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DEPARTMENT OF THE INTERIOR  
FISH AND WILDLIFE SERVICE  
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June 21, 1994

In Reply Refer To:  
AESO/ES  
2-21-93-F-348

E.A. Wueste  
Federal Highway Administration  
234 N. Central Avenue, Suite 330  
Phoenix, Arizona 85004

Dear Mr. Wueste:

This responds to your request of January 5, 1994, for formal consultation pursuant to section 7 of the Endangered Species Act (Act) of 1973, as amended, on proposed road repair on Arizona State Route 82 at MP 15.4 and 16.9, Santa Cruz County, Arizona. The species of concern is Gila topminnow (Poeciliopsis occidentalis). The 90-day consultation period began on January 6, 1994, the date your request was received in our office, and was scheduled to end on May 21, 1994. At the request of the Fish and Wildlife Service (Service) the consultation was extended until June 20, 1994.

The following biological opinion is based on information provided in the December 27, 1993 biological evaluation (BE), a letter from your office dated June 10, 1994, a site visit of May 31, 1994, data in our files, and other sources of information.

#### BIOLOGICAL OPINION

It is my biological opinion that the proposed repair, replacement, and construction of bank revetment on Sonoita Creek at MP 15.4 and 16.9 of Arizona State Route 82 is not likely to jeopardize the continued existence of Gila topminnow.

## BACKGROUND INFORMATION

### Species Description

*Gila topminnow* was listed as an endangered species on March 11, 1967. No critical habitat has been designated for this species. *Gila topminnow* is a small, one to two-inch long, livebearing fish of the family Poeciliidae (Minckley 1973). It occurs in the Gila, Sonora, and de la Concepcion River drainages in Arizona, New Mexico, and Sonora, Mexico, but is listed only in the United States portion of its range (Minckley 1973, Vrijenhoek *et al.* 1985). The species was once one of the most common fishes in the Gila River and its tributaries (Hubbs and Miller 1941). Destruction of its habitat through water diversion, stream downcutting, backwater draining, vegetation clearing, channelization, water impoundment, and other human uses of natural resources; plus competition with and/or predation by nonnative fish species, most notably mosquitofish (*Gambusia affinis*), have resulted in extirpation of *Gila topminnow* throughout most of its range (Meffe 1983, U.S. Fish and Wildlife Service 1984). At present, *Gila topminnow* is known from only 10 naturally occurring populations in the United States and about 20 reintroduced populations.

Sonoita Creek supports one of the naturally occurring populations of *Gila topminnow*. Four of the other naturally occurring populations are in waters tributary to Sonoita Creek. *Gila topminnow* in Sonoita Creek occur sporadically from Cottonwood Spring downstream to the mouth, excluding Patagonia Lake (Minckley *et al.* 1977, Simons 1987, Bagley *et al.* 1991, Brown and Abarca 1992, Arizona Game and Fish Department unpub. data, U.S. Fish and Wildlife Service unpub. data). Particularly above Patagonia Lake, their distribution throughout the creek varies over time due to shifts in habitat availability caused by variations in flow and channel configuration. The only ongoing fish monitoring in Sonoita Creek above Patagonia Lake is on The Nature Conservancy's Patagonia Preserve (Preserve) located about 1/3 mile above the proposed action area. Fish monitoring at the Preserve is conducted on an annual to biennial basis by the Arizona Game and Fish Department (AGFD). *Gila topminnow* have not been collected by AGFD at the Preserve since 1990 (Simons 1987, Bagley *et al.* 1991, Brown and Abarca 1992). No *Gila topminnow* were found at the proposed project site during surveys by the action agency's consulting biologists. On May 31, 1994, a Service biologist observed three juvenile *Gila topminnow* in a backwater in the project area.

### Project Description

The proposed action is to construct, repair, or replace bank revetment along approximately 1,812 linear feet of Sonoita Creek in two nearby locations to protect the roadbed of State Highway 82 south of the town of Patagonia in Santa Cruz County, Arizona. The downstream location is at mile post (MP) 15.4 and the upstream location is at MP 16.9 (Figure 1). Land at both sites is privately owned by the Circle Z Ranch. Easements exist for the highway and proposed revetment work.

MP 15.4  
At MP 15.4, revetments already exist along most of the 1,209 feet of stream proposed for modification. These revetments date from at least 33 years ago. In flooding during winter-spring 1993, the existing revetments were damaged and areas of the roadbed are eroding. The State Highway 82 roadbed forms the immediate southeast channel bank of Sonoita Creek, although the pavement is approximately 15 to 30 feet away from the low flow stream channel. The proposed action is to repair 770 linear feet of these revetments and to replace 439 linear feet with new revetment.

