick-up Truck Fuel	1	$3.50/Gal	100	$185.33	$164.67	$350.00
CONCRETE BOX						
Materials						
Concrete		$130.00/CY	6	$413.03	$366.97	$780.00
Reinforcing Steel		$1.20/lb	1050	$667.20	$592.80	$1,260.00
Forms		$2.50/ft²	192	$254.17	$225.83	$480.00
Foundation Material		$6.50/Ton	1.2	$4.13	$3.67	$7.80
Labor	#					
Senior Project Manager	1	$51.39/HR	10	$272.12	$241.78	$513.90
Excavator Operator	1	$21.25/HR	10	$112.52	$99.98	$212.50
Loader Operator	1	$21.25/HR	10	$112.52	$99.98	$212.50
Hauling Truck Driver	2	$21.25/HR	10	$225.05	$199.95	$425.00
Specialized Labor	4	$21.25/HR	10	$450.10	$399.90	$850.00
General Labor	3	$11.12/HR	10	$176.65	$156.95	$333.60
Equipment	#					
Pump Truck	1	$15.00/HR	10	$79.43	$70.57	$150.00
Excavator	1	$60.00/HR	10	$317.72	$282.28	$600.00
Front End Loader	1	$60.00/HR	10	$317.72	$282.28	$600.00
Hauling Truck	2	$40.00/HR	10	$423.62	$376.38	$800.00
Backhoe	1	$40.00/HR	10	$211.81	$188.19	$400.00
Skid Loader	1	$40.00/HR	10	$211.81	$188.19	$400.00
Pick-up Truck	1	$12.00/HR	10	$63.54	$56.46	$120.00
Other	#					
Excavator Fuel	1	$3.50/Gal	200	$370.67	$329.33	$700.00
Front End Loader Fuel	1	$3.50/Gal	200	$370.67	$329.33	$700.00
Hauling Truck Fuel	2	$3.50/Gal	200	$741.34	$658.66	$1,400.00
Backhoe Fuel	1	$3.50/Gal	200	$370.67	$329.33	$700.00
Skid Loader Fuel	1	$3.50/Gal	200	$370.67	$329.33	$700.00
Pick-up Truck Fuel	1	$3.50/Gal	200	$370.67	$329.33	$700.00
RIP-RAP OUTLET						
Materials						
EPDM 8 oz Liner		$2.50/ft²	400	$529.53	$470.47	$1,000.00

Budget Item Description		Computation		Recipient	Reclamation	Total Cost
Rip-Rap		$20.00/Ton	200	$2,118.10	$1,881.90	$4,000.00
Labor	#					
Senior Project Manager	1	$51.39/HR	5	$136.06	$120.89	$256.95
Excavator Operator	1	$21.25/HR	5	$56.26	$49.99	$106.25
Loader Operator	1	$21.25/HR	5	$56.26	$49.99	$106.25
Hauling Truck Driver	2	$21.25/HR	5	$112.52	$99.98	$212.50
General Labor	3	$11.12/HR	5	$88.32	$78.48	$166.80
Equipment	#					
Excavator	1	$60.00/HR	5	$158.86	$141.14	$300.00
Front End Loader	1	$60.00/HR	5	$158.86	$141.14	$300.00
Hauling Truck	2	$40.00/HR	5	$211.81	$188.19	$400.00
Pick-up Truck	1	$12.00/HR	5	$31.77	$28.23	$60.00
Other	#					
Excavator Fuel	1	$3.50/Gal	100	$185.33	$164.67	$350.00
Front End Loader Fuel	1	$3.50/Gal	100	$185.33	$164.67	$350.00
Hauling Truck Fuel	2	$3.50/Gal	100	$370.67	$329.33	$700.00
Pick-up Truck Fuel	1	$3.50/Gal	100	$185.33	$164.67	$350.00
			PIPELINE			
MOBILIZATION						
Materials						
Bond		1.50%	$358,036.60	$2,843.85	$2,526.70	$5,370.55
Labor	#					
General Contractor	1	$51.39/HR	10	$272.12	$241.78	$513.90
Senior Project Manager	2	$51.39/HR	10	$544.25	$483.55	$1,027.80
Truck Driver	2	$21.25/HR	10	$225.05	$199.95	$425.00
Equipment Operator	1	$21.25/HR	10	$112.52	$99.98	$212.50
Equipment	#					
Delivery Truck	2	$40.00/HR	10	$423.62	$376.38	$800.00
Delivery Truck Fuel	2	$3.50/Gal	200	$741.34	$658.66	$1,400.00
EXCAVATION						
Labor	#					
Senior Project Manager	1	$51.39/HR	50	$1,360.62	$1,208.88	$2,569.50
Excavator Operator	1	$21.25/HR	50	$562.62	$499.88	$1,062.50
Backhoe Operator	2	$21.25/HR	50	$1,125.24	$999.76	$2,125.00
Hauling Truck Driver	2	$21.25/HR	50	$1,125.24	$999.76	$2,125.00
General Labor	4	$11.12/HR	50	$1,177.67	$1,046.33	$2,224.00
Equipment	#					
Excavator	1	$60.00/HR	50	$1,588.58	$1,411.42	$3,000.00
Backhoe	2	$40.00/HR	50	$2,118.10	$1,881.90	$4,000.00
Hauling Truck	2	$40.00/HR	50	$2,118.10	$1,881.90	$4,000.00

