Date: November 30, 2017

From: Kurt Walker and Chris Perra (Technical Unit)

To: Trevor Hutton, John Kirk, and the File

RE: Update to Ecology's 1991 Wolf Creek – Methow River Closed Tributary Report

Background & Purpose

Under WAC 173-548 (the Rule), 15 tributary streams and 17 lakes within the Methow River Basin are closed to further consumptive appropriations unless the specified reservation applied. This closure included "all groundwaters hydraulically connected" to these streams and lakes. Ecology investigated the groundwater resources within the tributary basins from the headwaters to the main Methow River valley margin. In 1991, Ecology staff assembled broad technical findings into a collection of small reports. However, these reports did not describe the stream reach behavior and controls from the mouth of each tributary bedrock canyon to the confluence with the Methow River. Ecology is now providing additional information in an effort to update the record and provide a more complete understanding of the hydraulic relationship between surface and groundwater within Wolf Creek.

The occurrence and behavior of groundwater within the main Methow River Valley has been evaluated by many, including the Dept. of Ecology and the U.S. Geologic Survey. The reader is directed to these works for a more holistic description of the hydrogeology of the main Methow River Valley. The focus of this report will be on the local hydrologic conditions and behavior near Wolf Creek primarily between the previously described closed basin area and the confluence with the Methow River.

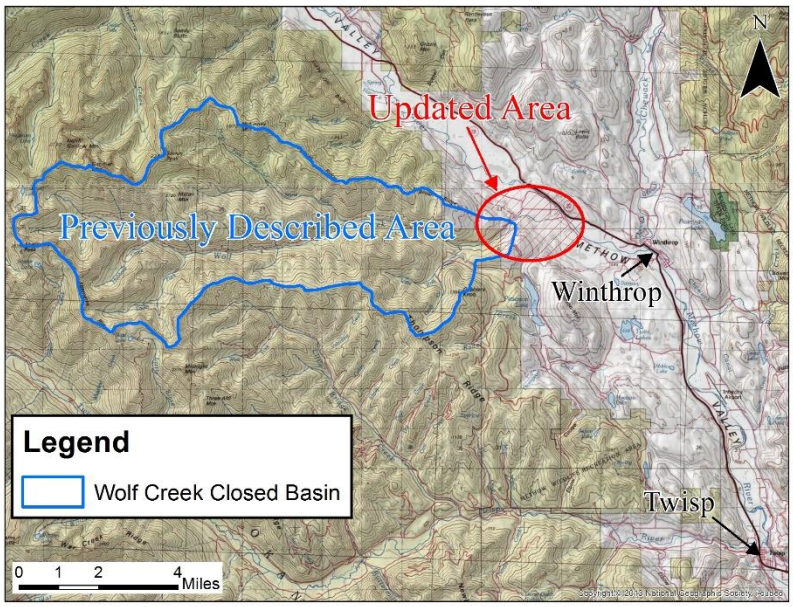


Figure 1 – Project location and overview of study areas.

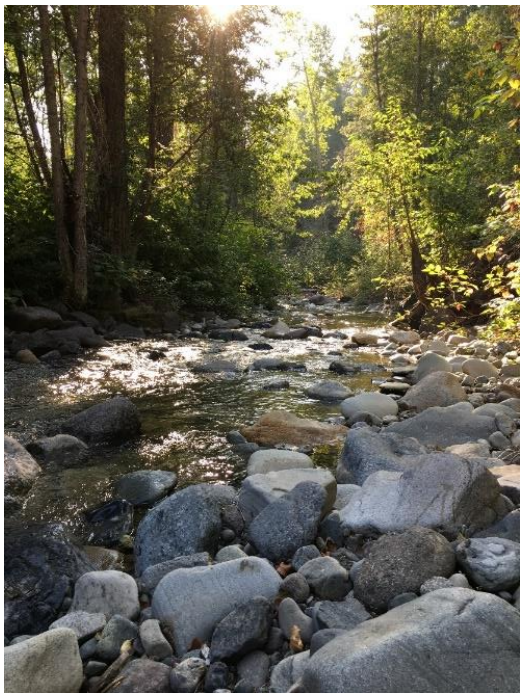
Investigation

Among the key conclusions of the 1991 closed tributary reports, Ecology found that groundwater within the unconsolidated sediments outside the main Methow River Valley are, more likely than not, in hydraulic continuity with the tributary stream (Peterson and Larson 1991). Groundwater within the bedrock units was generally not considered to be in hydraulic continuity with the stream. This is not a written conclusion within the said reports, but was determined through discussions among the report authors and Ecology managers shortly after the reports were finished. There is currently no effort to re-investigate these conclusions. However, Ecology recognizes the need to extend our understanding beyond the previously described areas to also include the lower most reaches of some closed streams.

