

**COLORADO RIVER RECOVERY PROGRAM  
FY-2020-2021 PROPOSED SCOPE OF WORK for:**

Project No.: 179

Operation and maintenance of passive interrogation arrays in the Upper Colorado River Basin

Submitted by:

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Category:

- Ongoing project
- Ongoing-revised project
- Requested new project
- Unsolicited proposal

Expected Funding Source:

- Annual funds
- Capital funds
- Other (explain)

I. Title of Proposal: Operation and maintenance of passive interrogation arrays in the Upper Colorado River Basin

II. Relationship to RIPRAP:

General Action Plan:

V.A Measure and document population and habitat parameters to determine status and biological response to recovery actions.

V.A.1.a Develop basinwide razorback monitoring program (implementation to be reflected in sub-basin worksheets).

V.A.1.a.(2) Investigate improving recapture rates through passive PIT tag monitoring, nets, etc. to improve population abundance estimates.

V.A.3. Collect and submit data according to standard protocol (e.g., location, PIT tag #, length, weight, etc.) on endangered fish encountered in all field activities in order to provide annual information on population status outside of formal population estimates.

V.D Establish sampling procedures to minimize adverse impacts to endangered fishes.

V.F Assess relative biological importance of tributaries and their potential contributions to endangered fish recovery.

## Green River Action Plan

II. Restore habitat

II.B.2 Screen Tusher Wash diversion to prevent endangered fish entrainment.

II.B.2.b Design.

V. Research and Monitoring

V.A Conduct research to acquire life history information and enhance scientific techniques required to complete recovery actions.

V.A.2 Identify additional razorback sucker spawning areas in lower Green.

V.C Conduct population estimate for Colorado pikeminnow. Sampling is conducted for 3 years, followed by no sampling for 2 years.

## White River Action Plan.

V. Research and Monitoring

V.A Conduct research to acquire life history information and enhance scientific techniques required to complete recovery actions.

## Colorado River Action Plan

II Restore Habitat

II.B.2 Restore fish passage at Price Stubb.

II.B.2.a.(5) Monitor and evaluate success.

V. Research and Monitoring

V.A Conduct research to acquire life history information and enhance scientific techniques required to complete recovery actions.

## Dolore River Action Plan.

V. Research and Monitoring  
V.A Survey native and nonnative fish in Dolores River

III. Study Background/Rationale and Hypotheses:

Over the last decade, Reclamation and various partners working through the Upper Colorado River Endangered Fish Recovery Program (Recovery Program) have installed a number of passive interrogation arrays (PIAs) throughout the river basin and have also utilized other Passive Integrated Transponder (PIT) tag detection equipment (floating antennas, portable submersible antennas) to explore a variety of questions about endangered fish life history and population dynamics. Passive interrogation arrays function by using stationary antennas which scan the overlaying water column for the presence of fish containing PIT tags. PIT tags are tiny transponder tags implanted into the body cavity of the fish by various fisheries agencies and return a unique alphanumeric code when activated by radio frequency identification (RFID) scanners.

In addition to PIAs and other automated PIT monitoring equipment, the Recovery Program also relies on PIT technology to manually mark individual endangered fish, recapture of which over the years has yielded substantial information on fish growth, movement, population size and survival. Hatchery reared bonytail *Gila elegans* and razorback sucker *Xyrauchen texanus* are injected with PIT tags prior to stocking. Field investigators employ manually operated PIT scanners, chargers, data loggers, PIT tags themselves, and tagging guns or syringes to mark fish of wild origin during various Recovery Program fish sampling projects.

Operation and maintenance (O/M), repair, upgrade and replacement of existing Upper Basin PIT facilities and creation of new facilities have for the most part not been regularly included in the Recovery Program work plans and budgeting processes. Historically, funding for installation and operation/maintenance (O/M) of Upper Basin PIAs has been provided by Reclamation, the Recovery Program and other partners (Utah Division of Wildlife, Colorado Parks and Wildlife) on a mostly opportunistic basis. As a result, O/M of Upper Basin facilities has also been performed on a somewhat opportunistic basis, and there is currently a need for more consistent funding and scheduling of O/M activities to consistently support these systems. Purchase of PIT tags and associated tagging and scanning equipment has historically taken place with Recovery Program funds, but has generally not been an itemized feature of the annual workplan for technical committee review, nor has there been a standardized schedule for determining requirements for a given year.

While PIAs and other equipment, in theory, generate little operation and maintenance costs when compared to those associated with active capture methods (boat- or raft-based mark/recapture surveys), exposure to extreme hydrologic and meteorological conditions in the desert Southwest nevertheless lead to unanticipated and non-trivial costs for repairs and component replacement; in-addition, expected upgrade and replacement costs for electronic and communication equipment is important to consider. Likewise, equipment used in marking and scanning

individual fish for presence of PIT tags eventually wears out, breaks or gets lost, making periodic replacement a necessity. PIT tags for tens of thousands of hatchery-reared fish are also required on an annual basis.

#### IV. Study Goals, Objectives, End Product:

Goal: The goals of this scope-of-work (SOW) are 1) to maximize continuity and performance of PIA operations by performing routine annual operation, maintenance, repair, and replacement activities and 2) provide Recovery Program investigators and hatchery staff with PIT tags and related tagging and scanning equipment for use on an annual basis.

#### Objectives:

- 1) Conduct routine remote monitoring and troubleshooting of PIA performance
- 2) Conduct site visits as needed to repair equipment, activate, power-up, troubleshoot and tune-up systems, and power down systems for winter months, if applicable.
- 3) Maintain cell and/or satellite connectivity with remote PIAs
- 4) Upgrade existing communication systems to allow more efficient downloads and possible cost savings.
- 5) Work with STReaMS database managers to ensure efficient downloading of data and to ensure all metadata is accurate and up to date.
- 6) Identify PIT tag and related equipment needs; procure and distribute those supplies and equipment as needed.

#### End Products:

- 1) Operational PIAs with minimal down-time thanks to routine preventative maintenance and repairs.
- 2) Notification to Recovery Program on needed repairs in a timely fashion.
- 3) Upgraded PIA communication systems (as needed).
- 4) Annual reports on a) PIA operation and maintenance activities; and b) summarization of detection data from PIAs
- 5) Adequate stores of PIT tags and related tagging and scanning equipment for use by hatchery and field staff throughout the year.

#### V. Study area

##### **PIA operation and maintenance**

Most PIAs currently in operation in the Upper Basin consist of the following components: 1) PIT-detecting antennas (either pass-through or pass-by types) affixed to streambeds or fish infrastructure such as passages and screens; 2) master controllers or multiplexers which actuate PIT transceivers housed within the antenna panels; 3) data loggers and communications with remote computers facilitated by cell or satellite modems; and 4) a power source which is most

commonly battery banks kept charged by solar panels or in some cases AC line voltage. These facilities are often located in remote areas and may require significant effort to access on occasion.

Additionally, the Green River Canal and Tusher Wash fish barrier PIAs currently have subscriptions to BioLogic®, which is a web interface service provided by Biomark which affords a range of services directly to end users (i.e., STReaMS need not be consulted to view information directly). End users interested in specific BioLogic®-monitored PIAs can monitor system diagnostics and receive system performance reports, receive reports of tagged fish and specific tag numbers, download data directly, and add upgrades as they become available which will increase data retrieval capabilities.