Budget Item Description		Computation		Recipient	Reclamation	Total Cost
Pick-up Truck	1	$12.00/HR	50	$317.72	$282.28	$600.00
Other	#					
Excavator Fuel	1	$3.50/Gal	1000	$1,853.34	$1,646.66	$3,500.00
Backhoe Fuel	2	$3.50/Gal	1000	$3,706.68	$3,293.32	$7,000.00
Hauling Truck Fuel	2	$3.50/Gal	1000	$3,706.68	$3,293.32	$7,000.00
Pick-up Truck Fuel	1	$3.50/Gal	1000	$1,853.34	$1,646.66	$3,500.00
PIPE PLACEMENT						
Materials						
36" Corrugated HDPE Pipe		$34.61/ft	1500	$27,490.35	$24,424.65	$51,915.00
26" HDPE Pipe		$30.62/ft	1100	$17,835.50	$15,846.50	$33,682.00
22" HDPE Pipe		$25.43/ft	3600	$48,477.06	$43,070.94	$91,548.00
Labor	#					
Senior Project Manager	1	$51.39/HR	50	$1,360.62	$1,208.88	$2,569.50
Backhoe Operator	2	$21.25/HR	50	$1,125.24	$999.76	$2,125.00
Truck Driver	2	$21.25/HR	50	$1,125.24	$999.76	$2,125.00
Specialized Labor	2	$21.25/HR	50	$1,125.24	$999.76	$2,125.00
General Labor	3	$11.12/HR	50	$883.25	$784.75	$1,668.00
Equipment	#					
Backhoe	2	$40.00/HR	50	$2,118.10	$1,881.90	$4,000.00
Delivery Truck	2	$40.00/HR	50	$2,118.10	$1,881.90	$4,000.00
Pick-up Truck	1	$12.00/HR	50	$317.72	$282.28	$600.00
Fusing Machine	1	$25.00/HR	50	$661.91	$588.09	$1,250.00
Auto-Level	1	$5.00/HR		$0.00	$0.00	$0.00
Other	#		1000			
Backhoe Fuel	2	$3.50/Gal	1000	$3,706.68	$3,293.32	$7,000.00
Delivery Truck Fuel	2	$3.50/Gal	1000	$3,706.68	$3,293.32	$7,000.00
Pick-up Truck Fuel	1	$3.50/Gal	1000	$1,853.34	$1,646.66	$3,500.00
COMPACTION						
Materials						
Embedment Material		$8.00/Ton	2000	$8,472.42	$7,527.58	$16,000.00
Native Fill		$2.00/Ton	1000	$1,059.05	$940.95	$2,000.00
Tracer Wire		$0.75/ft	6200	$2,462.30	$2,187.70	$4,650.00
Warning Tape		$0.50/ft	6200	$1,641.53	$1,458.47	$3,100.00
Labor	#					
Senior Project Manager	1	$51.39/HR	50	$1,360.62	$1,208.88	$2,569.50
Loader Operator	2	$21.25/HR	50	$1,125.24	$999.76	$2,125.00
Hauling Truck Driver	2	$21.25/HR	50	$1,125.24	$999.76	$2,125.00
General Labor	3	$11.12/HR	50	$883.25	$784.75	$1,668.00
Equipment	#					
Front End Loader	2	$60.00/HR	50	$3,177.16	$2,822.84	$6,000.00

Budget Item Description		Computation		Recipient	Reclamation	Total Cost
Hauling Truck	2	$40.00/HR	50	$2,118.10	$1,881.90	$4,000.00
Pick-up Truck	1	$12.00/HR	50	$317.72	$282.28	$600.00
Compactor	2	$12.00/HR	50	$635.43	$564.57	$1,200.00
Other	#					
Front End Loader Fuel	2	$3.50/Gal	1000	$3,706.68	$3,293.32	$7,000.00
Hauling Truck Fuel	2	$3.50/Gal	1000	$3,706.68	$3,293.32	$7,000.00
Pick-up Truck Fuel	1	$3.50/Gal	1000	$1,853.34	$1,646.66	$3,500.00
Compactor Fuel	2	$3.50/Gal	1000	$3,706.68	$3,293.32	$7,000.00
INSTALLATION OF APPURTENANCES						
Materials						
Air Vents		$2,000.00/EA	4	$4,236.21	$3,763.79	$8,000.00
HDPE Fittings		$1,000.00/EA	4	$2,118.10	$1,881.90	$4,000.00
Labor	#					
Senior Project Manager	1	$51.39/HR	40	$1,088.49	$967.11	$2,055.60
Backhoe Operator	1	$21.25/HR	40	$450.10	$399.90	$850.00
Truck Driver	1	$21.25/HR	40	$450.10	$399.90	$850.00
Specialized Labor	1	$21.25/HR	40	$450.10	$399.90	$850.00
Equipment	#					
Backhoe	1	$40.00/HR	40	$847.24	$752.76	$1,600.00
Delivery Truck	1	$40.00/HR	40	$847.24	$752.76	$1,600.00
Pick-up Truck	1	$12.00/HR	40	$254.17	$225.83	$480.00
Fusing Machine	1	$25.00/HR	40	$529.53	$470.47	$1,000.00
Other	#					
Backhoe Fuel	1	$3.50/Gal	800	$1,482.67	$1,317.33	$2,800.00
Delivery Truck Fuel	1	$3.50/Gal	800	$1,482.67	$1,317.33	$2,800.00
Pick-up Truck Fuel	1	$3.50/Gal	800	$1,482.67	$1,317.33	$2,800.00
SPLITTER BOX						
MOBILIZATION						
Materials	#					
Bond		1.50%	$34,472.45	$273.81	$243.28	$517.09
Labor	#					
General Contractor	1	$51.39/HR	5	$136.06	$120.89	$256.95
Senior Project Manager	1	$51.39/HR	5	$136.06	$120.89	$256.95
Truck Driver	1	$21.25/HR	5	$56.26	$49.99	$106.25
Equipment Operator	1	$21.25/HR	5	$56.26	$49.99	$106.25
Equipment	#					
Delivery Truck	1	$40.00/HR	5	$105.91	$94.09	$200.00
Delivery Truck Fuel	1	$3.50/Gal	100	$185.33	$164.67	$350.00
SITE PREPARATION						