Old and proposed new revetment consist of "rail bank protection" where lengths of steel railroad rail are embedded end-on into the stream bed angling in towards the bank. Galvanized welded wire mesh is then placed inside the rails and back-filled with crushed rock (Figures 2 and 3). The rails would be driven 10 feet below the streambed and the wire-enclosed rock would extend 2 to 4 feet below the streambed.

Diversion of the stream would be required to allow heavy equipment to work in the streambed excavating the trench for the revetment. Equipment to be used in the streambed would include backhoes, front end loaders, and dump trucks. Total stream channel disturbance would be about 0.5 acres; an area 1209 feet long and 18 feet wide.

Staging, mobilization, and materials stockpiling areas would be located outside of the floodplain. No equipment would be stored or serviced in the streambed. Sediment input into the stream would be mitigated by constructing a barrier of impervious materials to separate the diverted streambed from the work area. Water surfacing in the work area or seeping through the barrier would be placed in a settling pond and filtered through straw bales covered with filter fabric before being returned to the stream. Location of the settling pond is not specified.

The floodplain at MP 15.4 is a narrow rocky canyon. Segments of the low flow channel are located immediately at the foot of the existing revetment along about 400 to 600 feet of the total revetment length. In the remaining areas the low flow channel is located less than 15 feet from the base of the revetment.

In this area Sonoita Creek has a moderate gradient and the predominant aquatic habitat type is gravel/cobble-bottomed riffle. Little suitable habitat exists for Gila topminnow in the mainstream. However there is a moderate amount of backwater, secondary channel, and side-channel habitat with low velocities and soft substrate that appears to be suitable for Gila topminnow.

Riparian vegetation along this stretch of stream is of moderate density. On the southeast channel bank in the revetment area, ash (Fraxinus sp.), willow (Salix sp.), walnut (Juglans sp.), sycamore (Plantanus sp.), and elderberry (Sambucus sp.) are common species, often growing through and against the revetment. Much of this vegetation would be removed during the proposed action, although attempts would be made to minimize tree removal where there are larger trees. The BE identifies two cottonwood trees located at the base of the revetment of greater than 12 inch diameter at breast height that would be preserved. No cottonwood are present on the reveted bank; however, two large sycamore are present and it is assumed they are the trees identified for preservation.

Construction would take 6 to 8 weeks and would be conducted during the period of September through January to avoid disturbing the rose-throated becard (Pachyramphus aglaja) which is known to nest in the area of MP 15.4.

MP 16.9  
At MP 16.9, Sonoita Creek is cutting a meander bend into the mouth of Alum Canyon. This cutting was accelerated by the winter-spring flooding of 1993 and a raw eroding 6 to 8 foot vertical embankment is present for about 200 to 500 feet upstream and downstream from Alum Canyon. The erosion is threatening to undercut State Highway 82 at the Alum Canyon box culvert. The proposed action is to install revetments on the vertical embankment for 394 linear feet upstream of and 209 linear feet downstream of the box culvert. The revetment would consist of the same "rail bank protection" described for the proposed work at MP 15.4; however, the rails would be driven 15 feet below the streambed and the wire-enclosed rock will extend 5 feet below the streambed.

Diversion of the stream would be required to allow heavy equipment to work in the streambed for excavating the trench for the revetment. Equipment to be used in the streambed would include backhoes, front end loaders, and dump trucks. Total stream channel disturbance would be about 0.25 acres; an area 603 feet long and 18 feet

wide. Diversion would be accomplished by constructing a small temporary earthen dam that would turn the stream into an old high flow channel which cuts across existing low flow channel bend. Channel disturbance from dam construction is not included in the 0.25 acres. A small hand-constructed log and debris dam is present at the proposed diversion site but does not dam the stream sufficiently to force water through the high flow channel. This dam appears to have been constructed for recreational purposes.

Staging, mobilization, and materials stockpiling areas would be located outside of the floodplain. No equipment would be stored or serviced in the streambed. Sediment input into the stream would be mitigated by constructing a barrier of impervious materials to separate the diverted streambed from the work area. Water surfacing in the work area or seeping through the barrier would be placed in a settling pond and filtered through straw bales covered with filter fabric before being returned to the stream. Location of the settling pond is not specified.

At MP 16.9, Sonoita Creek flows through a relatively wide valley. The floodplain is approximately 200 to 300 feet wide. The low flow channel is located along the tail slope of the vertical embankment. Here the stream is of moderate gradient and the predominant aquatic habitat type is gravel/cobble-bottomed riffle or run. Little suitable habitat exists for Gila topminnow in the mainstream. Extensive water-cress covered shallows flanking the main flow may contain some habitat suitable for Gila topminnow.

