

# ***NIWQP Plan for Selenium Remediation at the Colorado River Wildlife Area Backwater*** (River mile ~176)

(a.k.a., Humphrey's or Island Backwater) - January 2003

## **Site Description**

The Colorado River Wildlife Area (CRWA) is a habitat replacement site for the Colorado River Salinity Control Program. This property is located along the north bank of the Colorado River between 30½ and 31 Roads approximately 4 miles east of downtown Grand Junction. The CRWA was purchased in 1992 and consists of 200 acres, of which the Bureau of Reclamation (Reclamation) holds title to approximately 127 acres, and the state of Colorado holds title to the balance of 73 acres (south of bike path). This property is shown in the aerial photo below. The Colorado Division of Parks and Outdoor Recreation funded and manages the recreation development which is limited in nature and non-disruptive to wildlife. Reclamation funded the wildlife habitat development, and the Mesa County Land Trust manages those features under contract with Reclamation. These lands were developed and are managed to replace a portion of the wildlife habitat lost due to lining irrigation canals and piping laterals in the Grand Valley.



CRWA Backwater showing sampling locations

There are two large ponds totaling 44 surface acres within the CRWA. These are described below as the East and West Pools. Water sources for the ponds are ground water from upgradient irrigated areas and diversions from Lewis Wash which is a tributary to the Colorado River. Lewis Wash carries irrigation drainage from land served via carriage contracts by the federal Grand Valley Project (operated by the Grand Valley Water Users Association) and from other lands served by the non-federal Grand Valley Irrigation Company. Lewis Wash and a Grand Junction Drainage District drain (known as GJ3; located at approximately 30 1/4 Road) flow into a one-mile long secondary channel where endangered Colorado pikeminnow have been captured. This secondary channel is also known as the CRWA Backwater.

### **Problems and Needs**

The CRWA Backwater is the primary area of concern and is affected by selenium from irrigation drainage similar to other endangered fish habitat in the Grand Valley. A general ***problem statement*** has been developed for the entire Grand Valley which states:

"Selenium concentrations in the Colorado River and most backwater and bottomland aquatic habitat (including tributaries within the 100 year flood plain) in the Grand Valley are at levels that adversely affect reproduction in selenium sensitive species including some aquatic birds and endangered fish".

In addition, a general ***needs statement*** for the Grand Valley states:

"Reduce or prevent selenium impacts to fish and wildlife in the Colorado River and in backwater and bottomland habitat (including tributaries within the 100 year flood plain) in the Grand Valley".

The NIWQP wishes to reduce or prevent selenium impacts to endangered fish and other biota in the CRWA Backwater/secondary channel. Both the USFWS and USGS have collected data within this area to help define the level of contamination.

### ***Water & Sediment data:***

Inflow to the backwater channel is composed of diffuse ground water from upgradient irrigated areas and water from three surface tributaries: Lewis Wash, the West Pool outflow, and the GJ3 Drain. During irrigation season, a large portion of Lewis Wash is diverted into the CRWA ponds, and thus makes up a significant component of the west pool outflow. During the

irrigation season, Lewis Wash has relatively low selenium concentrations, and as a result, the west pool outflow is typically at or below 5 ppb from late April to approximately December. In the backwater area used by endangered fish, median concentrations during the irrigation season are less than 2.5 parts per billion (ppb), with flow from the Colorado River, Lewis Wash, and the GJ3 Drain acting to dilute any highly concentrated ground water that may be seeping into the backwater.

The main period of concern at this site is during the non-irrigation season (November - March) because flow is considerably lower and dilution is less. Lewis Wash enters the secondary channel near its upper end typically flowing at less than 0.5 cfs during the non-irrigation period. The median non-irrigation season concentration in Lewis Wash is 23 ppb with samples ranging from 6.2 to 47 ppb. Downstream of the Lewis Wash confluence, the median concentration in the backwater channel is 6.7 ppb.



Beaver dam in secondary channel above CRWA west pool outlet

Moving downstream in the backwater to the site below the outflow from the west pool, the median concentration in the backwater decreases slightly to 6.4 ppb indicating there is minimal change in Se concentrations despite the influx of high selenium ground water in the east and west CRWA ponds. Non-irrigation season concentrations in the backwater downstream from the

west pool inflow range from 3.5 to 7.5 ppb. Median flow in the backwater downstream from the outflow of west pool is 0.88 cfs, which is approximately that of Lewis Wash and the west pool outflow combined.