Budget Item Description		Computation		Recipient	Reclamation	Total Cost
Labor	#					
Senior Project Manager	1	$51.39/HR	5	$136.06	$120.89	$256.95
Equipment Operator	1	$21.25/HR	5	$56.26	$49.99	$106.25
Truck Driver	1	$21.25/HR	5	$56.26	$49.99	$106.25
General Labor	2	$11.12/HR	5	$58.88	$52.32	$111.20
Equipment	#					
Front End Loader	1	$60.00/HR	5	$158.86	$141.14	$300.00
Hauling Truck	1	$40.00/HR	5	$105.91	$94.09	$200.00
Pick-up Truck	1	$12.00/HR	5	$31.77	$28.23	$60.00
Other	#					
Front End Loader Fuel	1	$3.50/Gal	100	$185.33	$164.67	$350.00
Hauling Truck Fuel	1	$3.50/Gal	100	$185.33	$164.67	$350.00
Pick-up Truck Fuel	1	$3.50/Gal	100	$185.33	$164.67	$350.00
CONCRETE BOX						
Materials						
Concrete		$130.00/CY	10	$688.38	$611.62	$1,300.00
Reinforcing Steel		$1.20/lb	1750	$1,112.00	$988.00	$2,100.00
Forms		$2.50/ft²	320	$423.62	$376.38	$800.00
Foundation Material		$6.50/Ton	2	$6.88	$6.12	$13.00
Headgate		$10,000.00/EA	2	$10,590.52	$9,409.48	$20,000.00
Labor	#					
Senior Project Manager	1	$51.39/HR	10	$272.12	$241.78	$513.90
Loader Operator	1	$21.25/HR	10	$112.52	$99.98	$212.50
Hauling Truck Driver	1	$21.25/HR	10	$112.52	$99.98	$212.50
Specialized Labor	3	$21.25/HR	10	$337.57	$299.93	$637.50
General Labor	2	$11.12/HR	10	$117.77	$104.63	$222.40
Equipment	#					
Pump Truck	1	$15.00/HR	10	$79.43	$70.57	$150.00
Front End Loader	1	$60.00/HR	10	$317.72	$282.28	$600.00
Hauling Truck	1	$40.00/HR	10	$211.81	$188.19	$400.00
Backhoe	1	$40.00/HR	10	$211.81	$188.19	$400.00
Skid Loader	1	$40.00/HR	10	$211.81	$188.19	$400.00
Pick-up Truck	1	$12.00/HR	10	$63.54	$56.46	$120.00
Other	#					
Front End Loader Fuel	1	$3.50/Gal	200	$370.67	$329.33	$700.00
Hauling Truck Fuel	2	$3.50/Gal	200	$741.34	$658.66	$1,400.00
Backhoe Fuel	1	$3.50/Gal	200	$370.67	$329.33	$700.00
Skid Loader Fuel	1	$3.50/Gal	200	$370.67	$329.33	$700.00
Pick-up Truck Fuel	1	$3.50/Gal	200	$370.67	$329.33	$700.00

Budget Item Description		Computation		Recipient	Reclamation	Total Cost
			HEADWORKS			
MOBILIZATION						
Materials	#					
Bond		1.50%	$22,787.25	$181.00	$160.81	$341.81
Labor	#					
General Contractor	1	$51.39/HR	5	$136.06	$120.89	$256.95
Senior Project Manager	1	$51.39/HR	5	$136.06	$120.89	$256.95
Truck Driver	1	$21.25/HR	5	$56.26	$49.99	$106.25
Equipment Operator	1	$21.25/HR	5	$56.26	$49.99	$106.25
Equipment	#					
Delivery Truck	1	$40.00/HR	5	$105.91	$94.09	$200.00
Delivery Truck Fuel	1	$3.50/Gal	100	$185.33	$164.67	$350.00
SITE PREPARATION						
Labor	#					
Senior Project Manager	1	$51.39/HR	5	$136.06	$120.89	$256.95
Equipment Operator	1	$21.25/HR	5	$56.26	$49.99	$106.25
Truck Driver	1	$21.25/HR	5	$56.26	$49.99	$106.25
General Labor	2	$11.12/HR	5	$58.88	$52.32	$111.20
Equipment	#					
Front End Loader	1	$60.00/HR	5	$158.86	$141.14	$300.00
Hauling Truck	1	$40.00/HR	5	$105.91	$94.09	$200.00
Pick-up Truck	1	$12.00/HR	5	$31.77	$28.23	$60.00
Other	#					
Front End Loader Fuel	1	$3.50/Gal	100	$185.33	$164.67	$350.00
Hauling Truck Fuel	1	$3.50/Gal	100	$185.33	$164.67	$350.00
Pick-up Truck Fuel	1	$3.50/Gal	100	$185.33	$164.67	$350.00
CONCRETE BOX						
Materials						
Concrete		$130.00/CY	6	$413.03	$366.97	$780.00
Reinforcing Steel		$1.20/lb	1050	$667.20	$592.80	$1,260.00
Forms		$2.50/ft²	192	$254.17	$225.83	$480.00
Foundation Material		$6.50/Ton	1.2	$4.13	$3.67	$7.80
Headgate		$10,000.00/each	1	$5,295.26	$4,704.74	$10,000.00
Labor	#					
Senior Project Manager	1	$51.39/HR	10	$272.12	$241.78	$513.90
Loader Operator	1	$21.25/HR	10	$112.52	$99.98	$212.50
Hauling Truck Driver	1	$21.25/HR	10	$112.52	$99.98	$212.50
Specialized Labor	3	$21.25/HR	10	$337.57	$299.93	$637.50
General Labor	2	$11.12/HR	10	$117.77	$104.63	$222.40

Budget Item Description		Computation		Recipient	Reclamation	Total Cost
Equipment	#					
Pump Truck	1	$15.00/HR	10	$79.43	$70.57	$150.00
Front End Loader	1	$60.00/HR	10	$317.72	$282.28	$600.00
Hauling Truck	1	$40.00/HR	10	$211.81	$188.19	$400.00
Backhoe	1	$40.00/HR	10	$211.81	$188.19	$400.00
Skid Loader	1	$40.00/HR	10	$211.81	$188.19	$400.00
Pick-up Truck	1	$12.00/HR	10	$63.54	$56.46	$120.00
Other	#					
Front End Loader Fuel	1	$3.50/Gal	200	$370.67	$329.33	$700.00
Hauling Truck Fuel	2	$3.50/Gal	200	$741.34	$658.66	$1,400.00
Backhoe Fuel	1	$3.50/Gal	200	$370.67	$329.33	$700.00
Skid Loader Fuel	1	$3.50/Gal	200	$370.67	$329.33	$700.00
Pick-up Truck Fuel	1	$3.50/Gal	200	$370.67	$329.33	$700.00
			OTHER			
ENVIRONMENTAL AND REGULATORY COMPLIANCE						
Dissipation Structure Environmental /Permits		$1,350.49	1	$715.12	$635.37	$1,350.49
Pipeline Environmental/Permits		$18,389.32	1	$9,737.63	$8,651.69	$18,389.32
Splitter Box Environmental/permits		$1,813.30	1	$960.19	$853.11	$1,813.30
Headworks Environmental/permits		$1,220.27	1	$646.16	$574.11	$1,220.27
OVERHEAD						
Legal/Dissipation Structure		$1,350.49	1	$715.12	$635.37	$1,350.49
Legal/Pipeline		$18,389.32	1	$9,737.63	$8,651.69	$18,389.32
Legal/Splitter Box		$1,813.30	1	$960.19	$853.11	$1,813.30
Legal/Headworks		$1,220.27	1	$646.16	$574.11	$1,220.27
REPORTING						
Engineer Reporting		$11,386.69	1	$6,029.55	$5,357.14	$11,386.69
Corporate Accountant Reporting		$11,386.69	1	$6,029.55	$5,357.14	$11,386.69
CONTINGENCY						
Outlet Structure	10%	$2,700.98	1	$1,430.24	$1,270.74	$2,700.98
Pipeline	10%	$36,778.64	1	$19,475.25	$17,303.39	$36,778.64
Splitter Box	10%	$3,626.59	1	$1,920.37	$1,706.22	$3,626.59
Headworks	10%	$2,440.55	1	$1,292.33	$1,148.22	$2,440.55
TOTAL DIRECT COSTS				**$337,654.58**	**$300,000.00**	**$637,654.58**
INDIRECT COSTS - _%						
TOTAL PROJECT COSTS				**$337,654.58**	**$300,000.00**	**$637,654.58**