The south bank where the revetment would be placed is basically barren of riparian vegetation. There are extensive cottonwood and willow on the north bank and along the high flow channel.

Construction would take 6 to 8 weeks. Construction at this site could be done at the same time as the work at MP 15.4 or at another time.

The rock fill to be used in both segments of the proposed project would be supplied by the contractor and would come from a commercial source or an established quarry. The Federal Highway Administration would require that the contractor or materials supplier meet any necessary environmental compliance requirements. For the purposes of this biological opinion, the Service assumed that appropriate environmental compliance has already been accomplished for the fill source. If this assumption is not correct and listed species may be affected by the removal of the material, then additional section 7 analyses may be required. Although the Federal Highway Administration would not be directly involved in the removal of fill

materials for use in this project, such removal is interdependent to and interrelated with the action being evaluated in this opinion and any effects on listed species of fill removal would require compliance with section 7 of the Endangered Species Act.

## EFFECTS OF THE ACTION

### Environmental Baseline

The environmental baseline includes past and present impacts of all Federal, State, or private actions in the action area, the anticipated impacts of all proposed Federal actions in the action area that have undergone formal or early section 7 consultation, and the impact of State and private actions which are contemporaneous with the consultation process. The environmental baseline defines the current status of the species and its habitat to provide a platform to assess the effects of the action now under consultation.

The status of Gila topminnow is poor. Nine of the ten natural populations of the species are small and isolated and only three of the natural populations are free of mosquitofish. Reintroduction efforts have had low success with only about 9 percent survival in the over 300 sites stocked since the 1930's.

Sonoita Creek is a highly perturbed aquatic system. Since the mid 1800's the watershed has undergone dramatic changes (Hastings and Turner 1965, Minckley 1969, Glinsky 1977). Large cienega and marsh areas have been drained and converted to agricultural or residential areas. Construction and maintenance of railroads and roads have altered the natural channel in a number of places and altered the available aquatic habitat. Livestock grazing and agriculture have destroyed riparian vegetation and reduced groundcover. The construction of Patagonia Lake eliminated several miles of stream habitat, altered the hydrology of the stream system and introduced a variety of nonnative fishes, many of which are predatory. Other nonnative species have been introduced by private and public parties and some have had adverse impacts on Gila topminnow and the aquatic ecosystem of Sonoita Creek.

Some portions of the watershed are being protected and restored, such as The Nature Conservancy's Sonoita Creek Preserve and the U.S. Forest Service's Redrock Watershed Action Plan. However, burgeoning suburban development in the watershed is further altering water availability, distribution, and runoff patterns in the drainage.

Although not well documented, the status of Gila topminnow in Sonoita Creek above Patagonia Lake is considered to be precarious. Much of the historic backwater and marsh habitat of this species in upper Sonoita Creek has been filled or dewatered. Channelization by road embankments, bridge abutments, and flood control dikes have simplified the aquatic habitat and favored the formation of a predominance of areas of straight channel with fast flow as opposed to meandering channels with slower flow and frequent backwaters.

#### Direct and Indirect Effects of the Proposed Action

The proposed repair, replacement, and construction of rail-bank revetment in Sonoita Creek along State highway 82 is expected to have adverse impacts to Gila topminnow and their habitat.

At MP 15.4, the existing roadbed confines the stream to a portion of the original canyon bottom. This confinement results in the stream flowing directly against the road embankment whenever hydraulic conditions force water to the east side of the channel. Stream flow against the embankment erodes that embankment and thus requires some type of revetment to preserve the roadbed. Because the channel is naturally narrow here, the roadbed does not remove a significant portion of the original channel available to the stream. Backwater, marsh, and other slow-water habitats were naturally limited by the canyon confinement and the moderate gradient. The 1,209 feet of channel with rail-bank revetment probably naturally provided only limited habitat for Gila topminnow. However, Gila topminnow are present in the area and three juveniles were observed in May 1994 in a backwater located between a rock outcrop and the revetment.

Channel alteration resulting from the proposed work at MP 15.4 may affect the long-term configuration and stability of the stream channel and availability of various habitat types. The proposed work would not expand the area of bank under revetment. Therefore, no change from the current conditions would be expected as a long-term effect of revetment presence. Nevertheless, substantial alterations to the channel in the project area would occur as a result of the proposed action. The existing stream channel would be temporarily diverted away from the base of the revetment. Because of the narrow character of the floodplain, diversion would require shunting the water to the far western side of the low flow channel. Even with diversion, only a narrow dewatered strip would be available for heavy machinery work in parts of the project area. Therefore, some encroachment of the machinery and spoils into the live water may be expected.

