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**ADDENDUM TO
ARCH CANYON CONDITION ASSESSMENT
AND MANAGEMENT RECOMMENDATIONS
Report for the
Southern Utah Wilderness Association**



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INTRODUCTION

This is an addendum to the August, 2006, report entitled “ARCH CANYON CONDITION ASSESSMENT AND MANAGEMENT RECOMMENDATIONS” prepared by ECOS Consulting for the Southern Utah Wilderness Association.

In the beginning of October, 2006, there was a series of wet storms that released over one-half the yearly average rainfall of a normal year of precipitation within a week. The consequent flooding in Arch Canyon brought about many of the impacts predicted in the August, 2006, report. This addendum addresses those impacts.

DAMAGE ASSESSMENT OF OCTOBER FLOODS

The heaviest damage was documented in areas where the flood waters jumped from the channel, and instead of spreading out over the floodplain, as would occur in a properly functioning system, were quickly diverted by the presence of an unvegetated and entrenched 4-wheel drive route that crosses the channel 60 times in 8.5 miles. This interception of the floodwaters by the 4-wheel drive route contributed to a substantial increase in flow velocity and energy because the waters became constricted and concentrated within the artificial channel created by the 4-wheel drive route. This, in turn, contributed to substantially more erosion than what would have occurred if the 4-wheel drive route didn't exist, and it greatly increased the destruction of vegetation and streambanks, in particular in areas where the 4-wheel drive route crosses the stream channel. There are many areas where the stream channel has widened due to streambank failure and vegetation loss during these floods. All of this has contributed to the further loss of riparian habitat, and in particular, fish habitat, upon which the flannelmouth sucker and the bluehead sucker depend for survival.

If the 4-wheel drive route did not exist in Arch Canyon at the time of the flood, the water would typically have spread out over the floodplain instead of being channeled quickly down the 4-wheel drive route. Spreading onto the floodplain, the water's energy would have been significantly reduced and dispersed. This would have minimized erosion and streambank failure and added many ecological benefits to the floodplain and surrounding area. The floodplains would have received additional sediment and nutrients and the water table would have been significantly recharged. This would have presented the ideal scenario for the development and enhancement of the future riparian habitat in Arch Canyon.

The remainder of this addendum primarily includes repeat photos of before and after riparian conditions of areas in Arch Canyon. Photos were originally taken in April, 2006, before the vegetation leafed-out for the season. Follow-up repeat photos were taken in October, 2006, after the flood events of early October. Upon



Figure 21. Photo taken in October, 2006. This is flood damage caused by water flowing down the 4-wheel drive route. The route has recently been diverted around the gully. Arch Canyon, San Juan County, Utah.



Figure 22. Additional flood damage from the tremendous energy of the flow that was augmented by the 4-wheel drive route over which much of the water flowed. Arch Canyon, San Juan County, Utah.

examination of these photo sets, it is apparent that the potential threats as described in the August, 2006, report have indeed become reality in Arch Canyon due to the presence of the 4-wheel drive route.

The photo sets in the remainder of this addendum illustrate in detail the following detrimental processes that have occurred in Arch Canyon as a direct consequence of floodwaters being diverted onto the road channel. The following are observed impacts from a post-flood field reconnaissance. See photos in the next section of this report for examples of these impacts.

- 1) The channel has widened in many sections because of the destruction of the streambank in many areas, especially areas where the 4-wheel drive route crosses the stream. See Figures or photo sets 3, 4, 7, 9, 12, 13, and 14.
- 2) The channel has changed from its natural sinuosity and straightened due to merging of the 4-wheel drive route and the stream in many areas, particularly at stream crossings. The effect is similar to having a constructed storm drainage channel. See Figures or photo sets 3, 4, 5, 6, 10, and 11.
- 3) There has been a significant loss of riparian and upland vegetation due to erosion and increased energy of the stream flow. Higher flow energy occurs in areas with less vegetative and substrate resistance, such as the 4-wheel drive route. See Figures or photo sets 3, 4, 5, 7, 8, 10, 11, 12, and 13.
- 4) The loss of fish habitat is visible in the form of soil and streambank erosion, and the loss of overhanging vegetation. This kind of impact from increased energy flow could eliminate the flannelmouth sucker and the bluehead sucker from Arch Canyon. These fish populations are physically separated from other populations and could be rare disjunct populations . Movement patterns, genetic studies, and habitat analyses are needed to answer questions about their viability in Arch Canyon. See Figure or photo set 14.
- 5) There was a visible increase in coarse rocky material and a decrease in fine sandy materials in the stream channel throughout Arch Canyon. This condition negatively effects the establishment of native riparian vegetation and it may give exotic weeds an advantage in the few areas where plants can re-establish. See Figures or photo sets 3, 4, 7, 8, 9, 12, 13, and 14.



Figure 3a. Photo taken in April, 2006. This is a proper functioning section of the streambed. Note the thick riparian vegetation on both sides of the 4-wheel drive route. Arch Canyon, San Juan County, Utah.