Budget Narrative

a) Salaries and Wages

All salaries and wages will be listed within the Contractual area of the narrative.

b) Fringe Benefits

All fringe benefits are fixed provisional rates for billing.

c) Travel

No travel will be required.

d) Equipment

Equipment will be part of the contracted portion of the project.

e) Materials and Supplies

Materials and supplies will be part of the contracted portion of the project and will be documented as required.

f) Contractual

J-U-B Engineers, Inc. has been the consultant on this project, has written the grant, and will prepare the design and bid packages for all areas of the project. A breakdown of the consultant's project costs is below.

A contract will be awarded to a construction company to perform the work of constructing the diversion structure and pipeline. The contractual costs shown are estimates for each of the components to furnish and install all the supplies and equipment. Generally, the low bidder will be selected based on a determination of acceptable qualifications.

The following will participate in the design of the proposed WaterSMART project for the Moon Lake Water Users Association:

Design Engineering/Bidding

Tracy Allen, Project Manager (25 hrs)

Chris Thomsen, Project Engineer (63 hrs)

Austin Ball, Design Engineer (36 hrs)

Brad Perkins, Design Engineer (94 hrs)

Erick Christiansen, Drafting (72 hrs)

Jonathan Clarkson, Surveyor (23 hrs)

Construction Observation

Tracy Allen, Project Manager (32 hrs)

Chris Thomsen, Project Engineer (78 hrs)

Austin Ball, Design Engineer (13 hrs)

Brad Perkins, Design Engineer (61 hrs)

Scott Fletcher, Construction Observation (153 hrs)

Engineering Team Members Rates and Fringe Benefits

J-U-B Team Member	Project Manager	Project Engineer	Design Engineer 1	Design Engineer 2	Drafting	Survey	Const. Observer
Hourly Billing Rate	$192.09	$116.09	$110.02	$82.53	$66.00	$81.97	$90.32
Composite Direct Labor Rate	$58.21	$35.18	$33.34	$25.01	$20.00	$24.84	$27.37
Overhead	$30.81	$18.64	$17.67	$13.25	$10.60	$13.16	$14.51
Fringe Benefits	$36.25	$21.91	$20.76	$15.58	$12.46	$15.47	$17.05
Indirect Labor	$47.28	$28.58	$27.08	$20.31	$16.25	$20.18	$22.23

Contract Labor Estimates

Contract Labors	Senior Project Manager	General Contractor	Operator	Specialized Labor	Truck Driver	General Labor
Hourly Billing Rate	$35.25	$35.25	$26.71	$19.69	$14.80	$11.12
Fringe Benefits	$16.14	$16.14	12.71	5.40	6.45	.00
Total	$51.39	$51.39	$39.42	$25.09	$21.25	$11.12
Estimated Hours on the Job	265	25	330	114	265	193
	$13,618.35	$1,284.75	$13,008.60	$2,860.26	$5,631.25	$2,146.16

g) Environmental and Regulatory Compliance Costs

The amount for the environmental and regulatory compliance costs represents 10% of the project construction costs and is $42,858.22

h) Reporting

All reports will be done by the Project Engineer $21,429.12

i) Other

N/A

j) Indirect Costs

MLWUA does not have a federally approved indirect cost therefore no indirect cost will be taken.

k) Contingency Costs

A 10% contingency has been applied to the estimated construction contract costs.