The proposed project would not allow material storage or equipment servicing in the streambed (either wet or dry). However, whenever equipment is being used in or near a streamcourse the accidental introduction of petroleum products or other toxic chemicals into the water is a possibility. Such an accident could result in a kill of fish in the project area and downstream, including Gila topminnow.

Diversion of the stream would also eliminate most, if not all, of the existing backwaters, marshy areas, and side channels which currently provide suitable Gila topminnow habitat within the project area. The backwater where juvenile topminnow were observed would be dewatered. Following completion of the project, the stream would be allowed to naturally reform a channel. Backwaters, side channels, and marshy areas may reform over time, depending upon the extent to which the floodplain surface is altered.

Additional adverse effects may occur through removal and destruction of riparian vegetation. The existing revetment now has substantial riparian growth inside and at the base. A number of trees of greater than 6 inch diameter are present. In order to repair and replace the revetment, much of this riparian vegetation would need to be removed or would be crushed by the movement of heavy machinery. Riparian vegetation provides important components of the aquatic habitat including shade, nutrients, and bank stabilization (Meehan *et al.* 1977, Knight and Bottorff 1981, Osborne and Kovacic 1993, Tait *et al.* 1994). Because of the limited extent of the proposed project, the generalistic nature of Gila topminnow regarding temperature and food, and the existing temperature and nutrient regimes of Sonoita Creek; loss of the riparian vegetation in the action area is not expected to have major impacts on Gila topminnow in Sonoita Creek. Some added sediment input into the stream can be expected both from the disturbance created during construction and from the removal of stabilizing riparian vegetation. Due to the rocky nature of the stream channel, removal of riparian vegetation is not likely to result in any significant streambank erosion, either in the project area or upstream or downstream.

At MP 16.9, the stream at the project site provides little habitat that may currently support Gila topminnow. The eroding embankment where the revetments are to be constructed is seriously destabilized and has little riparian vegetation. Disturbance of the embankment in the construction may increase the short-term sediment movement into the stream channel but should substantially decrease the sediment movement in the long-term. A substantial riparian vegetative community exists on the west streambank and that streambank and its riparian vegetation may be damaged by heavy machinery during construction. Such damage could increase erosion of that bank and alter the recovery of the stream after construction is completed.

As discussed for MP 15.4, accidental introduction of toxic substances into the streamcourse is a possible result of the proposed action and would adversely affect Gila topminnow.

The primary concern at MP 16.9 is the channel alteration that would occur as a result of diverting the stream through the old high flow channel. The high flow channel is 882 feet long as compared to the existing low flow channel which is 1,379 feet long from the head to the mouth of the high flow channel. Thus, 497 linear feet of stream would be lost during construction. The diverted channel would undergo the same elevational drop as the present channel, but the drop would occur in one-third the distance. Therefore, the diverted stream would be straighter with a higher flow velocity than the existing stream. Straight channels with moderate to high gradients and high flow velocities are unlikely to support Gila topminnow.

The mouth of the high flow channel is presently 2 to 3 feet higher than the existing channel of Sonoita Creek. Because of this difference, downcutting of the high flow channel would result from the diversion until the high flow channel is at or near the level of the existing channel. If the 882 linear feet of channel downcuts 2 feet at an average width of 4 feet, it would carry 260 cubic yards of material downstream. This material would be transported under low discharge conditions, so transport distances would be short, particularly for coarser sediments (Leopold and Maddock 1953). Therefore, pools, and slow velocity areas for an undetermined distance downstream from the construction site would be filled with sediment in the short-term (Heede and Rinne 1990). Slow velocity areas are most likely to support Gila topminnow. The scoured material would move through the system and eventually end up in Patagonia Lake.

Upstream and downstream changes in stream channel configuration may result from the diversion and downcutting, particularly if the low flow remains in the new channel following project completion. Rediversion of the low flow into the pre-project channel may or may not be achievable. The stream may revert to the newly lowered high flow channel during the next flood.

Construction of a small earthen dam to shunt the low flow into the old high flow channel would result in damage to riparian vegetation and streambank stability in the dam area. Long-term erosional problems are possible when riparian destruction and soil disturbance from heavy machinery are then subjected to impoundment followed by breaching of the dam.

### Cumulative Effects of the Proposed Action

Cumulative effects are those effects of future non-Federal (State, local government, or private) activities on endangered or threatened species or critical habitat that are reasonably certain to occur during the course of the Federal activity subject to consultation. Future Federal actions are subject to the consultation requirements established in section 7 and, therefore, are not considered cumulative in the proposed action.

