# APPENDIX D

# DRAFT TECHNICAL MEMORANDUM

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| **TO:** | John Knutson, Dianna Woods, Keelan McPhee, Yakima County | **DATE:** | June 23, 2005 |
| **FR:** | Andreas Kammereck, Marketa McGuire, Golder Associates Inc. | **OUR REF:** | 043-1238.340 |
| **CC:** | Mike Brown, Golder Associates Inc. | | |
| **RE:** | • Deliverable 3.4, Assessment of the need for additional Channel Migration Hazards Investigations in Ahtanum Creek and Wide Hollow systems | | |

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## 1.0 INTRODUCTION

This memorandum fulfills the requirements of the Task 3.4 deliverable addressing channel migration hazards within the project area, as outlined in the Scope of Work for the Ahtanum and Wide Hollow Comprehensive Flood Hazard Management Plan (CFHMP). Task 3.4 includes a review of existing information including studies and/or map resources, and the determination of the need, or lack of need for additional channel migration hazard assessments within the project area. This memo is not intended to provide a detailed review of the geomorphic processes that govern channel migration. Several background documents are provided as references that offer guidance in the technical aspects of channel migration assessments (DNR, 2000), (DOE, 2003), (DOE, 2004). These references were utilized as background resources for this assessment. This technical memorandum is focused on developing an understanding for the need for additional investigation to address channel migration hazard risks on the larger streams in the project area, including Ahtanum, Bachelor and Hatton Creeks. Any additional investigations would be addressed in subsequent phases of the Ahtanum/Wide hollow CFHMP. There are no plans for further CMZ studies to be performed.

## 2.0 REVIEW OF EXISTING INFORMATION

In general, a channel migration zone is defined as an area within the river corridor that a stream or river system has occupied historically, and where it is susceptible to erode or occupy within a given timeframe (DOE, 2003). Channel migration can occur through gradual lateral erosion and/or by more sudden changes in channel alignment called avulsions. In both cases, historical evidence of the potential for continued channel migration can be assessed through field investigations and review of existing available data (i.e.

historical aerial photos, LiDAR data, surveys, anecdotal information, photos, etc.). Channel migration is more apparent on larger river systems with more extensive active floodplain areas. Channel migration zones appear as a complex topography of gravel bars, multiple elevation floodplain surfaces, historical channel alignments, back-channel areas, swales and ox-bows. Woody debris often plays a major role in channel migration and can govern the movement of the channel across or outside of the active floodplain area.

The larger stream systems within the project area, including Ahtanum Creek, Bachelor Creek, Hatton Creek, Wide Hollow Creek, Cottonwood Creek, and Spring Creek, do not exhibit the characteristics of a larger river system with larger flow and sediment regimes, such as the Yakima and Naches Rivers. The major streams in the project area are Ahtanum Creek, and its two tributaries: Bachelor and Hatton Creeks. These three streams are relatively small during normal and low-flow periods. The floodplain within the project area is very complex due to flat and varied topography. Prediction of floodplain inundation areas is difficult at best, and the current floodplain maps are widely recognized as being in-accurate and/or not representative of the recent flooding conditions. Although floods in these systems can quickly jump their banks, occupy old channel or irrigation ditch alignments and inundate wide reaching areas throughout the project area, they do not typically avulse into new channel alignments. That said, there are numerous historical occurrences where flood flows have occupied road-way ditches and/or historical channels, leading to significant erosion damage. In most cases after these events, the channel has been re-located to pre-flood alignments.

The Bachelor and Hatton Creek systems are managed for irrigation and provide conveyance for downstream purveyors throughout the project area. The project area has numerous active and historical drainage and irrigation ditches/streams cross the valley floor. Irrigation management of flows out of Ahtanum Creek have been active since the valley was settled and developed for agriculture. As such, there are numerous old channels and drainage ditches throughout the project area. The oldest record of the irrigation system are a series of maps from the Ahtanum Irrigation District (AID) archives. The maps are very old paper reproductions of the originals from 1905 that are approximately 4 feet high and as much as 14 feet long, and show the network (at that time) of drainage ditches and streams throughout the Ahtanum valley.

The Ahtanum Creek channel has often been moved historically due to agricultural or residential development. Several examples of areas where the channel has been relocated to property boundaries or re-directed to facilitate drainage to agricultural land were identified during the public meetings and in subsequent inventory activities as a part of the on-going CFHMP. An example on Ahtanum Creek is at Emma Lane at S 42$^{nd}$ Avenue, where the channel has been moved to facilitate irrigation flows, leaving the historical channel lowland area subject to flooding. These types of locations inherently offer the potential for channel migration hazards during peak flow events.

Public comments indicate there are two locations on Wide Hollow Creek where the stream channel may have been altered for irrigation purposes, diversion around a property boundary, or other reasons. Upstream of the "S" curve on Wide Hollow Road there are reports that the Wide Hollow Creek has been rerouted. Additionally, Wide Hollow Creek just west of downtown Union Gap make a 90 degree turn which follows the property boundary of a private residence. Above average flow may cause the channel to migrate in this area.

