

**26 Foot Drop Power Plant Turbine Runner Upgrade**

**Water and Energy Efficiency Grant Proposal  
Bureau of Reclamation WaterSMART**

**Submitted by: Truckee-Carson Irrigation District  
2666 Harrigan Rd  
Fallon, NV 89406**

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## Executive Summary

Applicant: Truckee-Carson Irrigation District

Address:

2666 Harrigan Rd  
Fallon, NV 89406

County: Churchill County

Truckee-Carson Irrigation District is a Category A applicant.

Truckee-Carson Irrigation District (TCID) has a contract with the Bureau of Reclamation to operate and maintain the Newlands Project and provide water to approximately 57,000 acres of irrigated land near Fallon, Nevada. TCID proposes to upgrade two turbine runners in their 26 Foot Drop Power Plant to improve system performance, generate more hydropower, and reduce operations and maintenance costs. The District will upgrade the existing fixed blade cast steel turbine runners to adjustable blade Kaplan style stainless steel runners with mechanical operating shafts which will allow the plant to start producing power at a flow of 80 cubic feet per second (cfs) instead of the current 150 cfs. The project is a top priority for the District and will increase the amount of renewable hydropower that can be produced by approximately 1,250,652 kWh annually and decrease annual operations and maintenance costs for the District.

Project construction would last about 5 months and would occur during the non-irrigation season from approximately November 2023 through March 2024.

The proposed project is not located on a federal facility. TCID owns the 26 Foot Drop Power Plant and the two generation units; Reclamation holds an easement to the land.

## Project Location

The 26 Foot Drop Power Plant is located on the V-line canal, 5.8 miles downstream to the east of Diversion Dam, and 1.58 miles west of state route 117 on Casey Road near Fallon, Nevada. The project latitude is {39°484488'N} and longitude is {118°903524'W}.

## Technical Project Description

*Provide a more comprehensive description of the technical aspects of your project, including the work to be accomplished and the approach to complete the work. This description should provide detailed information about the project including materials and equipment and the work to be conducted to complete the project. This section provides an opportunity for the applicant to provide a clear description of the technical nature of the project and to address any aspect of the project that reviewers may need additional information to understand.*

### **Project background**

Truckee-Carson Irrigation District (TCID or the District) is a political subdivision of the State of Nevada located in Northern Nevada. The District was formed in 1918 and has a contract with the Bureau of Reclamation (Reclamation) for the operation and maintenance of the Newlands Reclamation Project. The Newlands Project is one of the first Reclamation projects in the country, with construction beginning in 1903. TCID delivers water to approximately 57,000 acres of irrigated land in the Lahontan Valley.

The District owns and operates the 26 Foot Drop Power Plant within the Newlands Project. The 26 Foot Drop Power Plant was constructed in 1954 to regulate flows in the V-Line Canal and produce power revenue for the Newland's Reclamation Project. The District relies on the revenue produced by this power to offset the assessments imposed on the water users of the Newland's Project. Those water users include farmers, ranchers, the Fallon Paiute-Shoshone Tribe, the Nevada Department of Wildlife, U.S. Fish and Wildlife, the U.S. Navy, Churchill County, the City of Fernley, Lyon County, and others.

The 26 Foot Drop Power Plant is a run-of-the river power plant and has two vertical 500-kilowatt generation units that were installed in 1954. The plant was sized to regulate canal water flows down the V-Line Canal. The two General Electric generators produce approximately 3,270,000 kWh annually. The power plant is fed by two 108-inch diameter penstocks which directly feed each of the units. The two units discharge into a common tailrace which empties back into the V-Line Canal. The two generation units currently use fixed blade cast steel turbine runners that can operate from 150 cubic feet per second (cfs) to a maximum 310 cfs per unit. The plant generates electricity during the irrigation season, which typically begins in March and ends in mid-November.

### **Need for the project**

The current fixed blade turbine runners can only operate over a limited range of flows to generate power. The turbine runners cannot operate with less than 150 cfs, which means TCID

misses out on potential generation early in the season when less irrigation water is flowing through the canals. TCID would like to be able to operate the power plant at lower flows, which would allow the power plant to be started earlier in the irrigation season and generate more power over the duration of the season.

Operation and maintenance costs are also a challenge with the existing turbine runners. The current fixed blade turbine runners have been in operation since 1954 and are reaching the end of their useful life. Over time, operation of these runners creates cavitation damage to the runners as well as damage to the draft tube inside of the units. The turbine runner in each unit requires regular maintenance to stay in working order and prevent serious deterioration. On average, TCID must remove the runner in each unit every 3 to 4 years to repair the cavitation damage. The cost of repair for each unit is approximately \$12,000 per occurrence and this takes staff time away from other duties.