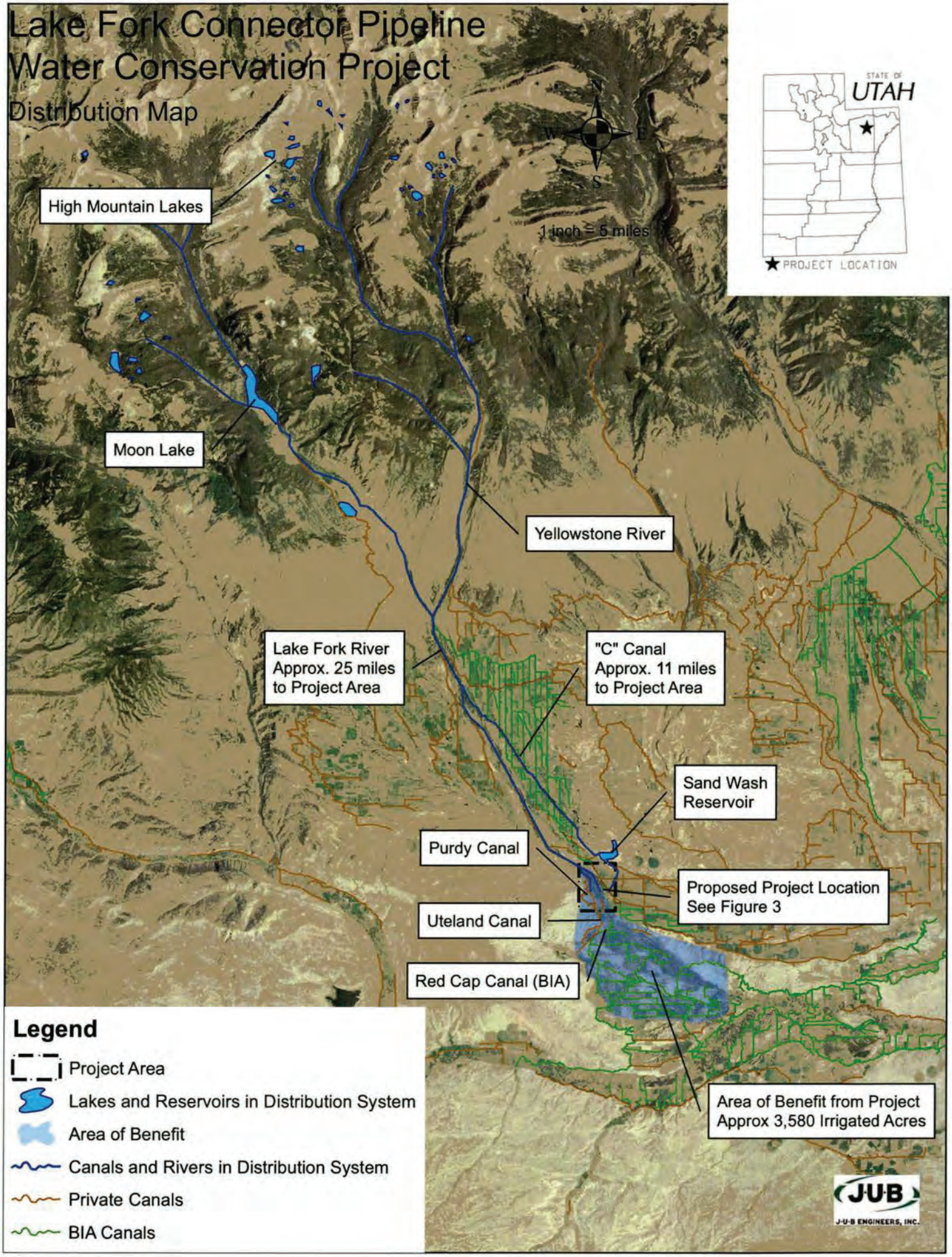
l) Total Cost

MLWUA	$337,654.58
Federal Share	$300,000.00
Total	$637,654.58

(4) Budget Form

Attachment A

Lake Fork Connector Pipeline
Water Conservation Project
Distribution Map



Attachment B

January 19, 2012

Bureau of Reclamation
Financial Assistance Services
Mail Code 84-27810
P.O. Box 25007
Denver, CO 80225

RE: Water and Energy Efficiency Grants for 2012
Moon Lake Water Users Association
Lakefork Connector Pipeline Project

Dear Sirs:

On behalf of the Uintah Indian Irrigation Project Operation and Maintenance Company, I wish to express our support as a partner for the above-referenced project. It is our responsibility to operate and maintain the canal system being benefited by this proposed pipeline project on behalf of the Uintah & Ouray Agency BIA Project Bureau of Indian Affairs. Our role in the proposed project as a partner will be to monitor construction in and around our canals and to provide construction inspection on the project where our canals are directly impacted.

The BIA's Red Cap Canal system is in the lower reaches of the Lake Fork drainage area and we anticipate a significant water conservation benefit to our canals through the completion of this project. By increasing the efficiency of delivery of water to our canal heading, Ute Tribe land being irrigated in this area will greatly benefit.

Sincerely,

Charles Hare

~~President~~ Sec.
Uintah Indian Irrigation Project Operation and Maintenance Company

Attachment C

Utah s Water Resources
Planning for the Future

May, 2001

STATE OF UTAH
NATURAL RESOURCES
Division of Water Resources

UTAH STATE WATER PLAN

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WATER TRANSFERS AND EFFICIENT MANAGEMENT OF DEVELOPED SUPPLIES

Using existing developed water supplies efficiently is an important element in successfully meeting Utah's future water needs. As competition for limited water supplies increases, the value of those supplies also increases. This economic incentive can lead to the outright transfer of water from one use to another, or it can encourage other water management strategies to be employed that maximize the benefits provided by existing uses. Accordingly, this chapter discusses agricultural water transfers as well as the following water management strategies: agricultural water-use efficiency, conjunctive use of surface and ground water, aquifer storage and recovery, secondary water systems, cooperative water operating agreements and water reuse.

> As competition for limited water supplies increases, the value of those supplies also increases. This competition provides an incentive to employ new management strategies that better utilize existing supplies.

Many areas in the state could experience increased benefits from their presently developed water supplies if they were to implement one or more of these management strategies. Where appropriate, state and federal agencies should promote these strategies by emphasizing them as alternatives to be explored in the planning stages of local projects.

AGRICULTURAL WATER TRANSFERS

Agriculture uses about 80 percent of the presently developed water supply.[1] Municipal and industrial (M&I) use account for the remaining developed water supply. Existing developed supplies for agriculture represent a significant source of water to meet future M&I demands, especially in basins where urbanization is replacing irrigated farmland.

The extent to which agricultural water will be converted to meet other needs depends on state agricultural policy, the proximity of growth to irrigated lands, and the relative value of the land and water to be exchanged. Another factor contributing to the extent to which such transfers will meet future needs is the amount of water that can actually be converted. Agricultural to M&I water transfers are typically not a one-to-one conversion, because the traditional use of agricultural water in the state is seasonal while M&I water use is year-round. Under these circumstances, it is difficult to predict to what extent future needs can be met by agricultural water transfers. Nevertheless, it is anticipated that these transfers will play a significant role in many areas of the state. To this end, this section discusses three forms of agricultural water transfers: land and water conversions, water rights sales and water leases.

Land and Water Conversions

As Utah's communities grow, this growth often occurs on adjacent irrigated agricultural land. This is especially true in the Greater Wasatch Area where nearly every city is constrained on one or more sides by geographical features such as mountains, rivers and lakes that prohibit development. The value of this adjacent agricultural land, and the water associated with it, has led to a growing trend of land and water conversions from agriculture to M&I.

When a piece of irrigated farm land changes from agriculture to urban use, the city may require the agricultural water rights associated with the land to be transferred to the municipality as a condition of approving the development. The amount of water required per acre of land for irrigated agriculture is about the same as the water required for urban development on the same acre.

Many municipalities in Utah follow this land and water conversion approach. Consequently, much of the increased water supply requirements brought on by growth in Utah can be satisfied by the conversion. However, in some areas, the quality of the water used for agriculture is such that its conversion to M&I use

may not be economically feasible. In these areas, other options will play a bigger role.