The increasing population and development of the Sonoita Creek watershed foretell abundant future State, local, and private activities which would cumulatively affect Gila topminnow and their habitat in Sonoita Creek. These activities may include increased urban and suburban development, increased land disturbance, decreased vegetative cover, increased water use and groundwater pumping, and increased water pollution.

### INCIDENTAL TAKE

Section 9 of the Act, as amended, prohibits any taking (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct) of listed species of fish and wildlife without a special exemption. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to, and not intended as part of, the agency action is not considered a prohibited taking provided that such taking is in compliance with the incidental take statement. **The measures described below are nondiscretionary, and must be undertaken by the agency or made a binding condition of any grant or permit issued to the applicant, as appropriate.**

The Service anticipates that the proposed repair, replacement, and construction of bank revetment on Sonoita Creek at MP 15.4 and 16.9 of Arizona State Route 82 would result in incidental take of Gila topminnow through direct mortality and through habitat loss and alteration.

Gila topminnow, present in backwaters, marshes, and side channels in the stream segment which would be diverted may be stranded and die from loss of water. Stranded fish may also be crushed during heavy equipment operation or poisoned by accidental introduction of toxic substances. Because population estimates of Gila

topminnow are not obtainable due to sampling difficulties and would be of little value due to the rapid population changes inherent in a short-lived, highly fecund species such as this, incidental take due to direct mortality cannot be quantified. However, if more than 20 dead fish of any species are found in the project area or within 500 yards downstream during project activities, the anticipated level of incidental take will be considered to have been exceeded.

Gila topminnow may also be taken as a result of the proposed action through loss or alteration of the habitat by creating more confined, faster velocity habitats with little or no backwaters. Therefore, incidental take anticipated from the proposed project is take of all Gila topminnow habitat in the 1,812 linear feet of Sonoita Creek where revetments would be placed or repaired, plus 50 linear feet on each end of the proposed action, and 100 linear feet in the area of the earthen dam to be constructed at MP 16.9. In addition substantial habitat modification through sediment and gravel transport is anticipated for 2,600 linear feet downstream of the proposed work at MP 16.9.

If, during the course of the action, the number of dead fish in the project area or the extent of habitat loss or alteration reaches or exceeds the anticipated limits stated above, the Federal Highway Administration must reinitiate consultation with the Service immediately to avoid violation of section 9. Operations must be stopped in the interim period between the initiation and completion of the new consultation if it is determined that the impact of the additional taking will cause an irreversible and adverse impact on the species, as required by 50 CFR 402.14(i). An explanation of the causes of the taking should be provided.

#### Reasonable and Prudent Measures

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize the incidental taking authorized by this biological opinion.

1. Conduct all proposed actions in a manner which will minimize direct mortality of Gila topminnow.
2. Conduct all proposed actions in a manner which will minimize loss and alteration of Gila topminnow habitat.
3. Monitor Gila topminnow and their habitat to document levels of incidental take of fish and their habitat.

4. Maintain a complete and accurate record of actions which may result in take of Gila topminnow and their habitat.

#### Terms and Conditions for Implementation

In order to be exempt from the prohibitions of section 9 of the Act, the Federal Highway Administration is responsible for compliance with the following terms and conditions, which implement the reasonable and prudent measures described above.

1. The following terms and conditions will implement reasonable and prudent measure 1.

- 1.1 All reasonable efforts shall be made to minimize activities within the wetted stream channel of Sonoita Creek.

- 1.2 All reasonable efforts shall be made to ensure that no pollutants enter surface waters during action implementation.

2. The following terms and conditions will implement reasonable and prudent measure 2.

- 2.1 Channel alteration and use of heavy equipment within the Sonoita Creek floodplain shall be limited to the 1,812 linear feet of Sonoita Creek where revetments would be placed or repaired plus 50 linear feet on each end of the proposed action, 100 linear feet in the area of the earthen dam to be constructed at MP 16.9, and a reasonable access track to each site.

- 2.2 All reasonable efforts shall be made to avoid damaging or removing riparian vegetation on the bank of the pre-project stream channel opposite the existing or proposed revetments.

- 2.3 All reasonable efforts shall be made to minimize bank disturbance and riparian destruction at the site of the earthen dam which would divert the stream at the MP 16.9 site.

3. The following terms and conditions will implement reasonable and prudent measure 3.

- 3.1 At any time when project activities are ongoing in or within 100 yards of Sonoita Creek, all reasonable efforts shall be maintained to monitor for

the presence of dead or dying fish in or within 500 yards downstream of the project area.