### **Proposed scope of work**

TCID proposes to upgrade both generation units from fixed blade cast steel runners to adjustable blade Kaplan stainless steel runners with mechanical operating shafts. This upgrade would allow TCID to operate the 26 Foot Drop Power Plant at a wider range of flows than is currently possible. The plant could start producing power at 80 cfs instead of the current minimum operating flow of 150 cfs. With the updated runners the District would be able to start up the generators earlier in the irrigation season. The Kaplan runners would also accommodate slightly higher maximum flows than the existing runners. The Kaplan runners could produce power up to 320 cfs whereas the current runners max out at 300 cfs. This upgrade will increase the amount of renewable energy the plant can produce by approximately 1,250,652 kWh annually. The estimated increase in power production was calculated by Far East Power, the engineering firm that is designing the turbine runners.

## **Project tasks**

Pre-construction activities include the following tasks:

### **Task 1. Order manufacture of Kaplan runners**

Description: TCID will contract with a qualified vendor to order and manufacturer two (2) appropriately sized Kaplan turbine runners and mechanical shafts. The turbine runners will have a manually adjustable blade mechanism to optimize efficiency over a range of flows. The vendor will design, engineer, and manufacture the following components:

- Runner with Stainless Steel Blades
- Turbine Shaft
- Mechanical Control Mechanism

### **Task 2. Complete NEPA and cultural resource requirements**

Description: TCID will work with Reclamation staff to evaluate the NEPA and cultural resource requirements of the project. Based on a June 2022 call with Reclamation staff at the Lahontan Basin Area Office, Reclamation indicated a Categorical Exclusion may be appropriate for the project given the scope of work, the limited construction footprint, and that the District has performed similar work in the past. Reclamation staff agreed that no other permits would be necessary to implement the project.

Construction activities would begin no later than November 15, 2023, and would be completed no later than March 1, 2024. All construction would take place outside of the irrigation season to avoid disruption of irrigation water deliveries and avoid disruption to power generation at the plant.

### **Task 3. Build access road and coffer dam below 26 Foot Drop Power Plant**

Description: Construction would begin at the end of the irrigation season by installing a coffer dam and access road below the 26 Foot Drop Power Plant. The coffer dam and access road are necessary to access the turbine units with the required equipment. The coffer dam is needed to dewater the area below the power plant because the canal never dries up due to the higher elevation downstream of the power plant. The coffer dam would enclose an area approximately 3 feet deep by 20 feet wide by 50 feet across the canal. Water would be pumped out and TCID would access the existing runners and shaft for removal. TCID would use the following major pieces of equipment: trucks, trailers, a loader, a long reach, and a pump.

**Task 4.** Remove old turbine runners and shafts

Description: TCID would remove the fixed blade cast steel turbine runners and the shafts in both generation units. The District has experience with this task as the turbine runners are currently removed every 3-4 years to repair cavitation damage.

**Task 5.** Inspect and repair any cavitation damage

Description: Once the old turbine runners are removed, TCID would perform an inspection of the draft tubes and turbine housings. TCID would repair cavitation damage as necessary. The District has experience with this task as this work is done every 3-4 years currently.

**Task 6.** Install 2 new Kaplan runners and shafts

Description: The District would use its qualified staff to install the new Kaplan turbine runners in each generation unit. The District would also install new turbine shafts, mechanical control mechanisms, and new bearings.

**Task 7.** Inspections and testing of new runners and shafts

Description: At the commencement of the irrigation season, testing and final adjustments would be performed on the runners to ensure they are operating as designed.

**Task 8.** Remove access road and coffer dam

Description: Once the new turbine runners are in place, TCID would remove the coffer dam and deconstruct the temporary access road.

**Task 9.** Prepare final reports

Description: TCID will prepare final reports and documentation of project outcomes.

## Evaluation Criteria

### Evaluation Criteria A. Quantifiable Water Savings (28 points)

Not applicable.

### Evaluation Criteria B. Renewable Energy (20 points)

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

**Describe the amount of energy capacity.** For projects that implement renewable energy systems, state the estimated amount of capacity (in kilowatts) of the system. Please provide sufficient detail supporting the stated estimate, including all calculations in support of the estimate.

The two General Electric generation units currently each have a capacity of 500 kW at a maximum flow of 300 cfs. By upgrading to the new Kaplan runners, the units will be able to operate at flows up to 320 cfs and as low as 80 cfs. Kaplan runners perform much better for partial flows than the existing fixed-blade runner. The adjustable blade mechanism allows the runner blade angle to be adjusted to match the optimal design according to each flow rate. This will increase the turbine efficiency substantially at partial flow compared to the existing fixed blade turbine runner.

The Kaplan runners will have a higher capacity across the entire range of flows that pass through the 26 Foot Drop Power Plant. The generation units will have a new capacity of up to 550 kW at a flow of 320 cfs, as estimated by Far East Power, the engineering firm that is designing the Kaplan runners. The chart below from Far East Power shows the flows and capacity in kW of the old runner versus new runner.

#### Expected Output of New Kaplan Runner with Manual Adjustable Blade Mechanism for 26 Foot Drop Power Plant Turbine Runner Upgrade

Flow (cfs)	320	300	280	260	240	220	200	180	160	140
Output for New Kaplan Runner (kW)	550	530	510	470	430	390	340	290	220	180
Output for Existing Runner (kW)	N/A	500	400	360	320	280	240	180	140	100

Estimate by Far East Power.