CRWA west pool outlet

Limited water data for the lower portion of the backwater, downstream of the GJ3 drain, indicate concentrations may be increasing significantly during the non-irrigation season. This is likely the result of inflow from either the GJ3 drain or diffuse ground water. One sample from the GJ3 drain in March 1999 showed a selenium concentration of 18.6 ppb. Sediments throughout the channel are low in selenium with a maximum value of 1.4 ppm.

#### Biota Data:

Biota samples were collected in CRWA backwater at the West Pool outlet and below during July and August 1998. Several species of small prey fish were collected, including green sunfish, mosquitofish, fathead minnows, plains killifish, sand shiners, and red shiners. With all species combined, the median selenium concentration was 6.7 ppm dry weight (DW), with a range of 5.8 ppm DW to 7.5 ppm DW. These selenium concentrations are above the dietary selenium toxicity threshold of 3 ppm DW, potentially exposing endangered fish to high selenium concentrations. One zooplankton sample

collected below the West Pool outlet contained only 0.8 ppm DW selenium, which is below the concentration of concern. Fish samples collected above the West Pool outlet in July and August 1998 had a median selenium concentration of 4.7 ppm DW with a range of 2.6 to 9.1 ppm DW. Zooplankton samples collected above the West Pool outlet contained 6.1 ppm DW selenium in July and <1.0 ppm DW in August.

Biota samples were collected from a beaver-ponded site directly above the West Pool outlet during March and August 1995. As expected, selenium concentrations were higher in the pond than in the flowing channel of the backwater. Fish samples collected from this pond included 10 fish species. During March, the median selenium concentration in combined species of fish was 9.5 ppm DW, with a range of 5.3 to 24 ppm DW. During August, the median selenium concentration was 5.9 ppm DW, with a range of 4 to 37 ppm DW. Crayfish samples contained 2.8 ppm DW selenium in March and 3.8 ppm selenium in August. Endangered fish would only have access to these ponded sites during high water events when flows top or take out beaver dams.

Fish samples were collected in the upper reach of the backwater above and below the Lewis Wash outflow in 1999. Two fish samples collected above Lewis Wash outflow contained 3.3 and 4.1 ppm DW selenium. Three fish samples collected below Lewis Wash outflow contained 4.2 to 7.2 ppm DW selenium. A zooplankton sample collected at Lewis Wash outflow contained <1.1 ppm DW selenium. Endangered fish would have access to the upper reach of the backwater only during high flow.

***Statement of CRWA Problems & Needs:***

Significant pikeminnow use has been documented in the lower reach of the backwater channel below the West Pool outlet with most of the use occurring during spring runoff when river water backs into the area. High selenium concentrations in the backwater during the non-irrigation season are contributing to long term bio-accumulation and leading to high concentrations in food organisms which endangered fish consume during their visits to the backwater. The



Lower reach of CRWA backwater

remediation need at this site is to reduce the non-irrigation season water concentrations which should lead to lower concentrations in the biota and a reduced hazard to the fish.

### **Remediation Objectives**

- Reduce selenium concentrations to 3 ppm or less in food organisms used by endangered fish in the backwater,
- If reasonable, reduce selenium concentrations in water in the ponds of the Colorado River Wildlife Area (CRWA),
- Do not exacerbate selenium problems within the CRWA,
- Use an adaptive management approach, and
- In addition to selenium, enhance the habitat, when possible.

### **Planning Considerations**

The following needs, concerns, and issues were considered during development of the alternatives:

- There is a need to protect existing physical conditions in endangered fish habitat (water temperature, channel morphology, etc.) in the lower portion of the backwater channel. Pikeminnow use the lower portion of the backwater channel during spring runoff. Flushing flows may make the channel unattractive to endangered fish. However, the available habitat has currently been reduced by sedimentation and flushing flows may be desirable to remove part of the sediment.
- Although Recovery Program personnel don't want frequent high flows, they would like to have high flows periodically flush the lower channel of sediments.
- Currently, there are issues with beavers in the area plugging the Lewis Wash diversion structure and potentially affecting the function of any remediation measures.
- Annual maintenance requirements of the "fix" should be minimized. Consideration should be given to how to address the effects of beaver dam construction in the backwater channel.
- High selenium levels in prey fish which escape from the CRWA ponds may be of concern because they are a food source for endangered fish in the backwater channel.
- Data collected over the last ten years indicate there has been a steady decline in the flow and corresponding selenium loading that is being contributed by Lewis Wash.