The following facilities currently operate in the Upper Colorado River Basin and will require operation and maintenance support in the coming years:

- 1) Colorado River: Price Stubb Diversion Dam fish passage. This facility consists of a multiplexer running two pass-through antenna subarrays, with two antennas per sub array, on a head gate structure at the top of the Price-Stubb fish passage located at river mile (RM) 188.3 left (L) on the Colorado River near Palisade, CO. The system has been operational since 2010 and has detected 2,597 individual PIT tags as of December 2018. The detection system is powered by solar-charged batteries, and data is transmitted via cell modem, however the latter must be upgraded from 3G to 4G by the end of calendar year 2019, and a BioLogic® subscription is recommended for improved communications with end users.
- 2) Dolores River (Utah): This facility is located at the Rio Mesa Center (aka Entrada Ranch) on the Dolores River about eight miles upstream from the Colorado River in southeastern Utah. The system consists of a Master Controller running two pass-by antenna subarrays (five 20' antenna panels in each) which span the channel width. It has detected 1,067 individual PIT tags since it became operational in 2013. The detection system is powered by solar charged batteries and data is transmitted via Iridium satellite modem at a cost of about \$50-\$70 per month. The latter configuration does not communicate directly with STReaMS and should be upgraded to include a BioLogic® subscription and Biomark satellite service.
- 3) Green River:
  1. Green River Canal fish screen. The Green River Canal originates at RM 127.8 R near the town of Green River, Utah. Since 2013, entrainment of PIT-tagged fish in the Green River canal was monitored by two pass-through style antenna subarrays, but these were decommissioned when construction on a new fish screen began in November 2018. The new facility will be equipped with a Master Controller running 3 pass-through antenna subarrays (2 antennas each) which will monitor PIT-tagged fish entering the fish screen facility, fish which are returned to the Green River and any fish which are able to bypass the screen and enter the canal. The detection system will be powered through a battery switcher system which is charged by AC power. Data will be transmitted by cell modem. This system currently includes a 5

- year subscription to BioLogic®.
2. Tusher Wash Diversion dam and fish passages. The Tusher Wash Diversion is located about a quarter mile upstream from the Green River Canal head gates and was renovated in 2016 to include fish and boat passages. PIAs were installed and became operational in May 2016 and consists of a Master Controller and several pass-by and pass-through antennas affixed to various features of the diversion dam that would likely to be used by fish (downstream passage notches, boat passage, fish passage, waterwheel structure). To date, antennas on this facility have collectively detected 4,059 unique individual fish. The detection system is powered directly by AC power and data is transmitted via cell modem. The system currently has a BioLogic® subscription that will need to be renewed beginning in FY2020.
  - 4) San Rafael River near Chaffin Ranch: This facility is located at Chaffin Ranch not far from the confluence of the Green and San Rafael rivers (RM 97.0) in southcentral Utah; a second PIA located near Hatt Ranch (State Highway 24) operated from 2009 through 2016 but no longer exists. The Chaffin Ranch PIA consists of a Multiplexer running two pass-by antenna subarrays (two 10' antenna panels each). Taken together, Chaffin Ranch and Hatt Ranch PIAs have detected 3,237 unique PIT tags since 2009. The detection system is powered by solar charged batteries and data is transmitted via cell modem. Currently, the Utah Division of Wildlife covers most communication costs for this site, however support for operation and maintenance is still needed.
  - 5) Price River: Three PIAs currently operate on the Price River in southcentral Utah, one about a mile upstream from the Green River (RM 138.1), one near Woodside and one near Wellington. The confluence and Woodside PIAs have detected a total of 464 individual PIT tags since 2011; both facilities were damaged beyond repair by flash floods in 2016 but were replaced in 2018. The Mounds PIA was also installed in 2018. The new confluence system consists of a Master controller running 2 sub-arrays (two 10' antenna panels each). The detection system is powered by solar charged batteries and data is transmitted via Hughes Net satellite modem. The new Woodside system consists of a Master controller running 2 sub-arrays (one 20' antenna panel each). The detection system is powered by solar charged batteries and data is transmitted via cell modem. The Mounds system consists of a Master controller running 2 sub-arrays (two 15' antenna panels each). The detection system is powered by solar charged batteries and data is transmitted via cell modem; all PIAs in the Price River currently have BioLogic® subscriptions. Currently, the Utah Division of Wildlife covers most communication costs for these sites, but support for operation and maintenance is still required.
  - 6) White River at Bonanza Bridge: This system is located just downstream of the Bonanza Bridge over the White River (State Highway 45) in northeastern Utah. It consists of a Multiplexer running a single antenna sub-array comprised of six, 20' antenna panels. The Bonanza Bridge PIA has detected 6,207 individual tags since 2012. The detection system is powered by solar charged batteries and data is transmitted via cell modem, however the latter should be upgraded from 3G to 4G by the end of calendar year 2019; BioLogic® subscription is recommended for improved communications with end users.

Additionally, numerous portable submersible PIT scanners (“submersibles” or “wagon wheels”)

are deployed during the spring-fall sampling season at a range of river locations. These units and/or their power sources and download equipment may also periodically require maintenance, although site visits are likely not necessary for this. Submersibles have been employed to identify sites of spawning activities, collect additional resight data to improve population and survival estimates, monitor fish use of tributaries, and other monitoring purposes in discrete areas. Examples of submersible deployment include monitoring of Colorado pikeminnow spawning movements in Yampa Canyon, use of Vermillion Creek (CO) by Colorado pikeminnow, Colorado pikeminnow spawning below Split Mountain (UT), humpback chub population estimates (Black Rocks, Westwater, Desolation/Gray canyons), razorback sucker spawning near Jensen UT, and other locations.

### **PIT tags and related tagging and scanning equipment**

PIT tags and equipment are utilized for marking and identifying individual hatchery-reared fish (mostly bonytail and razorback sucker at present, plus broodstock of humpback chub *Gila cypha* and Colorado pikeminnow *Ptychocheilus lucius*) as well as wild specimens captured during field investigations. Fish hatcheries which supply propagated endangered fish for stocking according to Recovery Program stocking plans include:

Ouray National Fish Hatchery, U.S. Fish and Wildlife Service (USFWS): Grand Valley Unit (Grand Junction, CO) and Randlett Unit (Ouray National Wildlife Refuge, Ouray, UT).

Wahweap State Fish Hatchery, Utah Division of Wildlife Resources (UDWR), Wahweap, UT.

J. W. Mumma Native Aquatic Species Restoration Facility, Colorado Division of Parks and Wildlife (CPW), Alamosa, CO.

In most cases, field investigators are directed to implant all captured endangered fish individuals with PIT tags, regardless of the objective of the field investigation which include mostly mechanical removal of non-native fish and abundance estimates of endangered fish. These investigations take place throughout the Upper Colorado River Basin, including large portions of the Colorado, Gunnison, Dolores, Green, White, and Yampa rivers. Submersible antennas are also typically deployed and retrieved at ca. two-week intervals during abundance estimation or surveys of spawning activity throughout the Upper Colorado River Basin.

## VI. Study Methods/Approach

### **PIA Operation and maintenance:**

Between weekly updates from STReAMS as well as monitoring by principle investigators, stationary PIAs will be contacted about once per week to check settings, download data, and perform diagnostics of the systems. Sometimes problems arise that cannot be solved remotely,

in which cases a site visit must be conducted by a technician to assess and repair the system. Once a site visit is deemed necessary, principle investigators (including project leaders, if appropriate) will meet by phone to develop a response plan. Promptness of site visits will vary with accessibility of sites which is often governed by seasonal factors (snow, ice, precipitation), physical attributes of the problem (e.g., submerged antenna loops vs. streamside equipment), weather events, streamflow levels, and occasionally facility or land ownership. If more than one site requires attention at the same time, sites which are integral to high-priority research and monitoring activities will be dealt with first. Typical problems which have arose in the past include drainage of batteries due to lack of sun or lack of solar panels or panel power ratings, antenna panels are washed away or damaged by ice, wires are cut, excessive ambient noise, data downloading is disrupted or intermittent, and vandalism/theft.

For the purposes of this SOW, equipment and components for PIA O/M was selected to cover the most common repairs associated with these incidents. The budget includes the replacement costs of two, 20' antenna sections per year plus equipment to operate them. If an antenna system replacement is not needed, the funding will be used to purchase additional PIT tags or other equipment to be used by other biologists. Thus, the figures in the budget approximate the amount of funding needed for replacement of a damaged antenna system and purchase of the maximum quantities of PIT tags and equipment for a given year.

We will work to ensure that efficient and consistent data downloading occurs, which involves occasional troubleshooting and coordination between the database and PIT technical personnel on the ground. Data coming out of automated systems should be formatted consistently to allow for easy upload by STReaMS.

While submersibles generally require the least amount of maintenance of all existing systems, some upkeep may be necessary on occasion. Currently some submersible users are maintaining their equipment using their own financial resources. Lithium-ion batteries can no longer be shipped via UPS or Fedex, so we will coordinate transportation of this equipment for repairs if necessary.

