

**SJRIP O&M of Existing PIT Tag Antennas  
2019 Project Proposal**

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**BACKGROUND:**

PIT tags are implanted in various fish species captured through various projects directly supported by the SJRIP, or funded through other agencies and projects (CDP&W, BOR, BLM, NMG&FD, and UDWR). Stationary PIT Tag antennas have been installed at various locations in the San Juan River Basin to passively detect fish as they swim above, through, or underneath the antennas. These antennas require periodic maintenance and support to keep them running and operational. Additionally cell and satellite service is required to access the antennas and download data and perform diagnostics. Locations and numbers of antennas at various sites are listed below:

- 1) PNM Weir and Fish Passage
  - a. One pass-over antenna, modified with a concrete base is located below the weir
  - b. Two pass through antennas are located in the fish passage.
  - c. One pass-over antenna is located above the fish passage at the trash rack intake
  - d. All six antennas are served by a single master controller located in a protected shed at the fish passage facility. The master controller is accessed using a Verizon cell data modem.

Antennas installed here are serving multiple uses, including giving us a lot of detections (meeting a broad goal of getting more recaptures), and giving us information on how, when, and where the fish passage is being used, or not as the case is. The antennas installed in the fish passage are providing information on species, timing, direction of movement, and success of passage, for fish that enter the passage. Fish detected on the antennas below the weir are providing information on species, timing, and success of fish finding the fish passage that are trying to move upstream. These antennas are being used in a "design" to test the effectiveness of PNM passage.

- 2) Hogback Irrigation Canal and Fish Weir, ~ 20 miles upstream of Shiprock, NM
  - a. Seven pass-through antennas are installed at various locations in the Hogback Fish Weir facility.
  - b. Five antennas are served by a master controller and bank of batteries in a protected shed at the Hogback Irrigation Site that controls the various gates connected to the fish weir. The master controller is accessed using a Verizon cell data modem.
  - c. Two antennas are located approximately 0.5 mi upstream of the fish weir near the canal headgate. These antennas are served by a master controller and bank of batteries (connected to 110 AC power source) located at the antennas. This site is accessed using a Verizon cell data modem.

- d. Six antennas are located in the Hogback Bypass and raft-launch channel that is south of the canal. These antennas are served by the same Master Controller and power source used to operate the antennas at the head of the headgates.

Antennas installed at Hogback Canal are being used in a "design" to give us information on how many, when, where, and how fish use the Hogback canal and fish weir. These antennas have been used under controlled experimental conditions and have given us some good information. If VFD pumps are replaced in the canal we can get good information on how the weir works under more normal operating conditions. Antennas were installed at the canal intake, in the canal downstream of the fish weir, and in the fish bypass that leads back to the river. Under this design, in theory, we can evaluate numbers of fish that enter the intake, numbers of fish that are entrained or bypassed back to the river, direction of fish movement, as well as date and timing of movements.

Antennas installed at Hogback Bypass were installed primarily due to proximity to existing infrastructure and antennas in the Canal portion of the project. These antennas are not part of a design, but are giving us information on recaptures (i.e., survival), timing of fish movements, and potential information about use of the fish passage right next to it. There were two arrays of antennas installed at this site so, theoretically, movement direction as well as date and time can be evaluated at this bypass. Since this site is protected by a radial gate just upstream that regulates the amount of water than can go through this channel the antennas cannot be flushed out during high water.

- 3) TNC Restoration Site ~ 20 miles west of Shiprock
  - a. Four pass-over antennas are installed in a secondary channel created by restoration activities conducted by TNC.
  - b. The four antennas are served by a single master controller and solar-energy supplied battery bank on an island created by the restoration activities. The site is accessed using a satellite data modem.

Antennas installed at TNC Restoration site were incorporated as a component of the evaluation of this habitat restoration and were installed in the secondary channel near the downstream mouth. Antennas were not installed as part of a "design" but can be used to provide information on movements of fish, timing, as well as simply increasing total number of detections river-wide. There are two arrays of antennas at this site so, theoretically, movement direction can be evaluated. For fish that are detected here there is little more that can be said other than they were present at a certain date and time since there is no comparison being made to main channel sites, control sites, or other restoration sites.

- 4) McElmo Creek, ~ 25 miles upstream of Bluff, UT
  - a. Five pass-over antennas were installed in McElmo Creek approximately 200m upstream of the confluence with the San Juan River.
  - b. The antennas are served with a multiplexing antenna controller and the controller is accessed using a Verizon cell data modem.
  - c. Four more antennas, along with a master controller and solar panel, were installed at the bridge crossing on McElmo Creek.

Antennas were initially installed in McElmo Creek near the mouth where it joins the San Juan. These antennas were installed as part of a "design" to look at fish movements (all fish) in and out of McElmo Crk. There are two arrays of antennas at this site so movement direction can

theoretically be evaluated. These antennas are continuing to function even though they are past their planned life-span, albeit at a reduced level of effectiveness due to burial by sediment and two of the 5 antennas being flushed away from floods.