## **Alternatives Considered**

### Alt. No.

#### 1. ***No action***

Description: No action would be taken to change the existing situation.

Evaluation: This is not considered a viable option for the NIWQP whose mission is to reduce selenium impacts to endangered fish resulting from return flows from federal irrigation projects. It would not solve the problem.

#### 2. ***Pipe the base flow drainwater from Lewis Wash to the Colorado River and excavate the river inlet to the backwater.***

Description: The Lewis Wash base flow during the non-irrigation season would be diverted in a small pipeline and routed directly south across the secondary channel to the Colorado River. During the irrigation season, Lewis Wash would continue to be used as a water source for the CRWA ponds. The upstream inlet from the river would be excavated to allow freshening or flushing flows to enter the backwater throughout most of the year. The approximate cost would be \$50,000.

Evaluation: This concept was discarded because of anticipated difficulties in constructing and maintaining the small pipeline to convey Lewis Wash base flow across the secondary channel and across an island in a relatively unstable section of the Colorado River.

#### 3. ***Collect the outflows from the GJ3 drain, West Pool and Lewis Wash in a pipeline and route to the west around the backwater to the Colorado River.***

Description: Collection of base flows from Lewis Wash and the GJ3 Drain (during the non-irrigation season) and the outflow from the West Pool (year-round) would require a 4,700-ft long, 15-in diameter pipeline. The approximate cost for this pipeline is \$590,000 including engineering and overhead. The upper end of the secondary channel would be opened by excavating a small channel approximately two to three feet deep at the mouth. Beaver dams would be removed to create a gradient for adequate dilution flow. The total cost is approximately \$610,000.

Evaluation: This concept was discarded because of its high cost compared to other alternatives.

4. ***Dam the secondary channel and divert contaminated water in an open channel to the river***

Description: This alternative would involve the following steps:

- construct a low dam in the secondary channel immediately below the CRWA West Pool outlet (the dam would be designed to easily overtop at higher flows to allow flushing of sediments from the lower reach),
- just upstream of this structure, excavate a channel south to the river to carry both the West Pool discharge and Lewis Wash flows coming down the secondary channel,
- relocate the beavers and their existing dams to prevent Lewis Wash water from being backed into the East Pool, and prevent them from plugging the newly excavated channel, and
- excavate the inlet to the secondary channel to provide flushing flows and encourage some level of scouring in the lower reach of the secondary channel during high flow events to benefit the fish habitat.
- regularly maintain channels and relocate beavers as needed.

Evaluation: This alternative is still considered viable, but probable high costs associated with maintaining a channel across the island make it less desirable than other available alternatives. Also, it does not address high selenium flows entering the lower channel during the non-irrigation season from the GJ3 Drain.

5. ***Open channel inlet and dilute with river water***

Description: This adaptive management type alternative would be constructed in phases. The first phase would involve excavating the inlet to the secondary channel to provide year round flushing flows and encourage some scouring in the lower reach of the secondary channel during high flow events to benefit the fish habitat. This would be the first phase. Additional measures would be undertaken later, if needed. These measures might include construction of a water control structure at the inlet to the channel to control flooding and provide optimal conditions for the endangered fish. The estimated cost of the first phase is \$20,000 including contingencies, design and supervision.





Upstream inlet of the secondary channel

Photo: T. Stroh

Evaluation: This is the Core Team's recommended plan. It was selected as the logical first step or phase of an adaptive management approach to the problem. The action of opening up the inlet to establish a better connection with the river may be enough to sufficiently decrease the concentrations of selenium in the fish and other biota at this site. It is relatively inexpensive compared to the other alternatives. The need for additional measures would be evaluated and undertaken later, if deemed necessary. Additional information and more details on the plan can be found in the following section entitled Recommendations.