### **PIT tags and related tagging and scanning equipment**

Currently, all PIT tags and related equipment are shipped from the manufacturer to the USFWS Fish and Wildlife Conservation Office (FWCO) in Grand Junction, CO where they are inventoried, stored and distributed to end users according to hatchery fish tagging schedules or on request by field offices on an "as-needed" basis. To determine the latter, field offices will coordinate with the USFWS FWCO (Travis Francis) and Reclamation (Dave Speas) prior to the coming field season with enough lead time to place orders and receive and distribute supplies and equipment (i.e., January of each year). In most cases, equipment will be ordered and paid for by Reclamation. PIT tag lot numbers (usually 100 tags per lot, either in trays or loose), their individual PIT tag numbers and their recipients will be entered and tracked in STReaMS.

PIT Tags are usually 12.5 mm, glass encapsulated 134.2 kHz PIT tags which are available both



in pre-loaded injection needles and as loose tags without needles. There are currently over 100,000 loose tags in our inventory, so we do not propose buying loose tags for the foreseeable future.

Annual PIT tag requirements for hatcheries are estimated as follows (all tags are pre-loaded in needles, 100 per tray, unless otherwise noted):

Ouray NFH Grand Valley Unit (24 Road; USFWS): 20,000/year.

ONFH Randlett Unit (USFWS): 20,000/year

Wahweap State Fish Hatchery (UDWR): 10,000/year

Mumma Native Aquatic Species Restoration Facility (CPW): 6,000/year

Field investigators (CPW, UDWR, CSU) in aggregate typically require 4,000 tags in needles/trays per year, and we recommend purchase of an additional 5,000 tags/trays for unforeseen needs. We currently estimate that we have an adequate number of PIT tags in our inventory to satisfy hatchery and field requirements for FY20, so no funds will be required for tags that year.

Scanners are usually available in two configurations, one consisting of a handheld scanning and data logging device with a circular “tennis racquet” antenna (Biomark HPR) attached to the scanner with a flexible chord, and the other is a one-piece scanner/antenna “stick reader”. Data logging software is either developed by individual investigators or procured from the manufacturer. Scanners are powered by rechargeable lithium ion batteries and 120VAC chargers are typically included along with a water- and shockproof carrying case. The Biomark HPR Lite is a new model which has most features of the regular HPR but is more streamlined and may also feature enhanced capabilities to detect older 400 kHz tags.

The FWCO warehouse in Grand Junction currently has on hand 15 Biomark HPR scanners for hatchery or field usage, as well as six stick readers. A single wagon wheel is also available for use at this time. In FY20 we recommend a purchase of four units with two batteries per unit.

In summary, while we currently have significant numbers of PIT tags and scanners in our inventory, in FY21 and beyond we estimate annual equipment needs for a given year to consist of:

Tags:

65,000 PIT tags in needles/trays (*note*: tags scheduled for purchase in FY2021 were purchased by Reclamation in FY2019 using non-program funds).

Equipment:

25 gun-style PIT tag implanters

5 HPR scanners or 5 HPR lite scanners (latter includes enhanced ability to read older 400 kHz tags; recommend purchase of 5 in 2020 to try them out)

4 wagon wheels with two batteries each\*

2 wagon wheel battery chargers  
6 PIT tag tray holders for hatchery use

We emphasize that **quantities of equipment are estimates only** and are meant to approximate needs for an average year. While quantities of PIT tags are relatively certain for a given year, quantities of equipment and other supplies will vary according to discussions with field crews which will take place early in January of each calendar year.

\*In the budget tables, we have included pricing and quantities for the latest generation IS1001 submersibles which feature an extended reading range (about 30”) and battery life (40 days). These units cost about twice as much as the current submersible models, which are operated by LM310 scanners and feature 20” read ranges and a 14-day battery life. The LM310 submersibles will be available to our Recovery Program for the foreseeable future but may eventually be phased out. New submersibles can also be powered by 70Ah batteries which can bring the cost down slightly. Also, antennas are usually purchased with two batteries each so that batteries can be swapped out at the end of their expected charge cycle; few batteries may be required with the new IS1001 depending on objectives.

**Annual reports:** We will report to the Recovery Program each year on PIA operation and maintenance.

#### VII. Generalized annual Task Description and Schedule.

- 1) January: field office personnel will coordinate with FWCO and Reclamation to identify equipment needs for the coming field season. Equipment will be ordered and distributed prior to the field season.
- 2) a) Spring (prior to peak flows): Coordinate with appropriate authorities, landowners etc. on activation of systems which had been dormant for winter months, if applicable. Activate systems and check performance.  
b) Spring through Fall: Operate and maintain PIAs (remote performance monitoring, physical visit for repair if needed, removal prior to winter)
- 3) Remote monitoring of PIT tag interrogation sites and data management
- 4) Payment of communications fees (paid directly by USBR)
- 5) Prepare annual report for Recovery Program.

#### Specific tasks for FY2020:

- 1) Upgrade cell modems from 3G to 4G versions on PIAs at White River (Bonanza Bridge) and Price Stubb fish passage
- 2) Replace satellite modem at the Dolores PIA such that communications with STReAMS can take place directly.
- 3) Purchase BioLogic® subscriptions for all PIAs except for the GRC fish screen, Price River, and San Rafael River.

VIII. Budget Summary, FY20 – FY24 (See Excel budget sheet for details)

| Name of Servicing Agency:                         |                    | Utah State University/USBR  |  |                    |                    |                 |  |
|---|--------------------|---|--|--------------------|--------------------|-----------------|--|
| Project Name:                                     |                    | Operation and Maintenance of Upper Colorado River Basin PIA infrastructure. |  |                    |                    |                 |  |
|   | YEAR 1             | YEAR 2**  | YEAR 3   | YEAR 4             | YEAR 5             | TOTAL           |  |
| Enter the BEGINNING dates for each year ----->    | 10/1/2019          | 9/30/2020   | 10/1/2021  | 10/1/2022          | 10/1/2023          |                 |  |
|   | Through            | Through   | Through  | Through            | Through            |                 |  |
| Enter the ENDING dates for each year ----->       | 9/29/2020          | 9/30/2021   | 9/30/2022  | 9/30/2023          | 9/29/2024          |                 |  |
| DIRECT LABOR AND FRINGE BENEFIT COSTS:            | YEAR 1             | YEAR 2**  | YEAR 3   | YEAR 4             | YEAR 5             | TOTAL           |  |
| Direct Labor - Hourly                             | \$ 24,325.00       | \$ 24,811.50  | \$ 25,307.73                                     | \$ 25,813.88       | \$ 26,330.16       | \$ 126,588.28   |  |
| Fringe Benefits - Hourly                          | \$ 11,432.75       | \$ 11,661.41  | \$ 11,894.63                                     | \$ 12,132.53       | \$ 12,375.18       | \$ 59,496.49    |  |
| Subtotal of Direct Labor & Fringe Benefits:       | \$ 35,757.75       | \$ 36,472.91  | \$ 37,202.36                                     | \$ 37,946.41       | \$ 38,705.34       | \$ 186,084.77   |  |
| OTHER DIRECT COSTS:                               | YEAR 1             | YEAR 2**  | YEAR 3   | YEAR 4             | YEAR 5             | TOTAL           |  |
| Materials and communications                      | \$ 8,240.00        | \$ 148,804.80   | \$ 150,922.89                                    | \$ 152,394.37      | \$ 152,938.36      | \$ 613,300.42   |  |
| Travel Costs                                      | \$ 7,274.40        | \$ 7,419.89   | \$ 7,568.29                                      | \$ 7,719.65        | \$ 7,874.04        | \$ 37,856.27    |  |
| Equipment   | \$ 66,166.00       | \$ 79,634.80  | \$ 81,208.98                                     | \$ 82,830.92       | \$ 84,504.13       | \$ 394,344.83   |  |
| Contractors                                       | \$ -               | \$ -  | \$ -   | \$ -               | \$ -               | \$ -            |  |
| Subtotal of Other Direct Costs:                   | \$ 81,680.40       | \$ 235,859.49   | \$ 239,700.15                                    | \$ 242,944.94      | \$ 245,316.54      | \$ 1,045,501.52 |  |
| INDIRECT/OVERHEAD COSTS:                          | YEAR 1             | YEAR 2**  | YEAR 3   | YEAR 4             | YEAR 5             | TOTAL           |  |
| Subtotal of Labor and Other Direct Costs:         | \$ 117,438.15      | \$ 272,332.39   | \$ 276,902.51                                    | \$ 280,891.35      | \$ 284,021.88      |                 |  |
| Total dollars exempt from indirect/overhead base: | \$ 74,406.00       | \$ 228,439.60   | \$ 232,131.87                                    | \$ 235,225.29      | \$ 237,442.49      |                 |  |
| <Enter Description of Indirect/OH Cost #1>        | 17.50% \$ 7,530.63 | 17.50% \$ 7,681.24  | 17.50% \$ 7,834.86                               | 17.50% \$ 7,991.56 | 17.50% \$ 8,151.39 | \$ 39,189.68    |  |
| Total dollars exempt from indirect/overhead base: | \$ -               | \$ -  | \$ -   | \$ -               | \$ -               | \$ -            |  |
| <Enter Description of Indirect/OH Cost #2>        | 0.00% \$ -         | 0.00% \$ -  | 0.00% \$ -                                       | 0.00% \$ -         | 0.00% \$ -         | \$ -            |  |
| Subtotal of Indirect/Overhead Costs:              | \$ 7,530.63        | \$ 7,681.24   | \$ 7,834.86                                      | \$ 7,991.56        | \$ 8,151.39        | \$ 39,189.68    |  |
|   | YEAR 1             | YEAR 2**  | YEAR 3   | YEAR 4             | YEAR 5             | TOTAL           |  |
| Subtotal:   | \$ 124,968.78      | \$ 280,013.63   | \$ 284,737.38                                    | \$ 288,882.91      | \$ 292,173.27      | \$ 1,270,775.96 |  |
| USBR contribution                                 | \$ 124,968.78      | \$ 140,400.00   | 0  | 0                  | 0                  | \$ 265,368.78   |  |
| UCRIP contribution                                | \$ -               | \$ 139,613.63   | \$ 284,737.38                                    | \$ 288,882.91      | \$ 292,173.27      | \$ 1,005,407.19 |  |
|   |                    |   | **USBR to purchase PIT tags<br>w/o program funds |                    |                    |                 |  |