Water Rights Sales

Another common form of water transfer is a simple water right sale. Unlike a land and water conversion, a water right sale involves the transfer of a water right from one user to another, separate from any land use considerations. In agriculture, such a transfer requires retiring (taking out of production) agricultural lands and changing the place and purpose of the associated water rights.

Water rights sales take advantage of available mechanisms to legally move water from one area to another. Such transfers generally result in a shift of available water supplies from lower-valued to higher-valued uses, thus producing an increase in the economic value of the water.

One of the most visible water rights sale to ever take place in Utah occurred in the Delta area in 1981. In this transfer, California and Utah power suppliers purchased 20 percent of the water shares from the Delta, Melville, Abraham and Deseret Canal Companies, as well as the Central Utah Water Company, in the Lower Sevier River Basin. These power suppliers then used most of the water in the production of power at the Intermountain Power Plant, located north of Delta.

Water Leases

Another type of transfer is a conditional or "dry year" transfer. Conditional transfers are temporary water leases that are contingent upon certain conditions. Such transfers often have arrangements that define an "interruptible supply" that may periodically be used, under certain conditions such as a drought or other emergency, by another user.[2] Leasing irrigators' surface water rights was used extensively in California to stave off the effects of the 1987-1992 drought.

AGRICULTURAL WATER-USE EFFICIENCY

Since irrigated agriculture is the largest user of water in Utah, many have suggested that using water more efficiently in agriculture is the main solution to meeting future water needs. With the exception of water quality improvements, most benefits of agricultural water-use efficiency (increased stream flows, for instance) do not extend far beyond the farm. In fact, many agricultural water-use efficiency projects result in a net increase in water depletions to the system. This occurs because the water that is "saved" is often stored in upstream reservoirs, which allows it to be released to meet late-season shortages.

This section discusses the major benefits of agricultural water-use efficiency, investigates some of the complexities that must be carefully considered in order for an efficiency project to be successful, and explores some of the irrigation methods that can be employed to increase agricultural water-use efficiency.

The Benefits of Water-Use Efficiency

The two major benefits of agricultural water-use efficiency: (1) increased agricultural productivity and (2) improved water quality. In some instances, a third benefit of reduced stream diversion may also be realized. A short discussion of these benefits follows.

Increased Agricultural Productivity

Unless increasing the productivity of farms is a central focus of agriculture water-use efficiency, it will likely be difficult to gain the needed support of irrigators. Increasing agriculture productivity should be a high priority of any efficiency project. It could be argued that if a project failed to benefit the farmers who are expected to implement it, it has missed the boat.

Proper implementation of agriculture water-use efficiency typically provides increases in crop yields of 15 to 30 percent. Usually, irrigation system improvements first focus on the conveyance network, followed by on-farm improvements. A combination of both is necessary to achieve the higher yields. This process usually increases depletions and ultimately reduces the amount of return flow or ground water recharge.

Improved Water Quality

Improved irrigation efficiency can alleviate water quality problems. Reduced conveyance seepage losses will result in less salt pickup during subsurface transport. Reduced tailwater runoff (return flows) from irrigated fields will result in less soil erosion and fewer adsorbed phosphate fertilizer being transported to downstream water bodies. Reduced deep percolation losses below

the crop roots will also result in less transport of nitrate fertilizer to the ground water and less salt pickup.

Improving water quality in the Colorado River is the major impetus for ongoing agriculture water-use efficiency projects in the Upper Colorado River Basin. Many irrigated valleys in the Colorado River Basin are underlain by the highly saline Mancos Shale formation, from which many of the soils are derived. During the irrigation season, conveyance seepage losses and deep percolation losses move downward through the soil profile, then across the top of the Mancos Shale, all the time taking salts into solution before returning to the river channel downstream.

In the Uinta Basin and the Price-San Rafael areas (part of the Uintah and West Colorado River basin planning areas), sprinkle irrigation is being employed to decrease deep percolation losses as part of the Colorado River Salinity Control Program. Thus far, the Uinta Basin Unit's efficiency improvements have resulted in a salt load reduction to the Colorado River of over 100,000 tons per year. Overall irrigation efficiency has improved from 20-25 percent to about 65 percent. In the Price-San Rafael areas, the increased efficiency projects will also result in an increased depletion of at least 25,000 acre-feet per year.

Reduced Water Diversions

Reducing water diversions may be a benefit of agricultural water-use efficiency. Increased and better quality flows in streams contribute to the health of riparian and wetland ecosystems, as well as fish and wildlife; it may also free up water for other uses. However, for many irrigation systems, most of the water savings from on- and off-farm improvements will first result in satisfying any deficiencies in water to the immediate farmers and then to individual farmers downstream. As a consequence, the full benefits of reduced diversions often affect only nearby stream segments, and not the entire river system. This is especially true during the peak irrigation demand season (mid-June to mid-August), and also often late in the irrigation season when most farms in Utah suffer from a lack of a reliable supply.

Water Rights, Supply and Other Considerations

Water rights may often be the determining factor in determining the appropriateness of a water-use efficiency project. In a basin that is over-appropriated

Changing on-farm application of water from flood irrigation to pressurized sprinkler irrigation can greatly improve application efficiency.

(more paper water rights than actual supply), any water savings resulting from agricultural efficiency improvements are simply consumed by lower-priority water rights holders. Although this can result in increased agricultural productivity, it typically results in greater depletions, poorer water quality and reduced end-of-system stream flows.

Water-use efficiency can also disrupt the timing of water deliveries, and thus the storage of excess supplies, to downstream users. The Sevier River Basin is an example of a river system where it has been argued for years that improving agricultural water-use efficiency in one area of the basin may result in adverse impacts to other users by altering the timing of return flow. Irrigators in this basin rely heavily on a delicate balance of return flows and slow releases of deep percolation–the so-called "inefficiencies" of upstream irrigators–to supply downstream farms with adequate water.

Irrigation Efficiency Methods

Once the appropriateness of efficiency measures in an area is determined, actual implementation of these measures can proceed. A host of irrigation efficiency technologies exist, for almost any imaginable situation. Typical irrigation systems in Utah include storage reservoirs, conveyance through open canals or distribution piping, and on-farm application facilities and equipment. These systems can "lose" between 20 and 65 percent of the water diverted into them to seepage and evaporation, although losses are typically between 35

The combination of laser land-leveling and recent advances in surface irrigation provide a hydraulic performance comparable to sprinkle irrigation. (Photos of laser land-leveling equipment [above] and surface irrigation of a leveled field [below] courtesy of Wynn Walker, Utah State University.)

and 55 percent. Clearly, technology or management improvements can result in an increase of total system efficiency and a reduction in water loss.