Shaw Creek, a tributary of Wide Hollow Creek in the north end of the project area, was historically rerouted and used as conveyance for irrigation. The channel makes a 90 degree turn as it meets S 80th Ave and crosses under the road through a culvert oriented perpendicular to the road before it joins Wide Hollow Creek. Shaw Creek is mainly comprised of irrigation return flows and is often dry due to diversion withdrawals. Unless the creek conveys unusually high flows, no channel migration hazard is identified.

Yakima County completed an assessment titled "DRAFT, Channel Migration and Avulsion Hazard Analysis for selected Shoreline Streams in Yakima County (2004)". Refer to this document for more detail on the means and methods of the channel migration hazard delineations. The assessment looked at channel migration hazards in the following river/stream systems:

- Lower Yakima River, Wapato Reach, Union Gap Reach, and Selah Reaches,
- Ahtanum Creek – Main channel, North Fork, and South Fork Reaches,
- Naches River at the Mouth, the Lower Reach, Middle Reach, Lower Rattlesnake & Nile Valley, and Upper Reaches,
- Bumping River.

The Ahtanum Creek portion of the assessment is most applicable to the Ahtanum/Wide Hollow CFHMP, and was therefore the focus of this review. The County's assessment of channel migration hazard in the mainstem Ahtanum Creek indicates that the channel has been fairly stable over the course of the available period of record, with actively migrating zones limited to areas adjacent to the main channel. The mainstem is disconnected from the Yakima River floodplain by urban development and transportation infrastructure (Yakima County, 2004). The mainstem generally has a single thread morphology that is heavily influenced by irrigation management and adjacent land use activities. Irrigation withdrawals throughout the reach have limited the occurrence of channel governing flows to only the largest flood events (Yakima County, 2004). The decreased occurrence of channel governing flows has therefore limited the transport of sediment through the system, in some cases leading to aggradation within the channel between peak flows, and erosion problems during peak floods. Riparian vegetation has been removed in overbank areas along the main channel, increasing the risk of bank erosion (Yakima County, 2004). Channel migration zones are limited to topographic low elevation areas, areas of recent instability due to bank

erosion, and specific known problem locations. Identified channel migration zones occupy approximately 26 percent (i.e. 756 acres) of the FEMA defined 100-year floodplain. Thirty-five percent of that area (i.e. 267 acres) is within the FEMA defined floodway. The active channel comprises approximately 132 acres of this area. In general, the channel migration zone is slightly wider in area than the FEMA defined floodway.

The North and South Forks of Ahtanum Creek have more limited available data than the mainstem. Channel gradients transition from steeper upper basin areas to flatter valley bottom gradients where they meet the mainstem. This leads to deposition of entrained sediments, exacerbated by increased agricultural and residential development and historical bank stabilization activities. The North Fork has numerous constrictions on the channel where private landowners have installed stream crossings to gain access to properties (DOE, 2004). The South fork has similar problems, but is less populated. These locations often have problems with debris accumulations, leading to bank erosion and damage to stream crossing structures. In general, the North and South Forks are constrained by the valley and experience bank erosion during peak flows, but have limited channel migration hazard potential.

## 3.0 SUMMARY

The Ahtanum Creek, Bachelor Creek, and Hatton Creek systems have the potential for channel migration hazards where the channel has been moved or re-aligned to facilitate historical agricultural and/or residential development, and there are limited locations where sediment accumulations are leading to overbank flooding and increasing the risk of bank erosion. These streams do not exhibit the broader active and dynamic floodplain topographies that are commonly seen in larger river systems. But, the same geomorphic principals still apply, and can be used to develop an understanding for future potential migration hazards.

The general flooding characteristics throughout the project area were well documented during the public meetings and subsequent inventory work. Based on this information, there does not appear to be a broad scale risk of channel migration hazards in Ahtanum, Bachelor, or Hatton Creek systems that requires extensive continued technical investigations. Where specific site issues have been identified as having historical problems with bank erosion and/or channel changes, they will be addressed on a site-by-site basis during the alternatives analysis phase of the CFHMP. An appropriate level of investigation will be completed at that time to characterize the risk and develop recommendations either for further study of the problem, or to support the development of mitigation strategies. We do not therefore see the need to complete a basin wide comprehensive channel migration assessment within the Ahtanum/Wide Hollow CFHMP project boundaries. We recommend that any additional investigation can be addressed on site-by-site basis.

## 4.0 REFERENCES

(DNR, 2000), "Standard Method for Measuring Physical Parameters of Stream and Channel Migration Zones", Department of Natural resources Forest Practices Board, 2000.

(DOE, 2003), "A Frame work for Delineating Channel Migration Zones", Department of Ecology Publication #03-06-027, C.F. Rappe, T.B. Abbe, November 2003.

(DOE, 2004), "Ahtanum Creek Watershed Assessment", Submitted to the Washington State Department of Ecology by Golder Associates and Fitch and Marshall, Inc., Document # 023-1167.2300, 2004.

(Yakima County, 2004), "DRAFT, Channel Migration and Avulsion Hazard Analysis for selected Shoreline Streams in Yakima County (2004)"

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