**SUMMARY OF PROPOSED COSTS**

|                                  |   |
|----------------------------------|---|
| <b>Name of Servicing Agency:</b> | Utah State University/USBR  |
| <b>Project Name:</b>             | Operation and Maintenance of Upper Colorado River Basin PIA infrastructure. |

|  | YEAR 1        | YEAR 2**        | YEAR 3        | YEAR 4        | YEAR 5        | TOTAL         |
|--|---------------|-----------------|---------------|---------------|---------------|---------------|
|  | 10/1/2019     | 9/30/2020       | 10/1/2021     | 10/1/2022     | 10/1/2023     |               |
|  | Through       | Through         | Through       | Through       | Through       |               |
| Enter the BEGINNING dates for each year -----> | 9/29/2020     | 9/30/2021       | 9/30/2022     | 9/30/2023     | 9/29/2024     |               |
| Enter the ENDING dates for each year ----->    |               |                 |               |               |               |               |
| <b>DIRECT LABOR AND FRINGE BENEFIT COSTS:</b>  | <b>YEAR 1</b> | <b>YEAR 2**</b> | <b>YEAR 3</b> | <b>YEAR 4</b> | <b>YEAR 5</b> | <b>TOTAL</b>  |
| Direct Labor - Hourly                          | \$ 24,325.00  | \$ 24,811.50    | \$ 25,307.73  | \$ 25,813.88  | \$ 26,330.16  | \$ 126,588.28 |
| Fringe Benefits - Hourly                       | \$ 11,432.75  | \$ 11,661.41    | \$ 11,894.63  | \$ 12,132.53  | \$ 12,375.18  | \$ 59,496.49  |
| Subtotal of Direct Labor & Fringe Benefits:    | \$ 35,757.75  | \$ 36,472.91    | \$ 37,202.36  | \$ 37,946.41  | \$ 38,705.34  | \$ 186,084.77 |

| <b>OTHER DIRECT COSTS:</b>      | YEAR 1       | YEAR 2**      | YEAR 3        | YEAR 4        | YEAR 5        | TOTAL           |
|---------------------------------|--------------|---------------|---------------|---------------|---------------|-----------------|
| Materials and communications    | \$ 8,240.00  | \$ 148,804.80 | \$ 150,922.89 | \$ 152,394.37 | \$ 152,938.36 | \$ 613,300.42   |
| Travel Costs                    | \$ 7,274.40  | \$ 7,419.89   | \$ 7,568.29   | \$ 7,719.65   | \$ 7,874.04   | \$ 37,856.27    |
| Equipment                       | \$ 66,166.00 | \$ 79,634.80  | \$ 81,208.98  | \$ 82,830.92  | \$ 84,504.13  | \$ 394,344.83   |
| Contractors                     | \$ -         | \$ -          | \$ -          | \$ -          | \$ -          | \$ -            |
| Subtotal of Other Direct Costs: | \$ 81,680.40 | \$ 235,859.49 | \$ 239,700.15 | \$ 242,944.94 | \$ 245,316.54 | \$ 1,045,501.52 |

| <b>INDIRECT/OVERHEAD COSTS:</b>                   | YEAR 1             | YEAR 2**           | YEAR 3             | YEAR 4             | YEAR 5             | TOTAL        |
|---|--------------------|--------------------|--------------------|--------------------|--------------------|--------------|
| Subtotal of Labor and Other Direct Costs:         | \$ 117,438.15      | \$ 272,332.39      | \$ 276,902.51      | \$ 280,891.35      | \$ 284,021.88      |              |
| Total dollars exempt from indirect/overhead base: | \$ 74,406.00       | \$ 228,439.60      | \$ 232,131.87      | \$ 235,225.29      | \$ 237,442.49      |              |
| <Enter Description of Indirect/OH Cost #1>        | 17.50% \$ 7,530.63 | 17.50% \$ 7,681.24 | 17.50% \$ 7,834.86 | 17.50% \$ 7,991.56 | 17.50% \$ 8,151.39 | \$ 39,189.68 |
| Total dollars exempt from indirect/overhead base: | \$ -               | \$ -               | \$ -               | \$ -               | \$ -               |              |
| <Enter Description of Indirect/OH Cost #2>        | 0.00% \$ -         | 0.00% \$ -         | 0.00% \$ -         | 0.00% \$ -         | 0.00% \$ -         | \$ -         |
| Subtotal of Indirect/Overhead Costs:              | \$ 7,530.63        | \$ 7,681.24        | \$ 7,834.86        | \$ 7,991.56        | \$ 8,151.39        | \$ 39,189.68 |

|                    | YEAR 1        | YEAR 2**      | YEAR 3        | YEAR 4        | YEAR 5        | TOTAL           |
|--------------------|---------------|---------------|---------------|---------------|---------------|-----------------|
| Subtotal:          | \$ 124,968.78 | \$ 280,013.63 | \$ 284,737.38 | \$ 288,882.91 | \$ 292,173.27 | \$ 1,270,775.96 |
| USBR contribution  | \$ 124,968.78 | \$ 140,400.00 | 0             | 0             | 0             | \$ 265,368.78   |
| UCRIP contribution | \$ -          | \$ 139,613.63 | \$ 284,737.38 | \$ 288,882.91 | \$ 292,173.27 | \$ 1,005,407.19 |

\*\*USBR to purchase PIT tags  
w/o program funds

# SUMMARY OF DIRECT LABOR & FRINGE BENEFITS

|                               |                      |       |
|-------------------------------|----------------------|-------|
| Enter Escalation Rates -----> | Yr 2 Escalation Rate | 2.00% |
|-------------------------------|----------------------|-------|

|   | Task # | Position Title  | OPM Pay Location | Current Hourly Rate | YEAR 1        |             |                     |             |                     | YEAR 2**      |             |                     |             |                     |
|---|--------|---|------------------|---------------------|---------------|-------------|---------------------|-------------|---------------------|---------------|-------------|---------------------|-------------|---------------------|
|   |        |   |                  |                     | 10/1/2019     |             | Through             | 9/29/2020   |                     | 9/30/2020     |             | Through             | 9/30/2021   |                     |
|   |        |   |                  |                     | # of Hours    | Hourly Rate | Salary Cost         | Fringe Rate | Fringe Cost         | # of Hours    | Hourly Rate | Salary Cost         | Fringe Rate | Fringe Cost         |
| 1 | 2,3,5  | Utah State University Electronic Engineer/RFID Specialist | Rest of US       | \$ 55.00            | 300.0         | \$ 55.00    | \$ 16,500.00        | 47.00%      | \$ 7,755.00         | 300.0         | \$ 56.10    | \$ 16,830.00        | 47.00%      | \$ 7,910.10         |
| 2 | 2,3,5  | Utah State University employee                            | Rest of US       | \$ 35.00            | 90.0          | \$ 35.00    | \$ 3,150.00         | 47.00%      | \$ 1,480.50         | 90.0          | \$ 35.70    | \$ 3,213.00         | 47.00%      | \$ 1,510.11         |
| 4 | 3      | Electrical Engineer                                       | Rest of US       | \$ 55.00            | 85.0          | \$ 55.00    | \$ 4,675.00         | 47.00%      | \$ 2,197.25         | 85.0          | \$ 56.10    | \$ 4,768.50         | 47.00%      | \$ 2,241.20         |
|   |        |   |                  |                     | <b>475.00</b> |             | <b>\$ 24,325.00</b> |             | <b>\$ 11,432.75</b> | <b>475.00</b> |             | <b>\$ 24,811.50</b> |             | <b>\$ 11,661.41</b> |