The effectiveness of canal operations can be improved by moving from a fixed rotation schedule, which supplies water to irrigators at pre-specified times regardless of need, to an on-demand scheduling approach which supplies water when an irrigator requests. The amount of available storage dictates the degree to which on-demand scheduling can be implemented.

Automated canal operations, utilizing a network of water level and flow measurement devices as well as gate control mechanisms, provide the capability to monitor and manage entire irrigation systems through telemetry and computerized equipment. Remotely operated systems usually require considerable investments in technology and personnel, but can realize substantial improvements in water use efficiency for large irrigation systems.

Many on-farm application technologies also exist which have the potential to improve irrigation application efficiency. For example, pressurized irrigation can be employed, such as sprinkle irrigation (designed for 80 percent irrigation application efficiency) or trickle (drip) irrigation (designed for 95 percent application efficiency). The appropriateness of these methods depends upon local soils and topography, along with the farm economics of the crops to be grown.[3,4,5]

Other technologies, such as laser land-leveling and advances in surface irrigation hydraulics, make it possible for traditional surface (flood) irrigation to be just as efficient. Laser land-leveling results in practically no tailwater runoff (return flows) and greatly reduces deep percolation.

CONJUNCTIVE USE OF SURFACE AND GROUND WATER SUPPLIES

In areas where available water resources have been nearly fully developed, optimal beneficial use can be obtained by conjunctive use of surface water and ground water supplies. This involves carefully coordinating the storage, timing and delivery of both resources. Surface water is used to the fullest extent possible year round, while ground water is retained to meet demands when streamflows are low.[6] Generally, the total benefit from a conjunctively managed basin will exceed that of a basin wherein the resources are managed separately. Additional benefits of conjunctive use may include:[7]

- better management capabilities with less waste;
- greater flood control capabilities;
- greater control over surface reservoir releases; and
- more efficient operation of pump plants and other facilities.

In evaluating alternatives for conjunctive use, water managers should view ground water as more than a supplement to surface supplies. In particular, managers should assess the value of ground water in optimizing storage capacity, enhancing transmission capabilities, and improving water quality of the system.

Where infiltration basins are not feasible, pumps can be used to inject water directly into the receiving aquifer. In some cases, the same pumps can also be used to recover the storage.

AQUIFER STORAGE AND RECOVERY

Aquifer storage and recovery (ASR) is a form of conjunctive use where excess water is stored underground in a suitable aquifer and recovered later as needed. Some water utilities use ASR to store treated surface water during periods of low water demand, and provide the recovered water later to meet peak daily, short-term, or emergency demands.[8] Others may store it for use during periods of water deficits.

Many communities have found ASR systems to have numerous advantages; these include:[9]

< Enhanced reliability of existing water supplies as aquifer storage provides a back-up supply during emergencies such as chemical spills or broken pipelines.
< Increased flows in streams to support fish, riparian habitat and aesthetic purposes during periods of low summer flow.
< Decreased vulnerability to evaporation and contamination than is typical with a surface reservoir.

Unlike surface water storage, aquifer storage requires minimal structural elements. This is an attractive benefit considering the difficult political and environmental challenges facing many surface water storage projects. Aquifers are also much more efficient water transmission mechanisms. An aquifer has the ability to convey water from the point of recharge to any point of use near the aquifer without the extensive canals, piping and appurtenances required by surface water distribution systems. Aquifers also provide a water quality benefit since they have a natural ability to filter sediment and remove some biological contaminants.

Along with the difficulties of building surface storage, water supply costs are a driving force for implementation of ASR. Unit costs for ASR facilities generally range from about $200,000 to $600,000 per million gallons per day (mgd) of recovery capacity, with an overall average of about $400,000 per mgd (or $357 per acre-foot per year). This can be less than the cost of some other water supply alternatives. The Jordan Valley Water Conservancy District's ASR project (see sidebar) has experienced a unit cost near the average of $400,000 per mgd.

Although the advantages of conjunctive use and ASR are numerous, they may also have disadvantages. These include possible disruption of return flows and springs, damage to riparian and wetland vegetation, and possible

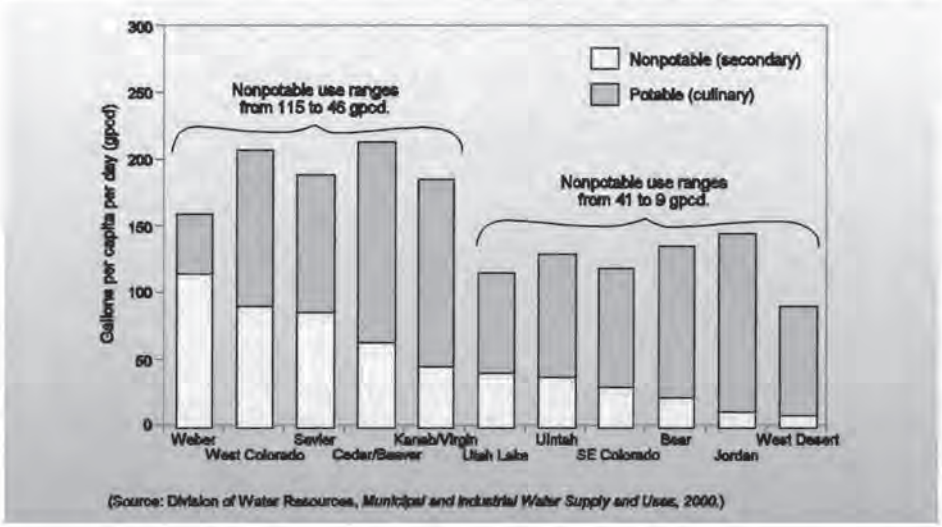
Aquifer Storage and Recovery Demonstration Project

The Jordan Valley Water Conservancy District (JVWCD) recently completed facilities for an artificial ground water storage and recovery project. Under the current operation of this project, which was built using federal funds through the Central Utah Project Completion Act Groundwater Program and local sources, JVWCD treats excess runoff from local streams and Deer Creek Reservoir, injects it into the semi-confined aquifer beneath the Salt Lake Valley from November thru May, and then recovers the injected water to satisfy late summer peak demands from July to September.