Attachment A provides methodology, results, and supporting calculations that were used to estimate the power capacity associated with the proposed Kaplan Runners over a range of flows that were estimated for the 2020 irrigation season.

***Describe the amount of energy generated.*** For projects that implement renewable energy systems, state the estimated amount of energy that the system will generate (in kilowatt hours per year). Please provide sufficient detail supporting the stated estimate, including all calculations in support of the estimate. Please explain how the power generated as a result of this project will be used, including any existing or planned agreements and infrastructure.

By upgrading to the Kaplan turbine runners, the generation efficiency of the two units at the 26 Foot Drop Power Plant will be greatly enhanced. The District would be able to produce power with the first unit beginning at a flow of 80 cfs instead of the current 150 cfs. The first unit would produce power up to a flow rate of 320 cfs. The second unit would begin producing power with flows at 400 cfs (320 cfs in the first unit plus 80 cfs in the second unit). The second unit would max out power production at a total flow of 640 cfs.

The proposed project will increase the amount of renewable energy the 26 Foot Drop Power Plant can produce by approximately 1,250,652 kWh annually. From July 2012 to June 2022, the median annual generation at the 26 Foot Drop Power Plant was 3,270,861 kWh. The details of the past generation at the power plant are attached for reference. TCID estimates that the Kaplan runners would provide a 38 percent increase in the amount of energy that the system can generate. This will create additional revenue for TCID, which will help the District accelerate other modernization projects to conserve water. The additional revenue will also offset annual assessments to the Newlands Project water users, keeping water rates affordable amid rising agricultural costs generally.

Attachment A provides the methodology, results, and supporting calculations that were used to estimate the energy generation associated with the proposed Kaplan Runners for the 2020 irrigation season.

***Describe any other benefits of the renewable energy project.*** Please describe and provide sufficient detail on any additional benefits expected to result from the renewable energy project, including:

- *How the system will combat/offset the impacts of climate change, including an expected reduction in greenhouse gas emissions*
- *Expected environmental benefits of the renewable energy system*

- *Any expected reduction in the use of energy currently supplied through a Reclamation project.*
- *Anticipated benefits to other sectors/entities.*
- *Expected water needs, if any, of the system.*

The District will sell the additional power generated by the project to Truckee Donner Public Utility District (PUD) under TCID’s existing power purchase agreement with the utility. Truckee Donner PUD purchases renewable energy from TCID to provide reliable, carbon-free, and affordable power to its customers. The project will allow Truckee Donner PUD to source more of its power from renewable energy, reducing reliance on carbon fuel sources that produce greenhouse gas emissions, and offsetting the impacts of climate change.

The increased production will also generate additional Renewable Energy Credits that will help the state of Nevada meet its Renewable Energy Portfolio Standard. The Nevada Renewable Portfolio Standard program requires that the state’s electric utilities derive at least 50% of the electricity they sell to retail customers from renewable energy resources by 2030 (NVTREC). Once the power generated from the 26 Foot Drop Plant is certified by NVTREC (Nevada Tracks Renewable Energy Credits), TCID transfers the Renewable Energy Credits to Nevada Gold Mines which provides additional revenue for TCID. The project will assist Nevada Gold Mines in meeting its portfolio standard requirements.

Installing new stainless steel turbine runners will also eliminate the need for periodically repairing cavitation damage to the draft tubes and turbine runners. By reducing the operation and maintenance needs at the power plant, TCID would drive fewer miles with its vehicles and use less fuel annually, reducing the District’s carbon footprint and offsetting impacts to climate change.

***Subcriterion No. B.2: Increasing Energy Efficiency in Water Management*** *Up to 10 points may be awarded for projects that address energy demands and reduce greenhouse gas emissions by retrofitting equipment to increase energy efficiency and/or through water conservation improvements that result in reduced pumping or diversions.*

The project will increase the energy efficiency of the turbine runners at the 26 Foot Drop Power Plant. The Kaplan runners can be manually adjusted to optimize generation efficiency at any given flow rate. This will increase the turbine efficiency at partial flow compared to the existing fixed blade turbine runner.

This upgrade will allow TCID to produce more renewable energy at the power plant and sell that energy to Truckee Donner Public Utility District. Providing more renewable energy to

Truckee Donner Public Utility District will reduce greenhouse gas emissions from the utility's electricity supply.

### Evaluation Criteria C. Sustainability Benefits (20 points)

*Up to 20 points may be awarded under this criterion. This criterion prioritizes projects that address a specific water and/or energy sustainability concern(s), including enhancing drought resilience, addressing the current and future impacts of climate change, and resolving water related conflicts in the region. In addition, this criterion is focused on the benefits associated with the project, including benefits to tribes, ecosystem benefits, and other benefits to water and/or energy supply sustainability.*

The project will utilize and enhance a renewable energy source to increase the energy supply sustainability of the Reclamation Newlands Project. The project will increase the amount of renewable energy generation from the 26 Foot Drop Power Plant by approximately 1,250,652 kWh annually.