# SUMMARY OF DIRECT LABOR & F

|                      |       |
|----------------------|-------|
| Yr 3 Escalation Rate | 2.00% |
|----------------------|-------|

|                      |       |
|----------------------|-------|
| Yr 4 Escalation Rate | 2.00% |
|----------------------|-------|

|   | Task # | Position Title  | OPM Pay Location | Current Hourly Rate | YEAR 3        |             |                     |             |                     | YEAR 4        |             |                     |             |                     |
|---|--------|---|------------------|---------------------|---------------|-------------|---------------------|-------------|---------------------|---------------|-------------|---------------------|-------------|---------------------|
|   |        |   |                  |                     | 10/1/2021     |             | Through             | 9/30/2022   |                     | 10/1/2022     |             | Through             | 9/30/2023   |                     |
|   |        |   |                  |                     | # of Hours    | Hourly Rate | Salary Cost         | Fringe Rate | Fringe Cost         | # of Hours    | Hourly Rate | Salary Cost         | Fringe Rate | Fringe Cost         |
| 1 | 2,3,5  | Utah State University Electronic Engineer/RFID Specialist | Rest of US       | \$ 55.00            | 300.0         | \$ 57.22    | \$ 17,166.60        | 47.00%      | \$ 8,068.30         | 300.0         | \$ 58.37    | \$ 17,509.93        | 47.00%      | \$ 8,229.67         |
| 2 | 2,3,5  | Utah State University employee                            | Rest of US       | \$ 35.00            | 90.0          | \$ 36.41    | \$ 3,277.26         | 47.00%      | \$ 1,540.31         | 90.0          | \$ 37.14    | \$ 3,342.81         | 47.00%      | \$ 1,571.12         |
| 4 | 3      | Electrical Engineer                                       | Rest of US       | \$ 55.00            | 85.0          | \$ 57.22    | \$ 4,863.87         | 47.00%      | \$ 2,286.02         | 85.0          | \$ 58.37    | \$ 4,961.15         | 47.00%      | \$ 2,331.74         |
|   |        |   |                  |                     | <b>475.00</b> |             | <b>\$ 25,307.73</b> |             | <b>\$ 11,894.63</b> | <b>475.00</b> |             | <b>\$ 25,813.88</b> |             | <b>\$ 12,132.53</b> |

# SUMMARY OF DIRECT LABOR & F

|                      |       |
|----------------------|-------|
| Yr 5 Escalation Rate | 2.00% |
|----------------------|-------|

| YEAR 5 |        |   |                  |                     |               |             |                     |             |                     |                      |                     |                      |
|--------|--------|---|------------------|---------------------|---------------|-------------|---------------------|-------------|---------------------|----------------------|---------------------|----------------------|
|        |        |   |                  |                     | 10/1/2023     |             | Through             | 9/29/2024   |                     |                      |                     |                      |
|        | Task # | Position Title  | OPM Pay Location | Current Hourly Rate | # of Hours    | Hourly Rate | Salary Cost         | Fringe Rate | Fringe Cost         | Total Salary Cost    | Total Fringe Cost   | Total Labor Cost     |
| 1      | 2,3,5  | Utah State University Electronic Engineer/RFID Specialist | Rest of US       | \$ 55.00            | 300.0         | \$ 59.53    | \$ 17,860.13        | 47.00%      | \$ 8,394.26         | \$ 85,866.66         | \$ 40,357.33        | \$ 126,223.99        |
| 2      | 2,3,5  | Utah State University employee                            | Rest of US       | \$ 35.00            | 90.0          | \$ 37.89    | \$ 3,409.66         | 47.00%      | \$ 1,602.54         | \$ 16,392.73         | \$ 7,704.58         | \$ 24,097.31         |
| 4      | 3      | Electrical Engineer                                       | Rest of US       | \$ 55.00            | 85.0          | \$ 59.53    | \$ 5,060.37         | 47.00%      | \$ 2,378.37         | \$ 24,328.89         | \$ 11,434.58        | \$ 35,763.46         |
|        |        |   |                  |                     | <b>475.00</b> |             | <b>\$ 26,330.16</b> |             | <b>\$ 12,375.18</b> | <b>\$ 126,588.28</b> | <b>\$ 59,496.49</b> | <b>\$ 186,084.77</b> |

# SUMMARY OF MATERIALS AND SUPPLIES

## **SUMMARY OF MATERIALS, SUPPLIES, AND SERVICES**

|                      |       |
|----------------------|-------|
| Yr 2 Escalation Rate | 2.00% |
|----------------------|-------|

Note: This selection of equipment represents the more common equipment replacement needs typically encountered within a given year.

|               | Task # | Item Description                    | Rationale for Proposed Cost | Year 1     |               |          | Year 2     |               |                      |
|---------------|--------|-------------------------------------|-----------------------------|------------|---------------|----------|------------|---------------|----------------------|
|               |        |                                     |                             | Unit Price | Unit Quantity | Subtotal | Unit Price | Unit Quantity | Subtotal             |
| 1             | 1      | APT12 PIT tags, pre-loaded in trays | USBR contract 140R4018D0012 |            | 0             | \$ -     | \$ 2.16    | 65000         | \$ 140,400.00        |
|               |        |                                     |                             |            |               | \$ -     |            |               | \$ -                 |
| 3             |        |                                     |                             |            |               | \$ -     | \$ -       |               | \$ -                 |
| 4             |        |                                     |                             |            |               | \$ -     | \$ -       |               | \$ -                 |
| 5             |        |                                     |                             |            |               | \$ -     | \$ -       |               | \$ -                 |
| 6             |        |                                     |                             |            |               | \$ -     | \$ -       |               | \$ -                 |
| 7             |        |                                     |                             |            |               | \$ -     | \$ -       |               | \$ -                 |
| 8             |        |                                     |                             |            |               | \$ -     | \$ -       |               | \$ -                 |
| <b>TOTAL:</b> |        |                                     |                             |            |               | \$ -     | \$ -       |               | <b>\$ 140,400.00</b> |



# SUMMARY OF MATERIALS AND SUPPLIES

|                              |                      |       |                      |       |
|------------------------------|----------------------|-------|----------------------|-------|
| <b>SUMMARY OF MATERIALS,</b> | Yr 3 Escalation Rate | 2.00% | Yr 4 Escalation Rate | 2.00% |
|------------------------------|----------------------|-------|----------------------|-------|

Note: This selection of equipment represents typically encountered within a given year

|   |        |                                     | Year 3     |               |                      | Year 4     |               |                      |
|---|--------|-------------------------------------|------------|---------------|----------------------|------------|---------------|----------------------|
|   | Task # | Item Description                    | Unit Price | Unit Quantity | Subtotal             | Unit Price | Unit Quantity | Subtotal             |
| 1 | 1      | APT12 PIT tags, pre-loaded in trays | \$ 2.19    | 65000         | \$ 142,350.00        | \$ 2.21    | 65000         | \$ 143,650.00        |
|   |        |                                     |            |               | \$ -                 |            |               | \$ -                 |
| 3 |        |                                     | \$ -       |               | \$ -                 | \$ -       |               | \$ -                 |
| 4 |        |                                     | \$ -       |               | \$ -                 | \$ -       |               | \$ -                 |
| 5 |        |                                     | \$ -       |               | \$ -                 | \$ -       |               | \$ -                 |
| 6 |        |                                     | \$ -       |               | \$ -                 | \$ -       |               | \$ -                 |
| 7 |        |                                     | \$ -       |               | \$ -                 | \$ -       |               | \$ -                 |
| 8 |        |                                     | \$ -       |               | \$ -                 | \$ -       |               | \$ -                 |
|   |        |                                     | \$ -       |               | \$ -                 | \$ -       |               | \$ -                 |
|   |        |                                     |            |               | <b>\$ 142,350.00</b> |            |               | <b>\$ 143,650.00</b> |