3.2 Following project completion, the project sites shall be monitored to identify any unexpected occurrences, such as revetment failure or increased bank or channel erosion in the area or upstream or downstream. This monitoring shall be conducted at least every other month for six months and once following the next late summer or spring flood season subsequent to project completion. Written reports shall be submitted to the Service within 60 days of the monitoring.

4. The following terms and conditions will implement reasonable and prudent measure 4.

4.1 A written report shall be submitted to the Service within 90 days after project completion documenting the project, as implemented. The report shall include photographs of the project and stream diversion areas, before project initiation and after project completion. The report shall also include a discussion of the compliance with the above terms and conditions.

## CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. The term conservation recommendations has been defined as Service suggestions regarding discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information. The recommendations provided here relate only to the proposed action and do not necessarily represent complete fulfillment of the agency's 7(a)(1) responsibility for these species.

The Service recommends that no trees over 6 inches diameter at breast height within the project area be removed or damaged. An intact riparian community is important to maintenance of high quality habitat for Gila topminnow and is also vital to a number of other wildlife and fish species in the area.

In order to keep the Service informed of actions that either minimize or avoid adverse effects or that benefit listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

### CONCLUSION

This concludes formal consultation on the proposed repair, replacement, and construction of bank revetment on Sonoita Creek at MP 15.4 and 16.9 of Arizona State Route 82. As required by 50 CFR 402.16, reinitiation of formal consultation is required if: (1) the amount or extent of incidental take is reached; (2) new information reveals effects of the agency action that may impact listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action.

Although this concludes formal consultation under section 7 of the Endangered Species Act regarding project effects to listed species, the Service may have other resource concerns regarding this project. These concerns will be addressed during Service review of the project application to the U.S. Army Corps of Engineers for a permit under section 404 of the Clean Water Act.

If we can be of further assistance, please contact Sally Stefferud or Tom Gatz.

Sincerely,



Sam F. Spiller  
Field Supervisor

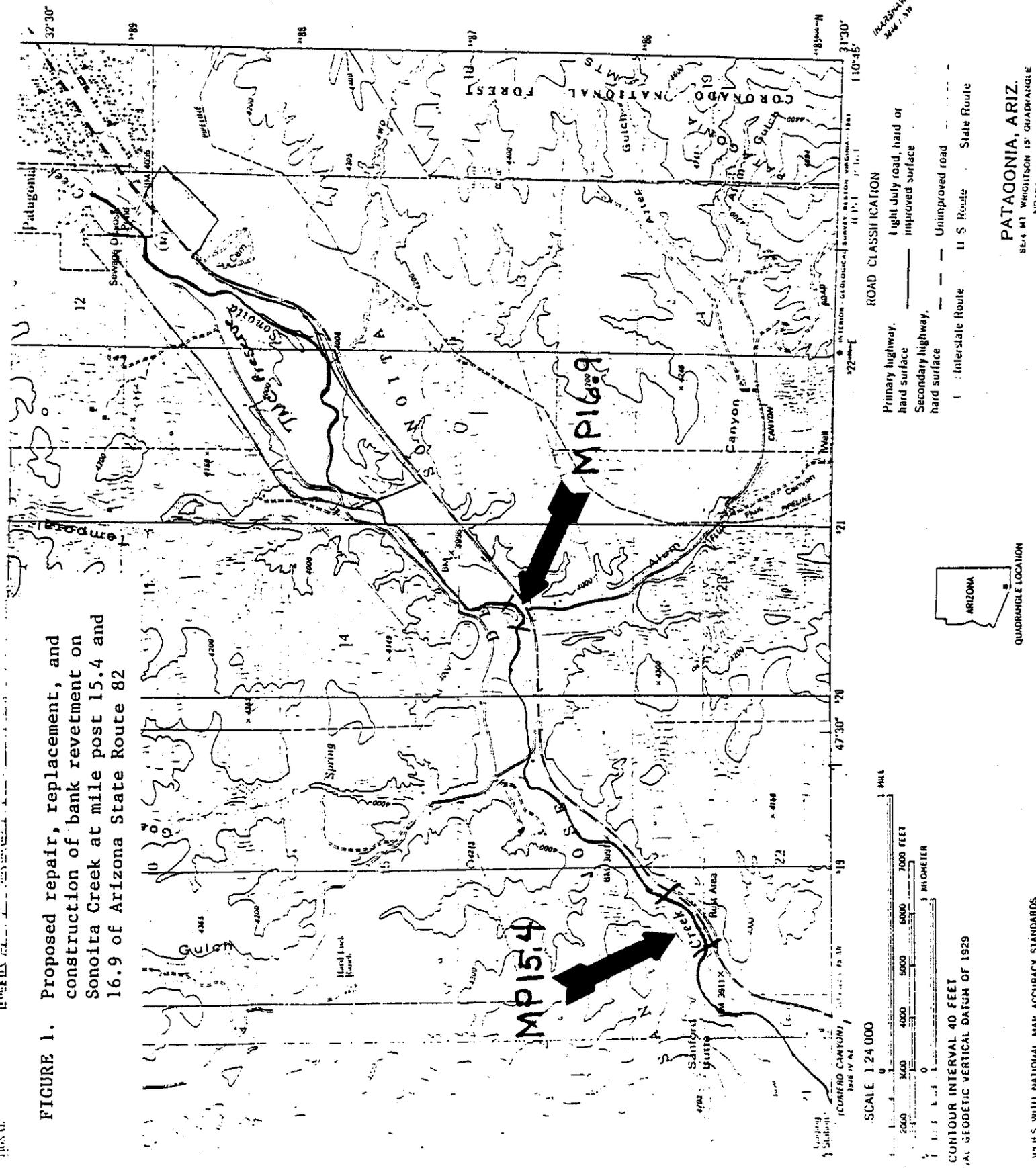
cc: Director, Arizona Game and Fish Department  
Regional Director, Fish and Wildlife Service, Albuquerque, NM (AES)  
Director, Fish and Wildlife Service, Washington, D.C. (HC)  
Chief, Regulatory Branch, Corps of Engineers, Phoenix, AZ