In this case, Wolf Creek leaves a tight bedrock valley and courses easterly approximately 7,500 feet before discharging to the Methow River. Ecology staff (Chris Perra, John Kirk, and Kurt Walker) performed a field investigation and collected data within the Methow River basin on September 13, 14, and 15, 2017. Geologic information was attained, wells near the creek were identified, and three sites were selected to measure Wolf Creek streamflow.

Geologic – Hydrogeologic Conditions

The majority of the Wolf Creek watershed terrain is extremely rugged, forested, with bedrock at or near the surface. In contrast, the landscape of the main Methow River Valley consists of gentle slopes and wide plains. Bedrock in the main valley has been scoured by glaciers into a U-shape with steep walls and a deep floor (Barksdale, 1941). Upstream from the main Methow River Valley, Wolf Creek is high gradient and tightly constrained by bedrock walls. At the margin of the main Methow River Valley, the landscape and creek behavior change dramatically. As the creek enters the main valley it is no longer constrained by near surface bedrock and has developed a low amplitude alluvial fan which extends to the Methow River. The alluvial fan (10-30 feet thick) consists of a variety of material from massive boulders to fine silts. The fan lies over much thicker glacial-fluvial deposits that have partially filled the main valley bedrock low with hundreds of feet of material (estimated at more than 800 feet where Wolf Creek joins the Methow River) (EMCON Northwest, 1993).



Picture 1 – Wolf Creek near the west margin of the main Methow River Valley, looking east. Note boulder sized bedload.

More than 50 well logs completed in the vicinity of Wolf Creek were analyzed in order to better understand the local hydraulic conditions. These well logs represent domestic wells drilled across a wide area of the fan, both to the north and south of Wolf Creek and along Wolf Creek from the valley bedrock margin to the it's confluence with the Methow River. In all cases the static water levels, as recorded at the time of drilling, are regularly consistent with the surface elevation of the Methow River and are all below the elevation of the Wolf Creek streambed. Near the valley margin the water table is about 90 feet below the elevation of the Wolf Creek streambed. Midway between the valley margin and the Methow River the water table is around 50 feet below the elevation of the Wolf Creek streambed. From here to the Methow River the difference in elevation between the groundwater table and the Wolf

Picture 2 – Confluence of Wolf Creek with the Methow River, looking north. Note higher Wolf Creek stream surface elevation.

Creek streambed gradually lessons, until they finally merge at the confluence with the Methow River (See Figure 2, and Picture 2).

While some correlative layers and sediment sequencing were evident in the well logs, the overall subsurface stratigraphy and stratigraphy appears strongly heterogeneous, as would be expected in an alluvial fan and glacial-fluvial depositional environment. Although several well logs record thicker sequences of clay and clay with more course material, these deposits appear laterally discontinuous and not broadly confining. These fine grained horizons appear to be associated with the other kettle-kame deposits found in the Winthrop area. Similar groundwater elevation observations are documented in many other areas along the main floor of the Methow River Valley (see Figure 2).