# SUMMARY OF MATERIALS AND SUPPLIES

|                              |                      |       |
|------------------------------|----------------------|-------|
| <b>SUMMARY OF MATERIALS,</b> | Yr 5 Escalation Rate | 2.00% |
|------------------------------|----------------------|-------|

Note: This selection of equipment represents typically encountered within a given year

|        |                  | Year 5                              |               |                      |                      |               |
|--------|------------------|-------------------------------------|---------------|----------------------|----------------------|---------------|
| Task # | Item Description | Unit Price                          | Unit Quantity | Subtotal             | TOTAL                |               |
| 1      | 1                | APT12 PIT tags, pre-loaded in trays | \$ 2.23       | 65000                | \$ 144,950.00        | \$ 571,350.00 |
|        |                  |                                     |               | \$ -                 | \$ -                 |               |
| 3      |                  |                                     |               | \$ -                 | \$ -                 |               |
| 4      |                  |                                     |               | \$ -                 | \$ -                 |               |
| 5      |                  |                                     |               | \$ -                 | \$ -                 |               |
| 6      |                  |                                     |               | \$ -                 | \$ -                 |               |
| 7      |                  |                                     |               | \$ -                 | \$ -                 |               |
| 8      |                  |                                     |               | \$ -                 | \$ -                 |               |
|        |                  |                                     |               | \$ -                 | \$ -                 |               |
|        |                  |                                     |               | <b>\$ 144,950.00</b> | <b>\$ 571,350.00</b> |               |

## SUMMARY OF TRAVEL COSTS

Note: Travel costs are based on round trips from Logan UT to Grand Junction, CO, which encompasses distances to all Upper Basin PIA facilities. Actual travel costs could be less because some trips can be conducted in conjunction with other projects (i.e., San Juan O/M), and 8 trips/year may not be needed, etc.

Cost of Living:                      0.02                      0.02                      0.02                      0.02

| Task 1                                 | Year 1                    | Year 2                    | Year 3                    | Year 4                    | Year 5                    | TOTAL               |
|--|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------|
|  | 1                         | 1                         | 1                         | 1                         | 1                         |                     |
| <b>From-To</b>                         | Logan UT - Green River UT | Logan UT - Green River UT | Logan UT - Green River UT | Logan UT - Green River UT | Logan UT - Green River UT |                     |
| <b>Reason</b>                          | PIA operation/maintenance | PIA operation/maintenance | PIA operation/maintenance | PIA operation/maintenance | PIA operation/maintenance |                     |
| <b># of Days (include travel days)</b> | 3                         | 3                         | 3                         | 3                         | 3                         |                     |
| <b>Airfare</b>                         |                           |                           |                           |                           |                           |                     |
| <b>Lodging (Per Night)</b>             | \$ 70.00                  | \$ 71.40                  | \$ 72.83                  | \$ 74.28                  | \$ 75.77                  |                     |
| <b>MI&amp;E Per Day</b>                | \$ 46.00                  | \$ 46.92                  | \$ 47.86                  | \$ 48.82                  | \$ 49.79                  |                     |
| <b>Auto Rental Per Day</b>             |                           |                           |                           |                           |                           |                     |
| <b>Misc Costs/Adjustments/Trip</b>     |                           |                           |                           |                           |                           |                     |
| <b>Total Per Trip</b>                  | <b>\$ 255.00</b>          | <b>\$ 260.10</b>          | <b>\$ 265.30</b>          | <b>\$ 270.61</b>          | <b>\$ 276.02</b>          |                     |
| <b>No. of persons</b>                  | 2                         | 2                         | 2                         | 2                         | 2                         |                     |
| <b>No. of trips</b>                    | 8                         | 8                         | 8                         | 8                         | 8                         |                     |
| <b>Mileage rate</b>                    | \$ 0.55                   | \$ 0.56                   | \$ 0.57                   | \$ 0.58                   | \$ 0.60                   |                     |
| <b>Total miles</b>                     | 726                       | 726                       | 726                       | 726                       | 726                       |                     |
| <b>SUBTOTAL =</b>                      | <b>\$ 7,274.40</b>        | <b>\$ 7,419.89</b>        | <b>\$ 7,568.29</b>        | <b>\$ 7,719.65</b>        | <b>\$ 7,874.04</b>        | <b>\$ 37,856.27</b> |