The project would result in lower greenhouse gas emissions from both Truckee Donner PUD and TCID. Truckee Donner PUD would buy the additional renewable energy from the project to sell to their customers. This would reduce Truckee Donner PUD's reliance on carbon emitting sources of electricity and make their energy portfolio more climate change resilient. Based on the EPA Greenhouse Gas Equivalencies Calculator, the fossil fuel energy generation that would be avoided by the purchase of an additional 1,250,652 kwh produced by the project would be the equivalent of 886 metric tons of CO<sub>2</sub> that would no longer be emitted. Additionally, TCID would drive fewer miles with its vehicles and use less fuel annually, reducing the District's carbon footprint and offsetting impacts to climate change.

Upgrading the two generation units from the fixed blade runners to adjustable blade Kaplan stainless steel runners will also eliminate the need for the TCID to perform periodic cavitation repair and the associated operation and maintenance costs. On average, TCID must remove the runner blade in each unit every 3 to 4 years to repair the cavitation damage. By eliminating this repair, TCID would save approximately \$12,000 per repair and free up staff time to focus on operating the water delivery system and implementing other irrigation modernization projects.

*If the proposed project is providing benefits to a disadvantaged community, provide sufficient information to demonstrate that the community meets the disadvantaged community definition in Section 1015 of the Cooperative Watershed Act, which is defined as a community with an annual median household income that is less than 100 percent of the statewide annual median*

*household income for the State, or the applicable state criteria for determining disadvantaged status.*

The project is in Churchill County, Nevada and power generated from the project would serve area residents and businesses. The median household income in Churchill County (\$56,335) is less than the statewide median household income of Nevada (\$62,043) according to the U.S. Census Bureau's 2021 estimates, so the project would provide benefits to a disadvantaged community.

U.S. Census Bureau. Quick Facts. Accessed on July 20, 2022. Website:

<https://www.census.gov/quickfacts/fact/table/NV,churchillcountynevada,US/PST045221>

### Evaluation Criteria D. Complementing On-farm Irrigation Improvements (10 points)

Not applicable.

### Evaluation Criteria E. Planning and Implementation (8 points)

#### Subcriterion E.1— Project Planning

*Points may be awarded for proposals with planning efforts that provide support for the proposed project.*

*Does the applicant have a Water Conservation Plan and/or System Optimization Review (SOR) in place? Does the project address an adaptation strategy identified in a completed WaterSMART Basin Study? Please self-certify or provide copies of these plans where appropriate to verify that such a plan is in place. Including a specific excerpt or a link to the planning document may also be considered where appropriate.*

*Provide the following information regarding project planning:*

*(1) Identify any district-wide, or system-wide, planning that provides support for the proposed project. This could include a Water Conservation Plan, SOR, Drought Contingency Plan or other planning efforts done to determine the priority of this project in relation to other potential projects.*

*(2) Describe how the project conforms to and meets the goals of any applicable planning efforts and identify any aspect of the project that implements a feature of an existing water plan(s).*

*(3) If applicable, provide a detailed description of how a project is addressing an adaptation strategy specifically identified in a completed WaterSMART Basin Study or Water Management*

*Options Pilot (e.g., a strategy to mitigate the impacts of water shortages resulting from climate change, drought, increased demands, or other causes)*

TCID developed a District-wide strategic plan in 2020 that describes major goals in the next 5 years. These goal areas include improving facility reliability; maximizing the efficiency of water deliveries; maximizing efficiency of the Newlands Project; accurately measuring water deliveries; and diversifying the District's funding base. The strategic plan details objectives, barriers, and critical success factors for each goal. This project will assist in Goal E, diversifying TCID's funding base, by increasing revenue from hydropower production. The project will increase reliable annual revenue that will allow TCID to plan for future modernization of their system. Increasing revenue from hydropower will assist TCID in addressing their other goal areas on behalf of the Newlands Project.

TCID is also working with Farmers Conservation Alliance (FCA) to develop a System Improvement Plan to plan for future infrastructure modernization. The System Improvement Plan effort will include collecting technical data across the District's water delivery system such as water loss measurements and GIS data. TCID will work with FCA to develop and refine a priority project list and a funding strategy to implement projects. Increasing TCID's hydropower revenue and reliability through the 26 Foot Drop Power Plant Turbine Runner Project will be critical to implementing the System Improvement Plan.