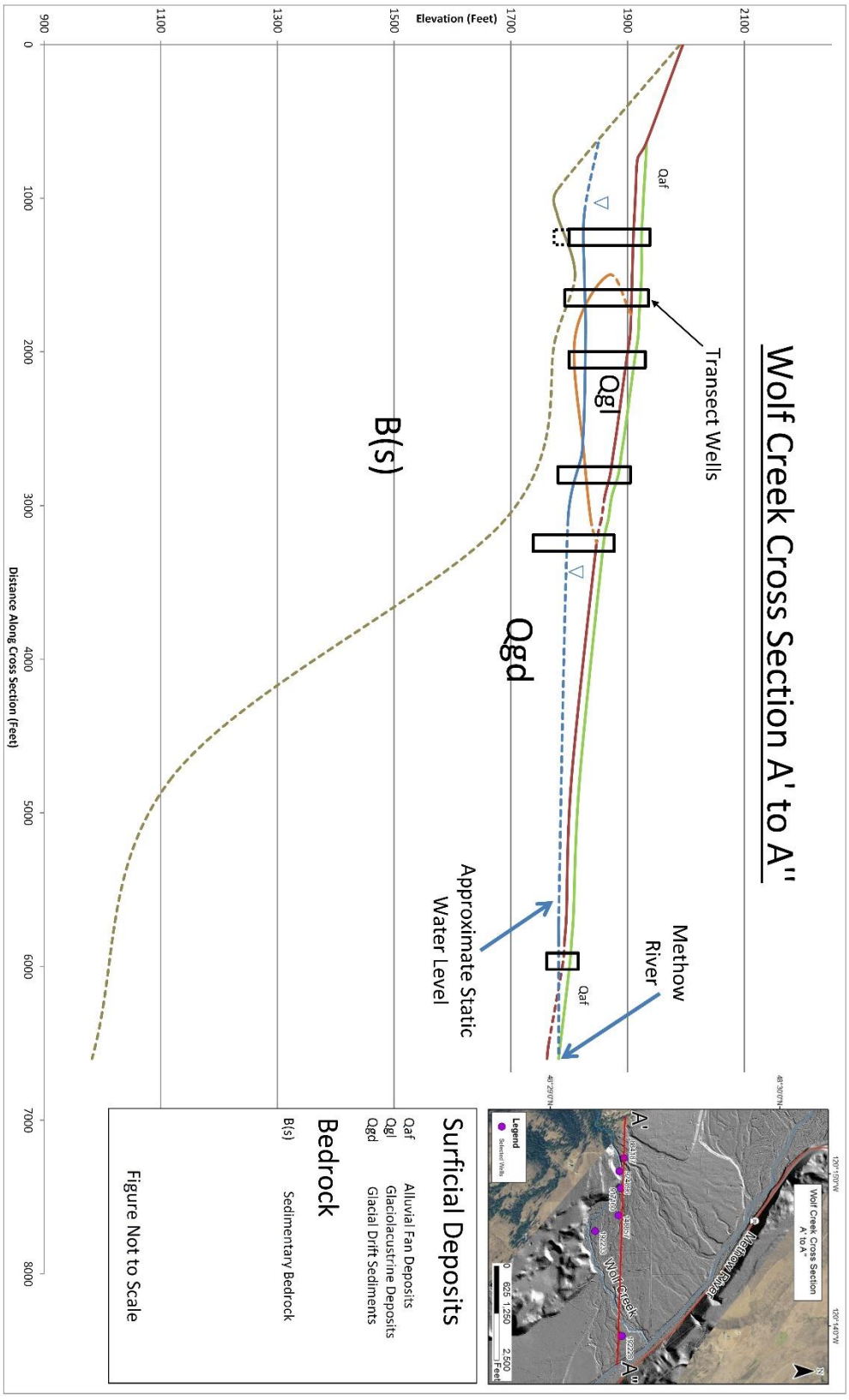


Figure 2 – Cross section across Wolf Creek alluvial fan.