McElmo Creek Bridge--These antennas were installed as part of a rework of the bridge abutment and, since the contractor had heavy equipment and was going to be using large rip rap to create a new channel, it was relatively easy and cheap to install a series of antennas. Antennas installed at the McElmo Creek Bridge were not installed as part of a "design", although there are two arrays of antennas, one upstream and the other downstream of the Bridge. Thus movement direction and ability of fish to swim up the channel can be assessed. Additionally, when combined with antennas approximately 300 yards downstream at the mouth of McElmo, the antennas can be used to assess direction, timing, and movements of fish that come in and out of McElmo Creek.

- 5) Submersible antennas located near the waterfall on the San Juan River near Gouldings, AZ.
  - a. Submersible antennas are installed at various locations including the waterfall near Gouldings, AZ, and Colorado pikeminnow spawning bar near 4-Corners Bridge, CO, UT, AZ, NM.
  - b. Additional submersible antennas and batteries are being purchased in 2016 to augment detections at additional sites.

A single semi-permanent antenna has been installed at the waterfall downstream of the falls. This antenna was installed as part of a design to determine species, timing, and numbers of fish visiting the Piute Farms Waterfall and which are precluded further movement upstream.

- 6) Floating PIT tag antenna system
  - a. A floating PIT Tag antenna system has been constructed and used in the San Juan in several locations including below the waterfall in the San Juan River and in the river between Hogback diversion and Bluff, UT. The system will also be deployed in the upstream portions of the San Juan Drainage including the Animas and upper San Juan rivers.

Proposed sites:

1) Shiprock Bridge Secondary Channel--This site consists of a restored secondary channel that will have a concrete inlet at the mouth. We propose to install a two-array system as part of the concrete apron, which would reduce risk of antennas being destroyed by flooding. Antennas installed here would consist of a two-array system that could give information on species and timing of use, as well as direction of movement in and out of the secondary channel.

2) Four-Corners Bridge---The Four-Corners Bridge is being reworked due to erosion of rip rap on the bridge abutment on the upstream side of the north abutment. Antennas could be installed at this site as part of the repair work on the rip rap. River-wide antennas would be ideal, but incorporating the antennas into the rip rap at the foot of the bridge is more likely. These antennas would not be part of a "design" but could provide more detections of fish in this portion of the river as well as information on a potential spawning bar for Colorado pikeminnow that may be located just upstream. Since this would not be a multiple-array system the data would only provide information on species, number, and timing of movements.

**METHODS:**

- 1) Stationary PIT tag antennas will be contacted periodically (bi-weekly) to check the settings, download the data, and perform diagnostics of the systems. Sometimes problems arise (batteries drain down due to lack of sun, antennas are washed away, wires are cut) that cannot be solved remotely. In these cases a site visit must be conducted by a technician to repair the system. The SOW and budget include the replacement of one antenna during the work period. If an antenna is not replaced the funding will be used to purchase additional PIT tags or submersible antennas to be used by other biologists.
- 2) Submersible antennas will be deployed at the waterfall for a continuous period from late February 2019 till August 2019 in an attempt to document fish movements and usage of the river immediately downstream of the waterfall.

**TASKS – 2019**

1. Maintain and operate stationary and portable PIT tag antennas
2. Replace one PIT tag antenna (PNM Passage)

**FY 2019 BUDGET****O&M of Existing Antenna Systems, Replacement of one Antenna, and Data Management****A) Labor**

Position	Salary total/hr	No. persons	Total Hours	Total cost
BOR Technical Representation for Contracts and Agreements	\$80.00	1	40	\$3,200.00
BioMark or USU Staff (contract)	\$80.00	1-2	100	\$6,400.00
<b>Total</b>				<b>\$9,600.00</b>

**B) Travel**

Position	Destination	Purpose	Days	Lodging per day/total	Per diem per day/total	Other*
Reclamation Technical representative	Farmington, Shiprock	Project evaluation or field trips	2 trips @ 5 days/trip	\$100/\$500	\$40/\$400	\$0
BioMark/USU representative	Boise, ID; Kennewick, WA; various	Field trips O&M Antennas	2 trips @ 5 days/trip	\$100/\$1000	\$40/\$400	\$2500
<b>Total</b>				<b>\$1,500.00</b>	<b>\$800.00</b>	<b>\$2,500.00</b>

\*mileage of 5,000 mi at \$0.55/mile

**C) Equipment**

Item	Unit Cost	Number	Total cost
Antenna system	\$10,000	1	\$10,000
<b>Total</b>			<b>\$10,000.00</b>

**Budget Summary  
FY-2019**

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<b>Category</b>	<b>Total</b>
Labor	\$9,600.00
Travel	\$4,800.00
Equipment	\$10,000.00
<b>Total FY2018 Budget</b>	<b>\$24,400.00</b>

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**Projected funding:**  
**FY-2020** \$40,000.00  
**FY-2021** \$40,000.00