## Subcriterion E.2— Readiness to Proceed

*Points may be awarded based upon the extent to which the proposed project is capable of proceeding upon entering into a financial assistance agreement. Please note, if your project is selected, responses provided in this section will be used to develop the scope of work that will be included in the financial assistance agreement.*

*Applications that include a detailed project implementation plan (e.g., estimated project schedule that shows the stages and duration of the proposed work, including major tasks, milestones, and dates) will receive the most points under this criterion.*

- *Identify and provide a summary description of the major tasks necessary to complete the project. Note: please do not repeat the more detailed technical project description provided in Section D.2.2.2. Application Content. This section should focus on a summary of the major tasks to be accomplished as part of the project.*
- *Describe any permits that will be required, along with the process for obtaining such permits.*

TCID has already invested time in planning for this project by researching and determining which type of turbine runner is the best fit given the net head and range of flows that pass through the 26 Foot Drop Power Plant. TCID reached out to several manufacturers who all recommended a Kaplan style runner for low head hydro such as the 26 Foot Drop. After determining that a Kaplan style turbine blade would be the most efficient for the project, TCID requested and received quotes from three qualified manufacturers for the turbine runners. Due to cost, TCID's preferred vendor is Far East Power. The District has experience working with Far East Power on upgrades to its Lahontan Power Plant. TCID is prepared to order the runners if a grant is awarded.

### **Project Schedule**

**Task 1.** Order the manufacture of Kaplan runners. Schedule: May-June 2023.

**Task 2.** Complete NEPA and cultural resource requirements in partnership with Reclamation staff at the Lahontan Basin Area Office. Schedule: June-October 2023.

**Task 3.** Build access road and coffer dam below 26 Foot Drop Power Plant. Schedule: November 2023.

**Task 4.** Remove old turbine runners and shafts. Schedule: December 2023.

**Task 5.** Inspect and repair any cavitation damage. Schedule: December 2023.

**Task 6.** Install 2 new Kaplan runners and shafts. Schedule: January-February 2024.

**Task 7.** Inspections and testing of new runners and shafts. Schedule: March 2024.

**Task 8.** Remove access road and coffer dam. Schedule: March 2024

**Task 9.** Prepare final reports. Schedule: March-April 2024.

Based on a June 2022 call with Reclamation staff at the Lahontan Basin Area Office, Reclamation indicated a Categorical Exclusion may be appropriate for the project given the scope of work, the limited construction footprint, and that the District has performed similar work in the past. Reclamation staff agreed that no other permits would be necessary to implement the project.

### **Evaluation Criteria F. Collaboration (6 points)**

*Up to 6 points may be awarded for projects that promote and encourage collaboration among parties in a way that helps increase the sustainability of the water supply.*

*Please describe how the project promotes and encourages collaboration. Consider the following:*

- Is there widespread support for the project? Please provide specific details regarding any support and/or partners involved in the project. What is the extent of their involvement in the process?*
- What is the significance of the collaboration/support?*
- Will this project increase the possibility/likelihood of future water conservation improvements by other water users?*
- Please attach any relevant supporting documents (e.g., letters of support or memorandum of understanding).*

The project is supported by Truckee Donner Public Utility District, which will purchase the additional renewable energy generated by the project from TCID. Please see the attached letter of support from Truckee Donner PUD.

The project will also benefit Nevada Gold Mines by providing them a source of additional Renewable Energy Credits (RECs). Additional RECs will help Nevada Gold Mines meet its requirements under the Nevada Renewable Energy Portfolio Standard.

There is also widespread support from water users in the Newlands Project to keep water assessment rates affordable. TCID delivers water to farmers, ranchers, the Fallon Paiute-Shoshone Tribe, the Nevada Department of Wildlife, U.S. Fish and Wildlife, the U.S. Navy, Churchill County, the City of Fernley, Lyon County, and others. Additional revenue for TCID to cover its costs means TCID can keep rates affordable for water users. The project will generate additional hydropower revenue that will help keep rates affordable and allow TCID to pursue additional modernization such as more meters, piping, and other water conservation efforts.

### **Evaluation Criteria G: Additional Non-Federal Funding (4 points)**

*Up to 4 points may be awarded to proposals that provide non-Federal funding in excess of 50 percent of the project costs.*

Not applicable, as TCID proposes to provide 50 percent of the total project costs for the project.

## Evaluation Criteria H: Nexus to Reclamation (4 points)

*Up to 4 points may be awarded if the proposed project is connected to a Reclamation project or Reclamation activity. No points will be awarded for proposals without connection to a Reclamation project or Reclamation activity.*

*Describe the nexus between the proposed project and a Reclamation project or Reclamation activity. Please consider:*

- Does the applicant have a water service, repayment, or operations and maintenance (O&M) contract with Reclamation?*
- If the applicant is not a Reclamation contractor, does the applicant receive Reclamation water through a Reclamation contractor or by any other contractual means?*
- Will the proposed work benefit a Reclamation project area or activity?*

TCID has had an operations and maintenance (O&M) contract with Reclamation since 1926 for the management of the Newlands Project. The Newlands Project is one of the first Reclamation projects in the country, and TCID delivers water to 57,000 acres on the Project. The proposed project will benefit water users of the Reclamation Newlands Project by enhancing hydropower production and offsetting annual repayments for project water. Those water users include farmers, ranchers, the Fallon Paiute-Shoshone Tribe, the Nevada Department of Wildlife, U.S. Fish and Wildlife, the U.S. Navy, Churchill County, the City of Fernley, Lyon County, and others.