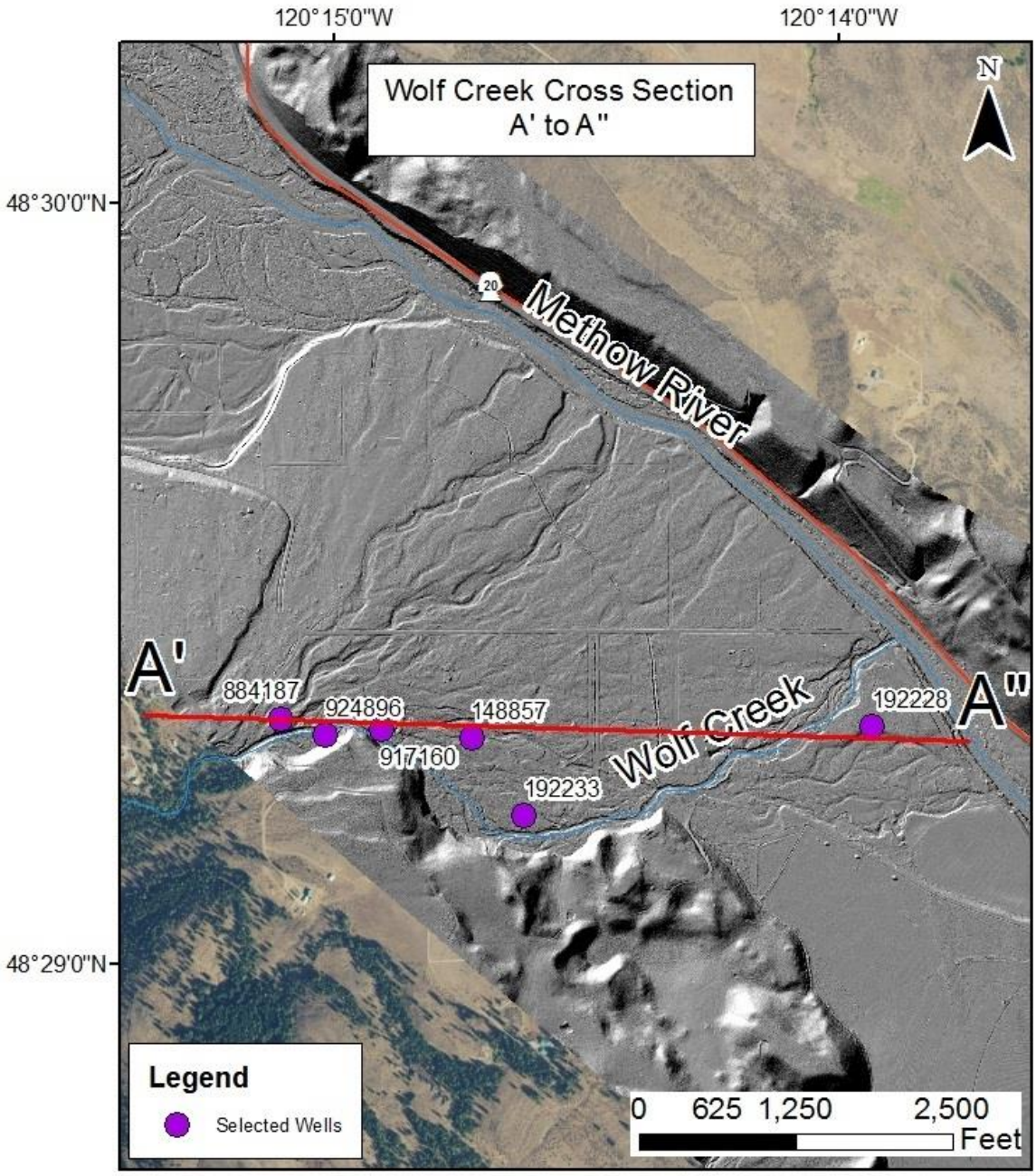


Figure 3 – Cross section across Wolf Creek alluvial fan. Ecology Well ID No. shown next to well location.

Streamflow measurements of Wolf Creek were taken at three locations from the head of the alluvial fan to the confluence with the Methow River (see Figure 4). All known water right diversions were visited in order to account for any active surface water diversions within the measured reach. Only one active diversion was noted for a private fish pond facility which is authorized as a non-consumptive use. Measurements suggests that Wolf Creek has a losing reach from the head of the fan to the Methow River. No gaining reaches within the study area were observed or suspected.