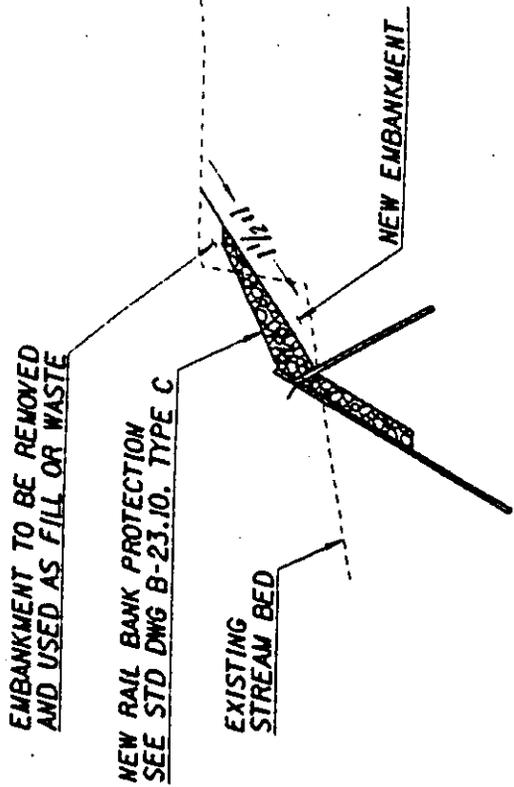
## LITERATURE CITED

- Bagley, B.E., D.A. Hendrickson, F.J. Abarca, and S.D. Hart. 1991. Status of the Sonoran topminnow (Poeciliopsis occidentalis) and desert pupfish (Cyprinodon macularius) in Arizona. Arizona Game and Fish Department, Phoenix, AZ. 64 pp.
- Brown, M. and F.J. Abarca. 1992. An update status report of the Sonoran topminnow (Poeciliopsis occidentalis) and desert pupfish (Cyprinodon macularius) in Arizona. Arizona Game and Fish Department, Phoenix, AZ. 39 pp.
- Glinsky, R. 1977. Regeneration and distribution of sycamore and cottonwood trees along Sonoita Creek, Santa Cruz County, Arizona. Pp. 116-123 In: Importance, preservation, and management of riparian habitat: a symposium. Johnson, R.R. and D.A. Jones, Eds. U.S. Forest Service Rocky Mountain Forest and Range Experiment Station, General Technical Report, Ft. Collins, CO.
- Hastings, J.R. and R.M. Turner. 1965. The changing mile. The University of Arizona Press. Tucson, AZ. 317 pp.
- Heede, B.H. and J.N. Rinne. 1990. Hydrodynamic and fluvial morphologic processes: implications for fisheries management and research. North American Journal of Fisheries Management 10(3):249-268.
- Hubbs, C.L. and R.R. Miller. 1941. Studies of the fishes of the order Cyprinodontes. XVII. Genera and species of the Colorado River system. Occasional Papers of the Museum of Zoology. University of Michigan, Ann Arbor, MI. 433:1-9.
- Knight, A.W. and R.L. Bottorff. 1981. The importance of riparian vegetation to stream ecosystems. California Riparian Systems Conference, Sept. 17-19, 1981. pp. 160-167.
- Leopold, L.B. and T. Maddock, Jr. 1953. The hydraulic geometry of stream channels and some physiographic implications. U.S. Geological Survey Professional Paper 252. 57 pp.