The additional hydropower revenue from the project would allow the District to accelerate modernization of other parts of the Newlands Project such as lining and piping canals, installing automation controls, and installing meters and SCADA. Additional hydropower revenue from the project will be critical to achieving the District's goals to implement other water conservation projects across the Newlands Project.



## Performance Measures

*Provide a brief summary describing the performance measure that will be used to quantify actual benefits upon completion of the project (e.g., water saved or better managed, energy generated or saved). For more information calculating performance measure, see Appendix A: Benefit Quantification and Performance Measure Guidance.*

Performance Measure B: Projects with Renewable Energy Benefits – this measure applies to the proposed project.

- *Explain the methodology for calculating project hydropower capacity and generation benefits.*
- *Include an estimate of incremental hydropower capacity (measured in kilowatts) and annual generation (measured in kilowatt hours) resulting from the project.*
- *Describe what loads will be served by project hydropower generation.*

The project will increase the hydropower capacity and annual generation from the 26 Foot Drop Power Plant. TCID worked with Far East Power to estimate the change in capacity and annual generation from upgrading to Kaplan adjustable blade turbine runners. Far East Power estimated that each of the two generation units would increase capacity from 500 kW to 550 kW. The new Kaplan runners will be able to operate at flows up to 320 cfs and as low as 80 cfs, as compared to 300 cfs and 150 cfs with the current fixed blade runners. Please see Attachment A for the methodology, results, and supporting calculations that were used to estimate the power capacity and generation associated with the proposed Kaplan Runners.

TCID estimates that the higher capacity and expanded range of flows will increase average annual generation by approximately 1,250,652 kWh. TCID calculated the average annual generation at the 26 Foot Drop Power Plant from July 2012 to June 2022 and estimates the new Kaplan runners will increase generation by approximately 38 percent based on the new capacity.

## Project Budget

### Funding Plan

The total estimated cost of the project is \$259,882.00. TCID plans to provide 50 percent of the total project costs or \$129,941.00. TCID requests an equal amount from the WaterSMART program. TCID will provide this amount through a combination of in-kind labor for installation, \$34,605.35; in-kind use of construction equipment for installation, \$14,296.65; and District resources towards the new Kaplan turbine runners, \$81,039.00.

### Budget Proposal

BUDGET ITEM	HOURS	TOTAL COST
Personnel	310	\$22,811.70
Fringe Benefits	310	\$11,793.65
Travel		\$0
Equipment	345	\$161,276.65
Supplies		\$0
Contractual		\$64,000.00
Construction		\$0
Other		\$0
<b>TOTAL DIRECT COSTS</b>		<b>\$259,882.00</b>
<b>TOTAL INDIRECT COSTS</b>		<b>\$0</b>
<b>TOTAL ESTIMATED PROJECT COST</b>		<b>\$259,882.00</b>

## Budget Narrative

A description of costs based on the above budget is provided below.

### **Personnel; Cost: \$22,811.70**

TCID will pay three of its staff laborers (160 hours, \$13,841.60) and several equipment operators (70 hours, \$4,108.50) to install the Kaplan runners in both generation units. TCID will also pay its staff to conduct testing of the new system and rating curve development (80 hours, \$4,861.60).

### **Fringe Benefits; Cost: \$11,793.65**

This is the cost of benefits and overhead to TCID for the personnel to complete the project.

### **Travel; Cost: \$0**

There are not anticipated to be any costs associated with this cost category.

### **Equipment; Cost: \$161,276.65**

TCID will need to use multiple of its machines and vehicles to install the Kaplan runners at a cost of \$14,296.65. Equipment for the project will include a truck (80 hours, \$1,788.80), trailer (25 hours, \$306.25), loader (40 hours, \$3,508.80), long reach (40 hours, \$3,691.20), and pump to remove water from behind the coffer dam (160 hours, \$5,001.60). The fuel to operate the equipment will cost \$2,500.00.

TCID solicited and received three quotes for the manufacture of Kaplan turbine runners for the project. The District identified Far East Power as the preferred vendor and manufacturer of the Kaplan turbine runners based on cost. Far East Power has experience designing and manufacturing Kaplan turbines of the scale necessary for this project. Far East Power provided a quote to TCID in March 2022 for \$98,600 for each turbine runner; since 2 turbine runners are needed for the project, the quote was \$197,200 (this quote includes \$64,000 in engineering costs which are described under the contractual cost category). Materials would come from China and would cost \$80,000.00. This includes 2 runners with stainless steel blades; 2 turbine shafts; and 2 mechanical control mechanisms. Freight, insurance, and duty for these materials would cost \$53,200.00. The project will also require 2 new sets of bearings for the Kaplan runners, at a cost of \$11,280.00.

### **Supplies; Cost: \$0**

### **Contractual; Cost: \$64,000.00**

In addition to sourcing the materials for the project, Far East Power will provide engineering, field support, and project management services to TCID. Far East Power has experience designing and supporting the installation of Kaplan turbines.

**Construction; Cost: \$0**

**Other; Cost: \$0**

There are not anticipated to be any costs associated with this cost category.