The average capacity of the 12 million dollar plus demonstration project is approximately 5,800 acre-feet per year. Because the State Engineer currently limits full recovery of water injected into the aquifer to the same year in which it was injected (any carry-over storage is subject to a 10% reduction each year it is stored in the aquifer), the options for long-term storage are presently limited. However, even with these restrictions the JVWCD could potentially store up to 33,000 acre-feet in the aquifer for future use. This water could then be used to mitigate the effects of drought and manage other common shortages.

This project allows JVWCD to capture high quality runoff that would otherwise go unused, increases the peak demand delivery capacity within Salt Lake County, and is a critical element in the effort to stabilize the declining ground water aquifer in the southeastern portion of the valley.

FIGURE 12
Residential Outdoor Water Use in Utah by Basin



(Source: Division of Water Resources, *Municipal and Industrial Water Supply and Uses, 2000.*)

cost increases. Water managers should fully investigate all aspects of proposed projects to avoid potential problems.

SECONDARY WATER SYSTEMS

A secondary (or dual) water system supplies nonpotable water for uses that do not have high water treatment requirements, such as residential landscape irrigation. A secondary system's major purpose is to reduce the overall cost of providing water by using cheaper, untreated water for irrigation and preserving higher quality water for drinking water uses.

Secondary systems are most suitable for areas where it is economically feasible to construct a separate distribution system in addition to the required potable (drinking) water system. Installing secondary systems is generally more feasible in rural areas or areas that are under development. This allows secondary lines to be installed at the same time as other infrastructure, greatly reducing costs and inconvenience to homeowners. The Weber River Basin has long recognized the value of secondary systems. Many communities within this basin require secondary systems be installed as a part of new development.

Although secondary systems do free up treated water supplies for drinking water purposes, it is important to recognize that they generally result in higher overall water use than a typical potable (culinary) water system. Figure 12 breaks down residential outdoor water use by basin into potable and nonpotable (secondary) components. As shown, the five basins with the highest overall per capita use are also the five basins with the highest residential outdoor per capita use of nonpotable water. This indicates that consumers use more water outdoors in basins where inexpensive unmetered secondary water is available than consumers in other basins. One way to deal with this over-use is to meter the water and charge according to an incentive pricing rate structure. Conventional meters plug up and wear out quickly on secondary systems. Filtering the water to a level where conventional meters will function properly or using a meter under development that can function in such condition should be considered.

COOPERATIVE WATER OPERATING AGREEMENTS

Temporary localized water shortages may occur as the result of system failures or as a result of growth that approaches the limits of the water system or supply. A cooperative approach to water resource and system management at the local and regional level can help water managers prevent shortages better and cope with them if they do occur. This is often accomplished without committing the large sums of money to capital expenditures for new supplies that would otherwise be required. In its simplest form, connections are installed between adjoining water systems and an agreement is made regarding the transfer of water between them.

Some of the many benefits to water suppliers who cooperatively operate their water systems at a local and regional level are:[10]

< Greater flexibility in meeting peak and emergency water demands.

- Better scheduling options associated with regular maintenance and repair programs.
- Decreased capital costs as construction of new projects can be delayed.
- Increased opportunities for joint improvement projects as cooperative relationships are formed and resources more fully utilized.

At an institutional level, the managers of the cooperating systems must agree on such things as water transfer strategies, plans for interconnections, water conservation enforcement policies and emergency management plans. Perhaps the most significant institutional challenge is to remove the psychological hurdle of taking water from one system and giving it to another. To do this, education of the public on the concept and benefits of a regional, cooperative approach to system management will often be necessary. The Utah Division of Drinking Water is working towards this goal by helping small local water systems consolidate their water treatment operations.

WATER REUSE

Water has always been used and reused (or recycled) by humans as a natural part of the hydrologic cycle. The return of wastewater to streams and rivers, and the reuse of these waters by downstream users, is not new. In this document, "water reuse" refers to the direct use of wastewater, which involves the application of some degree of treatment, and the planned use of the resulting effluent for a beneficial purpose.

Reuse Options

Many communities in the United States have safely and successfully used reclaimed wastewater for numerous purposes, including:

- Landscape irrigation: reclaimed sewage effluent can be used to irrigate parks, golf courses, highway medians and residential landscapes.
- Industrial process water: industrial facilities and power plants can use reclaimed water for cooling and other manufacturing processes.
- Wetlands: reclaimed water can be used to create, restore and enhance wetlands.
- Commercial toilet flushing: reclaimed water can be used to flush toilets in industrial and commercial buildings including hotels and motels.

Reuse in Utah

The *Utah Administrative Code*, Title R317-1-4, provides regulations that must be followed for reuse of treated wastewater. In addition to specifying water quality standards for certain types of reuse, state rules require anyone intending to reuse to provide:

- A description of the source, quantity, quality, and use of the treated wastewater to be delivered; the location of the reuse site; and how the requirements of this rule would be met.
- A description of the water rights for the use of the treated effluent, including evidence that the State Engineer has been notified and has agreed that the treatment entity has the right to use the water for the intended use.
- An operation and management plan that includes: a copy of the contract with the user, if other than the treatment entity; a labeling and separation plan for the prevention of cross connections between reclaimed water distribution lines and potable water lines; schedules for routine maintenance; a contingency plan for system failure or upsets; and a copy of the contract covering how the requirements of this rule will be met if the water will be delivered to another entity for distribution and use.

Table 11 contains a list of existing or proposed water reuse projects in Utah compiled by the Division of Water Quality. Most of these projects are type 2 reuse which do not involve potential contact with the general public. Type 1 reuse, which requires more stringent treatment due to potential human contact, is being used in Tooele for a broad range of uses and is proposed for use on a new golf course in the Salt Lake Valley. St. George is also considering type 1 reuse.

The appropriateness of any individual reuse project will depend upon the effect that it will have on existing water rights. Often, downstream users depend upon the wastewater effluent to satisfy their rights. The effects on downstream water rights need to be addressed as part of the feasibility of any reuse project.

Gray Water Reuse and Rainwater Harvesting

Gray water reuse is a form of water recycling that is often spoken of as a potential conservation measure. Gray water is typically what goes down the bathtub drain, bathroom sink or out of the washing machine.