#### Measures considered for the CRWA ponds

In 1996, the Fish & Wildlife Service found 2 deformed mallards in a nest within the CRWA. Beyond that one incident, no other evidence of selenium impacts to migratory aquatic birds has been found, although little additional sampling has been performed. The Core Team decided in its deliberations that the main focus of NIWQP remediation activities in the Grand Valley would be on protecting endangered fish habitat. However, while performing studies at the CRWA, the

Interdisciplinary Team did look briefly at what might be done to reduce selenium levels in the 2 large ponds (to benefit aquatic bird habitat) on the site.

Lewis Wash diversions into the ponds during the irrigation season seem to maintain selenium levels in water below 5 ppb. However, during the winter, when water with low selenium concentrations is unavailable to divert from Lewis Wash, levels of selenium within the ponds climb. Ground water inflow is suspected to be the primary source of dissolved selenium. One potential method of addressing this ground water issue was discussed. It would involve treating the ground water using a permeable reactive barrier, installed along the ground water drainage path, north of the CRWA ponds. The ground water would flow through this zone and the selenium would be reduced out of the water, resulting in lower selenium concentrations in the ponds. The approximate cost would be \$2,260,000, based on a \$600/linear foot installation cost and including contingencies, engineering and overhead. The ID Team's evaluation of this concept was concluded because the cost was considered way beyond what would be reasonable for the suspected benefits to fish and migratory birds using the ponds.