**Total Direct Costs: \$259,882.00**

**Indirect Costs: \$0**

**Total Project Costs: \$259,882.00**

### Buy America Waiver

If selected for an award, TCID anticipates requesting a waiver for the Buy America Act requirements based on the unreasonable cost of sourcing domestic materials for the project.

TCID solicited and received three quotes for the manufacture of Kaplan turbine runners for the project. Two of the quotes were from American manufacturers and one was from Far East Power, which would source the manufactured materials from China. The three quotes are attached to this application for reference. The quotes from the American manufacturers were significantly more expensive than the quote from Far East Power.

- Far East Power provided a quote on March 29, 2022, of \$98,600 for each turbine runner. Since two (2) Kaplan runners are required for the project, the total manufactured cost would be \$197,200.
- Norcan Hydraulic Turbine Inc. provided a quote on June 27, 2022, of \$380,000 for each turbine runner, for a total manufactured cost of \$760,000. This quote is cost prohibitive for TCID.
- American Hydro provided a quote on July 1, 2022, of \$1,300,000 for each turbine runner, for a total manufactured cost of \$2.6 million. This quote is cost prohibitive for TCID.

TCID would request an unreasonable cost waiver because the quotes from American Hydro and Norcan Hydraulic Turbine Inc. would increase the total cost of the project by much more than 25 percent, the threshold in the Buy America Act. Using materials from Norcan Hydraulic

Turbine Inc. would make the project 3.8 times more expensive compared to materials from Far East Power. Using materials from American Hydro would make the project 13 times more expensive compared to materials from Far East Power.

If TCID cannot obtain a Buy America Waiver for the project, the project is unlikely to be constructed and achieve the renewable energy benefits due to the unreasonable cost of American manufactured materials. TCID would need to find a different, non-federal funding source to invest in the project.

## Environmental and Cultural Resources Compliance

On June 23, 2022, Farmers Conservation Alliance staff, who are assisting TCID with modernization efforts, had a call with Reclamation staff at the Lahontan Basin Area Office about the proposed project. Reclamation staff indicated a Categorical Exclusion would likely be appropriate for the project given the scope of work, the limited construction footprint, and that the District has performed similar work in the past. Reclamation staff on the call thought that the dirt moving for the temporary road would be covered by a Categorical Exclusion given that it was previously disturbed and moved for past maintenance work. Reclamation staff did say that if a coffer dam is necessary for installation, a hydraulic analysis may be necessary to confirm the coffer dam would not inhibit downstream flow in the canal system. Reclamation staff agreed that no other permits would be necessary to implement the project.

TCID will work with staff at the Lahontan Basin Area Office to confirm these requirements comply with NEPA and Section 106 of the National Historic Preservation Act.

Attachment A: Power Capacity and Energy Generation  
Methodologies and Sample Calculations for the Proposed Kaplan  
Runners

## Methodology for Proposed Kaplan Runner Power Capacity

This section provides the methodology that was used to estimate the power capacity of the proposed upgraded turbines with the Kaplan Runners. Hydroelectric power plant capacity is a function of discharge, the net head across the turbine (or differential pressure), and the operating efficiency, commonly known as water-to-wire efficiency, as demonstrated in Equation 1. The net head of both proposed turbines is 26 feet.

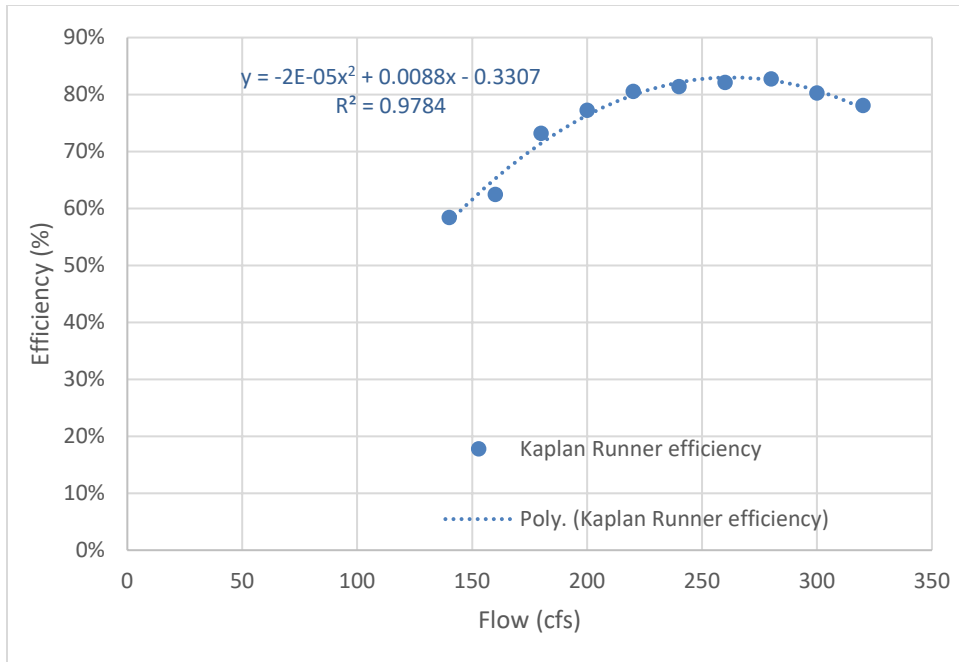
$$P_K = \frac{\eta Q_{E \text{ or } K} H_{net}}{11.82}$$