# SUMMARY OF EQUIPMENT COSTS

## SUMMARY OF EQUIPMENT

Enter Escalation Rates ----->

Yr 2 Escalation Rate

2.00%

Yr 3 Escalation Rate

|               | Task # | Item Description                                | Rationale for Proposed Cost   | Year 1      |               |                     | Year 2      |               |                     | Year 3      |               |
|---------------|--------|---|---|-------------|---------------|---------------------|-------------|---------------|---------------------|-------------|---------------|
|               |        |   |   | Unit Price  | Unit Quantity | Subtotal            | Unit Price  | Unit Quantity | Subtotal            | Unit Price  | Unit Quantity |
| 1             | 2      | Solar batteries: 260 AH SunXtender              | <a href="https://bdbatteries.com/collections/sun-xtender/application_solar-battery">https://bdbatteries.com/collections/sun-xtender/application_solar-battery</a>   | \$ 615.00   | 8             | \$ 4,920.00         | \$ 627.30   | 8             | \$ 5,018.40         | \$ 639.85   | 8             |
| 2             | 2      | Solar batteries: 115 AH SunXtender              | <a href="https://batteryguys.com/products/sunxtender-pvx-1040t?variant=32270621636&amp;gclid=EAlalQobChMlxKf13MHf4AIVkzlCh3kYQusEAQYASABEgIglXPD_BwE">https://batteryguys.com/products/sunxtender-pvx-1040t?variant=32270621636&amp;gclid=EAlalQobChMlxKf13MHf4AIVkzlCh3kYQusEAQYASABEgIglXPD_BwE</a> | \$ 300.00   | 4             | \$ 1,200.00         | \$ 306.00   | 4             | \$ 1,224.00         | \$ 312.12   | 4             |
| 3             | 2      | IS1001 Reader node                              | USBR contract 140R4018D0012 (good thru year 4; year 5 is estimated from 2% inflation rate)  | \$ 1,374.00 | 2             | \$ 2,748.00         | \$ 1,415.00 | 2             | \$ 2,830.00         | \$ 1,458.00 | 2             |
| 4             | 2      | IS1001 Submersible enclosure                    | USBR contract 140R4018D0012 (good thru year 4; year 5 is estimated from 2% inflation rate)  | \$ 956.00   | 2             | \$ 1,912.00         | \$ 965.00   | 2             | \$ 1,930.00         | \$ 975.00   | 2             |
| 5             | 2      | 20' Antenna                                     | USBR contract 140R4018D0012 (good thru year 4; year 5 is estimated from 2% inflation rate)  | \$ 2,240.00 | 2             | \$ 4,480.00         | \$ 2,267.00 | 2             | \$ 4,534.00         | \$ 2,289.00 | 2             |
| 6             | 2      | 20' stout antenna for multiplexer (White River) | USBR contract 140R4018D0012 (good thru year 4; year 5 is estimated from 2% inflation rate)  | \$ 3,500.00 | 1             | \$ 3,500.00         | \$ 3,570.00 | 1             | \$ 3,570.00         | \$ 3,641.40 | 1             |
| 7             | 2      | Anchors   | USBR contract 140R4018D0012 (good thru year 4; year 5 is estimated from 2% inflation rate)  | \$ 66.00    | 16            | \$ 1,056.00         | \$ 67.00    | 16            | \$ 1,072.00         | \$ 68.00    | 16            |
| 8             | 2      | 4G Modem Kit                                    | USBR contract 140R4018D0012 (good thru year 4; year 5 is estimated from 2% inflation rate)  | \$ 610.00   | 3             | \$ 1,830.00         | \$ 630.00   | 2             | \$ 1,260.00         | \$ 650.00   | 2             |
| 9             | 2      | Satellite modem                                 | USBR contract 140R4018D0012 (good thru year 4; year 5 is estimated from 2% inflation rate)  | \$ 1,800.00 | 1             | \$ 1,800.00         | \$ 1,850.00 | 1             | \$ 1,850.00         | \$ 1,900.00 | 1             |
| 10            | 1      | Gun-style PIT implanter MK25                    | USBR contract 140R4018D0012 (good thru year 4; year 5 is estimated from 2% inflation rate)  |             |               | \$ -                | \$ 36.00    | 25            | \$ 900.00           | \$ 37.00    | 25            |
| 11            | 1      | HPR Plus handheld PIT scanner                   | USBR contract 140R4018D0012 (good thru year 4; year 5 is estimated from 2% inflation rate)  |             |               | \$ -                | \$ 2,876.00 | 5             | \$ 14,380.00        | \$ 2,933.00 | 5             |
| 12            | 1      | HPR Lite handheld PIT scanner                   | USBR contract 140R4018D0012 (good thru year 4; year 5 is estimated from 2% inflation rate)  | \$ 780.00   | 5             | \$ 3,900.00         | \$ 796.00   | 0             | \$ -                | \$ 812.00   | 0             |
| 13            | 1      | NEW Submersible, IS1001, 36", antenna only*     | USBR contract 140R4018D0012 (good thru year 4; year 5 is estimated from 2% inflation rate)  | \$ 4,305.00 | 4             | \$ 17,220.00        | \$ 4,391.10 | 4             | \$ 17,564.40        | \$ 4,478.92 | 4             |
| 14            | 1      | NEW Submersible 180Ah battery*                  | USBR contract 140R4018D0012 (good thru year 4; year 5 is estimated from 2% inflation rate)  | \$ 2,700.00 | 8             | \$ 21,600.00        | \$ 2,754.00 | 8             | \$ 22,032.00        | \$ 2,809.08 | 8             |
| 15            | 1      | Submersible battery charger 25A                 | USBR contract 140R4018D0012 (good thru year 4; year 5 is estimated from 2% inflation rate)  | \$ -        | 0             | \$ -                | \$ 375.00   | 2             | \$ 750.00           | \$ 385.00   | 2             |
| 16            | 1      | PIT tag try holder                              | USBR contract 140R4018D0012 (good thru year 4; year 5 is estimated from 2% inflation rate)  | \$ -        | 0             | \$ -                | \$ 120.00   | 6             | \$ 720.00           | \$ 120.00   | 6             |
| 17            |        |   |   | \$ -        | 0             | \$ -                | \$ -        | 0             | \$ -                | \$ -        | 0             |
| 18            |        |   |   | \$ -        | 0             | \$ -                | \$ -        | 0             | \$ -                | \$ -        | 0             |
| 19            |        |   |   | \$ -        | 0             | \$ -                | \$ -        | 0             | \$ -                | \$ -        | 0             |
| 20            |        |   |   | \$ -        | 0             | \$ -                | \$ -        | 0             | \$ -                | \$ -        | 0             |
| 21            |        |   |   | \$ -        | 0             | \$ -                | \$ -        | 0             | \$ -                | \$ -        | 0             |
| 22            |        |   |   | \$ -        | 0             | \$ -                | \$ -        | 0             | \$ -                | \$ -        | 0             |
| <b>TOTAL:</b> |        |   |   |             |               | <b>\$ 66,166.00</b> |             |               | <b>\$ 79,634.80</b> |             |               |

\*total cost of these items can be used to purchase twice the number of older model submersibles (RM310) and batteries

# SUMMARY OF EQUIPMENT COSTS

|                |       |                      |       |                      |       |
|----------------|-------|----------------------|-------|----------------------|-------|
| <b>SUMMARY</b> | 2.00% | Yr 4 Escalation Rate | 2.00% | Yr 5 Escalation Rate | 2.00% |
|----------------|-------|----------------------|-------|----------------------|-------|

|    | Task # | Item Description                                | Year 4              |             |               | Year 5              |             |               | TOTAL               |                      |
|----|--------|---|---------------------|-------------|---------------|---------------------|-------------|---------------|---------------------|----------------------|
|    |        |   | Subtotal            | Unit Price  | Unit Quantity | Subtotal            | Unit Price  | Unit Quantity |                     | Subtotal             |
| 1  | 2      | Solar batteries: 260 AH SunXtender              | \$ 5,118.77         | \$ 652.64   | 8             | \$ 5,221.14         | \$ 665.70   | 8             | \$ 5,325.57         | \$ 25,603.88         |
| 2  | 2      | Solar batteries: 115 AH SunXtender              | \$ 1,248.48         | \$ 318.36   | 4             | \$ 1,273.45         | \$ 324.73   | 4             | \$ 1,298.92         | \$ 6,244.85          |
| 3  | 2      | IS1001 Reader node                              | \$ 2,916.00         | \$ 1,501.00 | 2             | \$ 3,002.00         | \$ 1,531.02 | 2             | \$ 3,062.04         | \$ 14,558.04         |
| 4  | 2      | IS1001 Submersible enclosure                    | \$ 1,950.00         | \$ 985.00   | 2             | \$ 1,970.00         | \$ 1,004.70 | 2             | \$ 2,009.40         | \$ 9,771.40          |
| 5  | 2      | 20' Antenna                                     | \$ 4,578.00         | \$ 2,312.00 | 2             | \$ 4,624.00         | \$ 2,358.24 | 2             | \$ 4,716.48         | \$ 22,932.48         |
| 6  | 2      | 20' stout antenna for multiplexer (White River) | \$ 3,641.40         | \$ 3,714.23 | 1             | \$ 3,714.23         | \$ 3,788.51 | 1             | \$ 3,788.51         | \$ 18,214.14         |
| 7  | 2      | Anchors   | \$ 1,088.00         | \$ 70.00    | 16            | \$ 1,120.00         | \$ 71.40    | 16            | \$ 1,142.40         | \$ 5,478.40          |
| 8  | 2      | 4G Modem Kit                                    | \$ 1,300.00         | \$ 670.00   | 2             | \$ 1,340.00         | \$ 683.40   | 2             | \$ 1,366.80         | \$ 7,096.80          |
| 9  | 2      | Satellite modem                                 | \$ 1,900.00         | \$ 1,950.00 | 1             | \$ 1,950.00         | \$ 1,989.00 | 1             | \$ 1,989.00         | \$ 9,489.00          |
| 10 | 1      | Gun-style PIT implanter MK25                    | \$ 925.00           | \$ 38.00    | 25            | \$ 950.00           | \$ 40.00    | 25            | \$ 1,000.00         | \$ 3,775.00          |
| 11 | 1      | HPR Plus handheld PIT scanner                   | \$ 14,665.00        | \$ 2,992.00 | 5             | \$ 14,960.00        | \$ 3,051.00 | 5             | \$ 15,255.00        | \$ 59,260.00         |
| 12 | 1      | HPR Lite handheld PIT scanner                   | \$ -                | \$ 828.00   | 0             | \$ -                | \$ 844.00   | 0             | \$ -                | \$ 3,900.00          |
| 13 | 1      | NEW Submersible, IS1001, 36", antenna only*     | \$ 17,915.69        | \$ 4,568.50 | 4             | \$ 18,274.00        | \$ 4,659.87 | 4             | \$ 18,639.48        | \$ 89,613.57         |
| 14 | 1      | NEW Submersible 180Ah battery*                  | \$ 22,472.64        | \$ 2,865.26 | 8             | \$ 22,922.09        | \$ 2,922.57 | 8             | \$ 23,380.53        | \$ 112,407.27        |
| 15 | 1      | Submersible battery charger 25A                 | \$ 770.00           | \$ 395.00   | 2             | \$ 790.00           | \$ 405.00   | 2             | \$ 810.00           | \$ 3,120.00          |
| 16 | 1      | PIT tag try holder                              | \$ 720.00           | \$ 120.00   | 6             | \$ 720.00           | \$ 120.00   | 6             | \$ 720.00           | \$ 2,880.00          |
| 17 |        |   | \$ -                | \$ -        | 0             | \$ -                | \$ -        | 0             | \$ -                | \$ -                 |
| 18 |        |   | \$ -                | \$ -        | 0             | \$ -                | \$ -        | 0             | \$ -                | \$ -                 |
| 19 |        |   | \$ -                | \$ -        | 0             | \$ -                | \$ -        | 0             | \$ -                | \$ -                 |
| 20 |        |   | \$ -                | \$ -        | 0             | \$ -                | \$ -        | 0             | \$ -                | \$ -                 |
| 21 |        |   | \$ -                | \$ -        | 0             | \$ -                | \$ -        | 0             | \$ -                | \$ -                 |
| 22 |        |   | \$ -                | \$ -        | 0             | \$ -                | \$ -        | 0             | \$ -                | \$ -                 |
|    |        |   | <b>\$ 81,208.98</b> |             |               | <b>\$ 82,830.92</b> |             |               | <b>\$ 84,504.13</b> | <b>\$ 394,344.83</b> |