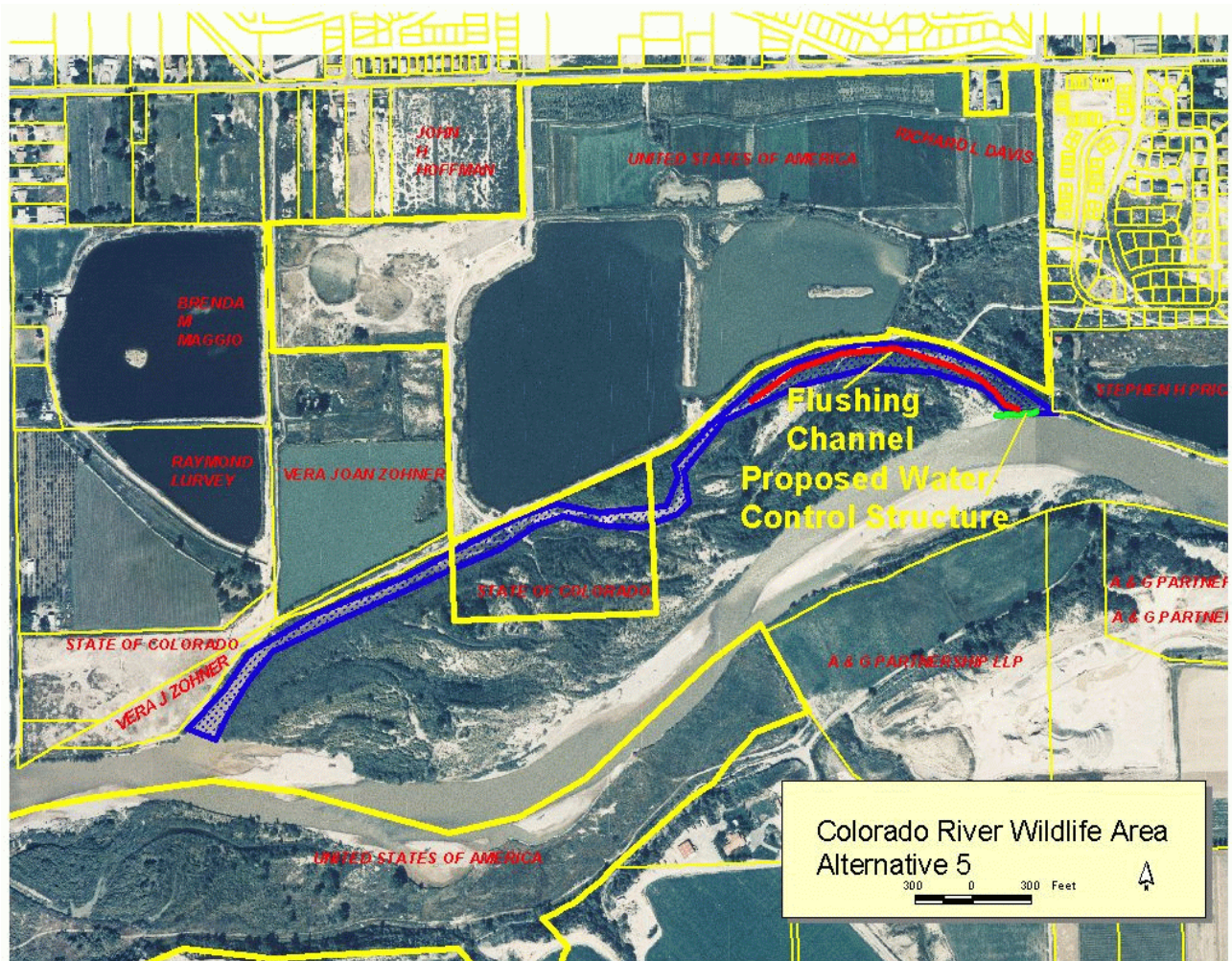
### **Public Involvement**

A workshop that invited public comment and discussion regarding the CRWA Backwater site and 2 other Grand Valley remediation study sites was held on October 30, 2001. Ten citizens attended the meeting including landowners from the CRWA vicinity. Many personal contacts were made, and ongoing coordination has been accomplished including with the following potentially affected parties:

- Grand Junction Drainage District
- Adjacent landowners
- State of Colorado (Division of Wildlife)
- Mesa County Land Trust

## Recommendations

Alternative 5 is the Core and Interdisciplinary Teams' recommended plan. The first phase would involve excavating the inlet of the secondary channel to provide year-round flushing flows and encourage some scouring in the lower reach of the secondary channel during high flow events to benefit the fish habitat. The invert of the channel would be excavated to a sufficient elevation to allow approximately 4 cfs of flow through the channel during a majority of the non-irrigation season. This would likely result in an excavation 1 to 4 feet deep along about 1,600 feet of the upper secondary channel. Excavated material (about 1,900 cubic yards) would be side cast and spread thinly on the river side of the channel. Beaver would be removed to prevent them from blocking the newly excavated channel. Permanent access would be established from 31 Road. This would be the first phase of an adaptive management approach to the problem. Additional measures would be undertaken later, if needed. These measures might include construction of a water-control structure at the inlet to the channel. The estimated cost of the



first phase is \$20,000 including contingencies, engineering, design and administrative expenses. The State of Colorado (DOW) is the landowner and has indicated that they would allow these improvements. No funding for right-of-way acquisition should be needed with the exception of some limited administrative expenses.

The Core Team recommends approval of this plan by the NIWQP Manager. Following approval and any recommended changes in the plan, the ID Team will proceed with design and construction.

### **Easement/Right-of-Way Needs/Status**

Excavation of the inlet channel envisioned in Alternative 5 will require permission be obtained from the Colorado DOW. Discussions are presently underway with the DOW to obtain a letter granting permission.

### **NEPA Compliance**

Initially, a categorical exclusion checklist will be completed and may be sufficient based on the anticipated impacts of the project. However, if more detailed NEPA analysis is needed, an environmental assessment process will be initiated.

### **Forecast of Long Term Maintenance & Funding Requirements**

Long term maintenance required for Alternative 5 would involve periodically:

- cleaning accumulated sediment from the inlet channel, and
- removing beavers and beaver dams.

It is estimated the annual cost for this work would be approximately \$3,500. This cost includes an annual site visit to check on the function of the channel, planning/arranging the needed maintenance, equipment rental, and an operator's time.

### **Monitoring Plan**

Additional water, sediment and biota samples will be collected prior to the construction of the remediation plan. Pre- and post-project sampling will include areas where endangered fish have been found.

After construction, water and biota data will be collected in areas likely to be affected by increased flow through the secondary channel. This will include the

following sites:

- Secondary channel above and below the West Pool outlet,
- West Pool and GJ3 Drain outflow
- Lower reach of the secondary channel below the confluence with the GJ3 Drain

The measure of success of this remediation project will be how well we meet the objective of reducing selenium concentrations to 3 ppm or less in food organisms used by endangered fish.

**Periodic Results/Changes** — Changes resulting from the remediation activities will be evaluated at regular intervals, i.e., 1 year, 2 years, etc. Photos will be included. (info to be added in future years)

**Record of Periodic Maintenance/Plan Modifications**  
(info to be added in future years)