

## Memorandum

Date: May 21, 2007

To: Sam Coulson

From: Tom Keegan,  
Director, Aquatic Resources Group  
ECORP Consulting, Inc.

RE: Clover Valley Creek Culvert/road Crossing Design

I have reviewed Stantec Consulting, Inc. proposed project drawings of streambed and streamflow conditions at the culvert/road crossings over Clover Valley Creek, as well as the conceptual drainage alternatives. The purpose of my review is to determine whether there would be any additional biological impacts resulting from the proposed project designs. My findings are based solely on review of the conceptual designs. It would be beneficial to have additional information, such as channel cross-sections, longitudinal profile, and water depth (stage) vs. flow (discharge) relationship. However, I can make the following general statements.

- 1) The proposed design of cobble and boulder substrate at road crossings (Conceptual Creek Armoring at Culvert/Road Crossing) appears to allow connection and continuity between upstream and downstream aquatic habitats. The grouted cobble and rip-rap is intended to stabilize the streambed under the culvert/road crossing. Without additional information, it is difficult to tell whether scour would occur at the interface between the grouted cobble and the naturally-placed cobbles, however the one-ton boulders would certainly help to maintain stability under the culvert/road crossing. I believe that this design will facilitate migration of aquatic resources between downstream and upstream habitats, as well as provide suitable habitat for the aquatic community.
- 2) Velocities modeled at the input of each road crossing (HEC-RAS, proposed conditions) are within the range of values known to be suitable for upstream salmonid passage (about 8 ft./sec.) across each cross section, and under all flow scenarios. Proposed flow velocities are generally much improved at the face of each culvert over existing conditions (HEC-RAS, existing conditions). Proposed velocities are also well within the range for protection of aquatic communities.
- 3) Both conceptual piped drainage and conceptual drainage channels are appropriate for the project. Since there are no migration issues to contend with, neither of the designs will likely adversely affect aquatic resources, assuming that appropriate erosion control measures are in place.

Please feel free to call me with any questions regarding the above statements. I can be reached at (916) 782.9100.