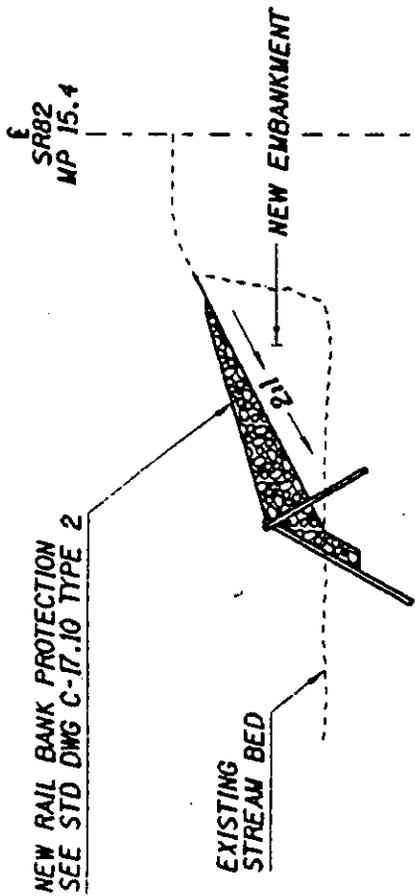
- Meehan, W.R., R.J. Swanson, and J.R. Sedell. 1977. Influences of riparian vegetation on aquatic ecosystems with particular reference to salmonid fishes and their food supply. Pp. 137-145 In: Importance, preservation and management of riparian habitat: a symposium. Johnson, R.R. and D.A. Jones, Eds. U.S. Forest Service Rocky Mountain Forest and Range Experiment Station, General Technical Report, Ft. Collins, CO.
- Meffe, G.K., D.A. Hendrickson, and W.L. Minckley. 1983. Factors resulting in decline of the endangered Sonoran topminnow Poeciliopsis occidentalis (Atheriniformes:Poeciliidae) in the United States. *Biological Conservation* 25(1983):135-159.
- Minckley, W.L. 1969. Aquatic biota of the Sonoita Creek basin, Santa Cruz County, Arizona. The Nature Conservancy, Ecological Studies Leaflet No. 15, Washington, D.C. 8 pp.
- Minckley, W.L. 1973. Fishes of Arizona. Arizona Game and Fish Department, Phoenix, AZ. 293 pp.
- Minckley, W.L., J.N. Rinne, and J.E. Johnson. 1977. Status of the Gila topminnow and its co-occurrence with mosquitofish. USDA Forest Service Research Paper RM-198, Ft. Collins, CO. 8 pp.
- Osborne, L.L. and D.A. Kovacic. 1993. Riparian vegetated buffer strips in water-quality restoration and stream management. *Freshwater Biology* 29:243-258.
- Simons, L.H. 1987. Status of the Gila topminnow (Poeciliopsis occidentalis occidentalis) in the United States. Arizona Game and Fish Department, Phoenix, AZ.
- Tait, C.K., J.L. Li, G.A. Lamberti, T.N. Pearsons, and H.W. Li. 1994. Relationships between riparian cover and the community structure of high desert streams. *Journal of the North American Benthological Society* 13(1):45-56.
- U.S. Fish and Wildlife Service. 1984. Gila and Yaqui topminnow recovery plan. U.S. Fish and Wildlife Service, Albuquerque, NM. 56 pp.
- Vrijenhoek, R.C., M.E. Douglas, and G.K. Meffe. 1985. Conservation genetics of endangered fish populations in Arizona. *Science* 229:400-402.

FIGURE 1. Proposed repair, replacement, and construction of bank revetment on Sonoita Creek at mile post 15.4 and 16.9 of Arizona State Route 82





MILEPOST 16.9  
 NEW RAIL BANK PROTECTION  
 SECTION DOWNSTREAM OF BOX CULVERT  
 STATION 804+00



MILEPOST 15.4  
 TYPICAL SECTION FOR NEW RAIL BANK PROTECTION  
 STATIONS: 730+83 TO 732+50  
 738+30 TO 741+00



FIGURE 2. Rail-bank protection for State Route 82

FIGURE 3. Existing Rail-bank revetment at mile post 15.4 on State Route 82