Crockett	<p><b><i>How can the technical aspects of this SOW be improved?</i></b> No recommendations</p> <p><b><i>What is this SOW's contribution to recovery?</i></b> Document movement, and survival of rare fish, including tributary use and seasonal movement; evaluate fish passage success.</p>
Davis	<p><b><i>How can the technical aspects of this SOW be improved?</i></b> No comments</p> <p><b><i>What is this SOW's contribution to recovery?</i></b> As we've already seen, these antennas provide the Program with a wealth of data. Pending the analyses of FY18-23 we will have a better understanding of the cost-benefit of continuing to maintain these antennas.</p>
Gori	<p><b><i>How can the technical aspects of this SOW be improved?</i></b></p> <p><b><i>What is this SOW's contribution to recovery?</i></b></p>
Lamarra	<p><b><i>How can the technical aspects of this SOW be improved?</i></b> No comment</p> <p><b><i>What is this SOW's contribution to recovery?</i></b> No comment</p>
Mazzone	<p><b><i>How can the technical aspects of this SOW be improved?</i></b> No Comment.</p> <p><b><i>What is this SOW's contribution to recovery?</i></b> A significant amount of data has been generated by the operation of multiple PIT Interrogation Arrays within the Basin, though there is significant work required to continually distill data into useable information for recovery. I would suggest maintaining the PIT Interrogation Array infrastructure into the foreseeable future. The need for future O&amp;M could hopefully be refined by SOW # 23 Task 2 (lines 118-140).</p>
McKinstry	<p><b><i>How can the technical aspects of this SOW be improved?</i></b> A strategic plan could be developed due guide efforts on where to place PIT tag antennas. To date it has been somewhat haphazard and dependent entirely upon the suitability of the location. More time is needed to allow the antennas to collect data and see what they provide. The system at Hogback is the only one that is really in a great location. A new system should be incorporated into the new Fruitland passage, as well as the APS weir when it gets rebuilt for passage. It would also be nice to incorporate antennas in the lower river, but it is difficult to install them without any structures. The rebuilding the bridge at 4-corners should be pursued as a new site.</p> <p><b><i>What is this SOW's contribution to recovery?</i></b> Getting good and numerous detections/resights of tagged fish is critical for survival and pop'n estimation. Hard to say whether effort should be put into Pop estimates with physical recaptures or more work with antennas. The issue if maintaining them is important.</p>
Miller	<p><b><i>How can the technical aspects of this SOW be improved?</i></b> The SOW describes the O&amp;M, however, the title also states "Evaluation of Data". I recommend removing "Evaluation of Data" from the title.</p> <p><b>Response: This was corrected</b></p> <p><b><i>What is this SOW's contribution to recovery?</i></b></p>

Schleicher	<p><b><i>How can the technical aspects of this SOW be improved?</i></b> No comment</p> <p><b><i>What is this SOW's contribution to recovery?</i></b> No comment</p>
Townsend	<p><b><i>How can the technical aspects of this SOW be improved?</i></b> No Comment</p> <p><b><i>What is this SOW's contribution to recovery?</i></b> No Comment</p>
Wesche	<p><b><i>How can the technical aspects of this SOW be improved?</i></b> The O &amp;M portion of the scope is well-written and adequate. Nothing is really mentioned about "evaluation" and this could be removed from the title. The SOW should reference the UNM work regarding evaluation of PIT tag data.</p> <p><b><i>Response: This was corrected as per Miller's comment above</i></b></p> <p><b><i>What is this SOW's contribution to recovery?</i></b> This work provides important documentation of recovering endangered fish populations in the SJR and provides contact with many fish we haven't collected by other means.</p>
Westfall	<p><b><i>How can the technical aspects of this SOW be improved?</i></b> Looks good – I support</p> <p><b><i>What is this SOW's contribution to recovery?</i></b></p>
Zeigler	<p><b><i>How can the technical aspects of this SOW be improved?</i></b> A large amount of data is collected from all of these remote PIT tag antennas. When the data is downloaded is it directly uploaded to the STreaMS database or does it go through any type of error checking/clean-up before being uploaded?</p> <p><b><i>Response: Data is downloaded as is and is not edited.</i></b></p> <p><b><i>What is this SOW's contribution to recovery?</i></b> The data being collected from these remote PIT tag antennas is being used in several different studies to determine its usefulness for assessing recovery of Colorado Pikeminnow and Razorback Sucker in the San Juan River. Continued collection of remote detections will be valuable for assessing survival and population abundances of both endangered species.</p>
PO	<p><b><i>How can the technical aspects of this SOW be improved?</i></b> Because of the new PIT antenna being installed at the Fruitland diversion, should there be O&amp;M considered for those as well?</p> <p><b><i>Response: This is a good question, but it is unknown how much to anticipate. I am assuming that the system is more reliable than the other systems since it will be integrated in the design and antennas will not need to be replaced or maintained as much as the less permanent systems like at Hogback.</i></b></p> <p><b><i>What is this SOW's contribution to recovery?</i></b> We also agree a strategic plan should be developed to guide efforts on where to place PIT tag antennas.</p>