\*total cost of these items car  
older model submersibles (F

# SUMMARY OF MATERIALS AND SUPPLIES

**Communications (to be paid directly by USBR/**

Yr 2 Escalation Rate

2.00%

|               | Task # | Item Description  | Rationale for Proposed Cost   | Year 1     |               |                    | Year 2     |               |                    |
|---------------|--------|---|---|------------|---------------|--------------------|------------|---------------|--------------------|
|               |        |   |   | Unit Price | Unit Quantity | Subtotal           | Unit Price | Unit Quantity | Subtotal           |
|               | 4      | Green River Canal cell service  | Based on several years of billing (USU and USBR payment records)  | \$ 18.00   | 12            | \$ 216.00          | \$ 18.36   | 12            | \$ 220.32          |
|               | 4      | Tusher Diversion cell service   |   | \$ 18.00   | 13            | \$ 234.00          | \$ 18.36   | 13            | \$ 238.68          |
|               | 4      | White river cell service  |   | \$ 10.00   | 14            | \$ 140.00          | \$ 10.20   | 14            | \$ 142.80          |
|               | 4      | Price-Stubb cell service  |   | \$ 18.00   | 15            | \$ 270.00          | \$ 18.36   | 15            | \$ 275.40          |
|               | 4      | Dolores Rio Mesa satellite service  | USBR contract 140R4018D0012 CLIN: 00310A Sat service \$155/month; reflects full cost for Biomark BioLogic service/month, but efforts underway to reduce these costs | \$ 155.00  | 12            | \$ 1,860.00        | \$ 158.10  | 12            | \$ 1,897.20        |
| <b>10</b>     | 4      | White River, Bonanza Bridge, Biologic communication service                   | USBR contract 140R4018D0012 CLIN: 00340A Biologic \$115/month; reflects full cost for Biomark BioLogic service/month, but efforts underway to reduce these costs    | \$ 115.00  | 12            | \$ 1,380.00        | \$ 117.30  | 12            | \$ 1,407.60        |
| <b>11</b>     | 4      | Green River, Tusher Diversion, Green River, UT Biologic communication service | USBR contract 140R4018D0012 CLIN: 00340A Biologic \$115/month; reflects full cost for Biomark BioLogic service/month, but efforts underway to reduce these costs    | \$ 115.00  | 12            | \$ 1,380.00        | \$ 117.30  | 12            | \$ 1,407.60        |
| <b>12</b>     | 4      | Dolores Rio Mesa Biologic communication service                               | USBR contract 140R4018D0012 CLIN: 00340A Biologic \$115/month; reflects full cost for Biomark BioLogic service/month, but efforts underway to reduce these costs    | \$ 115.00  | 12            | \$ 1,380.00        | \$ 117.30  | 12            | \$ 1,407.60        |
| <b>13</b>     | 4      | Price Stub communication service  | USBR contract 140R4018D0012 CLIN: 00340A Biologic \$115/month; reflects full cost for Biomark BioLogic service/month, but efforts underway to reduce these costs    | \$ 115.00  | 12            | \$ 1,380.00        | \$ 117.30  | 12            | \$ 1,407.60        |
| <b>TOTAL:</b> |        |   |   |            |               | <b>\$ 8,240.00</b> |            |               | <b>\$ 8,404.80</b> |

# SUMMARY OF MATERIALS AND SUPPLIES

|                              |                      |       |                      |       |
|------------------------------|----------------------|-------|----------------------|-------|
| <b>Communications (to be</b> | Yr 3 Escalation Rate | 2.00% | Yr 4 Escalation Rate | 2.00% |
|------------------------------|----------------------|-------|----------------------|-------|

|           | Task # | Item Description  | Year 3     |               |                    | Year 4     |               |                    |
|-----------|--------|---|------------|---------------|--------------------|------------|---------------|--------------------|
|           |        |   | Unit Price | Unit Quantity | Subtotal           | Unit Price | Unit Quantity | Subtotal           |
|           | 4      | Green River Canal cell service  | \$ 18.73   | 12            | \$ 224.73          | \$ 19.10   | 12            | \$ 229.22          |
|           | 4      | Tusher Diversion cell service   | \$ 18.73   | 13            | \$ 243.45          | \$ 19.10   | 13            | \$ 248.32          |
|           | 4      | White river cell service  | \$ 10.40   | 14            | \$ 145.66          | \$ 10.61   | 14            | \$ 148.57          |
|           | 4      | Price-Stubb cell service  | \$ 18.73   | 15            | \$ 280.91          | \$ 19.10   | 15            | \$ 286.53          |
|           | 4      | Dolores Rio Mesa satellite service  | \$ 161.26  | 12            | \$ 1,935.14        | \$ 164.49  | 12            | \$ 1,973.85        |
| <b>10</b> | 4      | White River, Bonanza Bridge, Biologic communication service                   | \$ 119.65  | 12            | \$ 1,435.75        | \$ 122.04  | 12            | \$ 1,464.47        |
| <b>11</b> | 4      | Green River, Tusher Diversion, Green River, UT Biologic communication service | \$ 119.65  | 12            | \$ 1,435.75        | \$ 122.04  | 12            | \$ 1,464.47        |
| <b>12</b> | 4      | Dolores Rio Mesa Biologic communication service                               | \$ 119.65  | 12            | \$ 1,435.75        | \$ 122.04  | 12            | \$ 1,464.47        |
| <b>13</b> | 4      | Price Stub communication service  | \$ 119.65  | 12            | \$ 1,435.75        | \$ 122.04  | 12            | \$ 1,464.47        |
|           |        |   |            |               | <b>\$ 8,572.89</b> |            |               | <b>\$ 8,744.37</b> |

# SUMMARY OF MATERIALS AND SUPPLIES

|                                |                      |       |
|--------------------------------|----------------------|-------|
| <b>Communications (to be p</b> | Yr 5 Escalation Rate | 2.00% |
|--------------------------------|----------------------|-------|

|           |   | Year 5     |               |                    |                     |
|-----------|---|------------|---------------|--------------------|---------------------|
| Task #    | Item Description  | Unit Price | Unit Quantity | Subtotal           | TOTAL               |
| 4         | Green River Canal cell service  | \$ 19.48   | 12            | \$ 233.81          | \$ 1,124.08         |
| 4         | Tusher Diversion cell service   | \$ 19.48   | 13            | \$ 253.29          |                     |
| 4         | White river cell service  | \$ 10.82   | 14            | \$ 151.54          |                     |
| 4         | Price-Stubb cell service  | \$ 19.48   | 15            | \$ 292.26          |                     |
| 4         | Dolores Rio Mesa satellite service  | \$ 167.78  | 12            | \$ 2,013.32        | \$ 9,679.51         |
| <b>10</b> | White River, Bonanza Bridge, Biologic communication service                   | \$ 124.48  | 12            | \$ 1,493.76        | \$ 7,181.58         |
| <b>11</b> | Green River, Tusher Diversion, Green River, UT Biologic communication service | \$ 124.48  | 12            | \$ 1,493.76        | \$ 7,181.58         |
| <b>12</b> | Dolores Rio Mesa Biologic communication service                               | \$ 124.48  | 12            | \$ 1,493.76        | \$ 7,181.58         |
| <b>13</b> | Price Stub communication service  | \$ 124.48  | 12            | \$ 1,493.76        | \$ 7,181.58         |
|           |   |            |               | <b>\$ 7,988.36</b> | <b>\$ 41,950.42</b> |