*Equation 1*

Where:

- $P_K$  = Power generated from the two turbines associated with the Proposed Kaplan Runner in kW
- $\eta$  = Operating efficiency of the two Proposed Upgraded Kaplan Turbines (a fraction)
- $Q_K$  = Discharge through each of two Proposed Upgraded Kaplan Turbines cfs
- $H_{net}$  = The net head across the turbines at the 26-Foot Drop Hydropower Facility in ft

The overall efficiency for the Kaplan runner turbines were estimated based on the Table provided by Far East Power as shown in Evaluation Criteria Section B of the grant application and vary based on flow. Figure 1 presents the trendlines used to estimate turbine efficiencies for the Existing Fixed Blade Runner and Proposed Kaplan Runner turbines.



**Figure 1. 26-Foot Drop Hydropower Facility Proposed Kaplan Runner Turbine Efficiencies over a Range of Flow.**

### Methodology for the Proposed Kaplan Runner Energy Generation

The annual energy generation was estimated for the two turbines with the proposed Kaplan runners by using the estimated power capacity and estimated flows provided by the District over the irrigation season in 2020. It was assumed that no energy was generated when flows were less than 80 cfs and the second turbine would not generate energy until the flows exceeded 400 cfs. To estimate the total annual energy generation for the Kaplan Runners, the energy generation from each day when the turbine operates was summed over the irrigation season.



## Estimated Proposed Kaplan Runner Power Capacities and Energy Generation

The following Table 1 presents the power capacity and energy generation estimated over the 2020 irrigation season for the Proposed Kaplan Runners.

**Table 1. 26-Foot Drop Hydropower Facility Proposed Kaplan Runner Power Capacity and Energy Generation Estimated Over the 2020 Irrigation Season.**

Date Range	Estimated Minimum Flow (cfs)	1st Turbine Flow (cfs)	2nd Turbine Flow (cfs)	1st Turbine Efficiency	2nd Turbine Efficiency	Turbine 1 Power Capacity (kW)	Turbine 2 Power Capacity (kW)	Energy Generation (kWh)
3/1 to 3/14	80	80	0	26.67%	0.00%	47	0	16,912
3/15 to 4/10	225	225	0	79.50%	0.00%	394	0	264,624
4/10 to 4/16	450	320	130	75.35%	52.96%	531	152	131,018
4/17 to 4/22	460	320	140	75.35%	57.20%	531	176	101,823
4/23 to 5/8	520	320	200	75.35%	75.49%	531	332	352,181
5/9 to 5/13	550	320	230	75.35%	80.04%	531	405	134,799
5/14 to 5/19	620	320	300	75.35%	78.77%	531	520	176,576
5/20 to 6/1	450	320	130	75.35%	52.96%	531	152	229,281
6/2 to 7/1	520	320	200	75.35%	75.49%	531	332	642,213
7/2 to 7/10	450	320	130	75.35%	52.96%	531	152	163,772
7/11 to 7/21	555	320	235	75.35%	80.51%	531	417	272,824
7/22 to 8/1	520	320	200	75.35%	75.49%	531	332	248,599
8/2 to 8/10	500	320	180	75.35%	70.75%	531	280	194,684
8/11 to 8/20	520	320	200	75.35%	75.49%	531	332	227,882
8/21 to 8/30	640	320	320	75.35%	75.35%	531	531	280,264
9/1 to 9/18	560	320	240	75.35%	80.88%	531	427	436,919
9/19 to 10/25	450	320	130	75.35%	52.96%	531	152	622,335
10/26 to 11/15	80	80	0	26.67%	0.00%	47	0	24,805
<b>Total 2020 Annual Energy Generation:</b>								<b>4,521,513</b>

### Sample Calculations for Proposed Kaplan Runner Power Capacities

The following set of calculations were used to determine the power capacity of the Proposed Kaplan Runner assuming the estimated 225 cfs from 3/15/20 to 4/10/20. In this sample calculation the power capacity of the second turbine would be zero because flows were less than 380 cfs.

$$P_K = \frac{79.5\% * 225 \text{ cfs} * 26 \text{ ft}}{11.81}$$

$$P_K = 394 \text{ kW}$$

### Sample Calculations Proposed Kaplan Runner Energy Generation

The following are calculations used to determine the energy generation for the Proposed Kaplan Runner assuming a power capacity of 394 kW from 3/15/20 to 4/10/20.

$$E_K = 394 \text{ kW} * 24 \text{ hrs} * 28 \text{ days}$$

$$E_k = 264,624 \text{ kWh}$$