Figure 3b. Repeat photo of Figure 3a, taken in October, 2006. The 4-wheel drive route funneled water through and caused extensive damage through widening and deepening around the route. Other areas with thick vegetation stayed intact. Arch Canyon, San Juan County, Utah.



Figure 4a. Photo taken in April, 2006. Note the thick riparian vegetation on both sides of the 4-wheel drive route. Arch Canyon, San Juan County, Utah.



Figure 4b. Repeat photo of Figure 4a, taken in October, 2006. The 4-wheel drive route carried a large portion of the flood load and scoured out the route into a new channel. The thick vegetation on the sides protected those areas and tended to shunt the flood waters into the 4-wheel drive route. Arch Canyon, San Juan County, Utah.



Figure 5a. Photo taken in April, 2006. 4-wheel drive route facing upstream; stream channel is out of sight on left. Arch Canyon, San Juan County, Utah.



Figure 5b. Repeat photo of Figure 5a, taken in October, 2006. Flood waters jumped onto the 4-wheel drive route and caused much soil and bank erosion, and elimination of vegetation. Arch Canyon, San Juan County, Utah.



Figure 6a. Photo taken in April, 2006. 4-wheel drive route facing upstream; stream channel is on right. Arch Canyon, San Juan County, Utah.



Figure 6b. Repeat photo of Figure 6a, taken in October, 2006. The 4-wheel drive route experienced heavy flow and caused much soil and bank erosion. The route is now becoming part of the stream channel, especially when there is a flood. Arch Canyon, San Juan County, Utah.



Figure 7a. Photo taken in April, 2006. Upstream view from where 4-wheel drive route exits the stream channel. Arch Canyon, San Juan County, Utah.



Figure 7b. Repeat photo of Figure 7a, taken in October, 2006. Many plants have been eliminated between the 4-wheel drive route and the channel as flow was diverted onto the route during flooding. Arch Canyon, San Juan County, Utah.



Figure 8a. Photo taken in April, 2006. Downstream view where 4-wheel drive route crosses the stream channel. Arch Canyon, San Juan County, Utah.



Figure 8b. Repeat photo of Figure 8a, taken in October, 2006. Note the erosion and loss of vegetation along the bank on the left side and the exposure of tree roots. Arch Canyon, San Juan County, Utah.



Figure 9a. Photo taken in April, 2006. Downstream view where 4-wheel drive route crosses the stream channel. Arch Canyon, San Juan County, Utah.



Figure 9b. Repeat photo of Figure 9a, taken in October, 2006. Flood waters followed the 4-wheel drive route and eroded away the streambank and vegetation between the road and the channel. Also note the erosion of soil and exposure of large rocks from the tremendous energy of the early October floods. Arch Canyon, San Juan County, Utah.



Figure 10a. Photo taken in April, 2006. 4-wheel drive route facing upstream; stream channel is on right. Arch Canyon, San Juan County, Utah.



Figure 10b. Repeat photo of Figure 10a, taken in October, 2006. Flood waters flowed down the 4-wheel drive route and swept away the soil and vegetation between the route and the stream channel. Arch Canyon, San Juan County, Utah.



Figure 11a. Photo taken in April, 2006. 4-wheel drive route facing downstream; stream channel is on left. Arch Canyon, San Juan County, Utah.



Figure 11b. Repeat photo of Figure 11a, taken in October, 2006. Flood waters entered the 4-wheel drive route and eroded away the soil, route, and vegetation. This area is now much more susceptible to future flooding events and erosion. With this extensive damage there is also a much higher chance of exotic weeds becoming established. Arch Canyon, San Juan County, Utah.



Figure 12a. Photo taken in April, 2006. Upstream view where 4-wheel drive route crosses the stream channel. People are walking on the 4-wheel drive route. Arch Canyon, San Juan County, Utah.



Figure 12b. Repeat photo of Figure 12a, taken in October, 2006. Flood waters jumped onto the 4-wheel drive route and eroded away the streambank and vegetation between the road and the channel. Arch Canyon, San Juan County, Utah.



Figure 13a. Photo taken in April, 2006. Stream channel facing upstream; stream channel is on left. Arch Canyon, San Juan County, Utah.



Figure 13b. Repeat photo of Figure 13a, taken in October, 2006. Flood waters jumped onto the 4-wheel drive route just upstream of this location and caused soil and bank erosion and elimination of vegetation. The stream channel has widened and deepened and riparian vegetation has been eliminated from inside the channel. Note the rocks and cobbles that have been exposed in the channel. Arch Canyon, San Juan County, Utah.



Figure 14a. Photo taken in April, 2006. Stream channel facing upstream; 4-wheel drive route is out of sight and on left. Arch Canyon, San Juan County, Utah.



Figure 14b. Repeat photo of Figure 11a, taken in October, 2006. The stream channel has widened and deepened and vegetation has been eliminated. Arch Canyon, San Juan County, Utah.