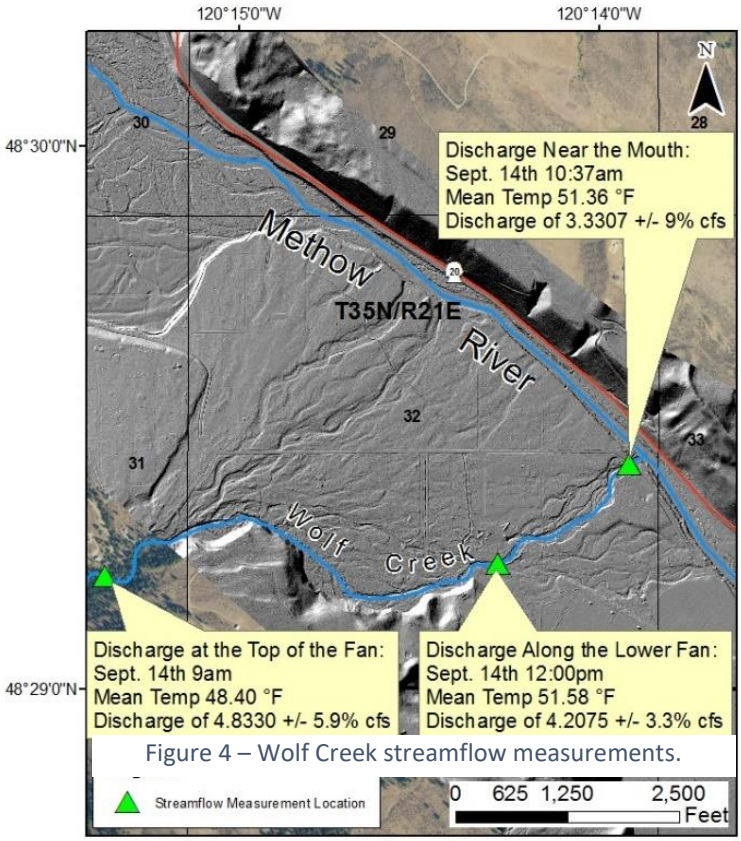


Figure 4 – Wolf Creek streamflow measurements.

The glacial-fluvial aquifer within the main Methow River Valley has been thoroughly studied by the US Geological Survey, Ecology, and many others. The aquifer is distinguished in part due the limited amount of fine material, unlike the upland till deposits which often contain more silts and clays (Konrad et al, 2003). It is broadly accepted that the main Methow Valley glacial-fluvial aquifer and the Methow River are in a high degree of hydraulic continuity. Exchange of water (gains and losses) between surface and groundwater vary by location and season, but the phenomenon is well documented. The hydraulic conductivity of the valley aquifer between Goat Creek and Winthrop is noted as being high and the river is a gaining reach (Konrad et al, 2003). This aquifer characteristic results in a relatively flat groundwater water table that extends the width of the main Methow Valley aquifer with a steady gradient down river.

Findings

Considering the stratigraphic setting, recorded static water levels, measured streamflow, recent field observations, and previous technical reports, it is strongly evident that groundwater within the unconsolidated glacial-fluvial sediments of the main Methow River Valley is not hydraulically connected to Wolf Creek. This physical condition is due to the continuous unsaturated zone beneath Wolf Creek along its length within the study area, leaving it hydraulically separated and perched distinctly above the valley water table aquifer. However, while disconnected from the streamflow of Wolf Creek, groundwater within the main valley is undoubtedly hydraulically connected to the Methow River.

Limitations

Ecology has conducted this work with the intent of providing a general description and interpretation of the subsurface stratigraphy and hydraulic behavior within the aforementioned study area containing Wolf Creek. While we hope this work will be useful to Ecology managers and other parties considering water management decisions, we caution that additional investigation may be warranted depending on the degree of certainty needed and the information available in site specific cases.

This technical analysis has been prepared in effort to update our understanding of groundwater and surface water interactions in the lower Wolf Creek drainage, WRIA 48, Okanagan County, Washington. Because each hydrogeologic study is unique, each hydrogeologic analysis is unique and is based on conditions that existed at the time the investigation was performed. The findings and conclusions of this analysis may, however, be affected by the passage of time as a result of either manmade or natural events.

The practice of geology, geological engineering and hydrogeology are far less exact than other engineering and natural science disciplines. Interpretations of subsurface conditions presented in this report are based on available data. Professional judgment was applied to form an opinion about subsurface conditions throughout the area of interest. Actual subsurface conditions may differ, sometimes significantly, from those indicated in this report. Thus, conclusions and interpretations should not be construed as a warranty of the subsurface conditions.

References

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