Fish Passage and Diversion Screening Prioritization Inventory and Habitat Assessment Report for Seven Streams in WRIA 48

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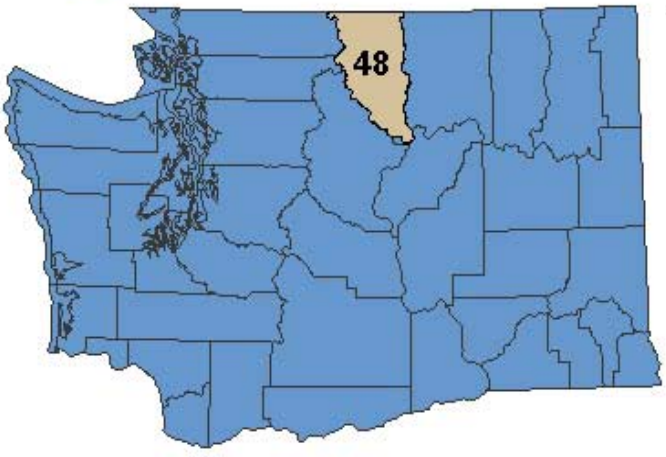

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INTRODUCTION

Fish Passage Barrier and Surface Water Diversion Screening

Washington Department of Fish and Wildlife's (WDFW) Yakima Inventory Crew (YIC) conducted a comprehensive fish passage barrier and diversion screening assessment of three streams in WRIA 48 from 20 October through 17 November 2004 through authorized funding provided by the Fish Restoration and Irrigation Mitigation Act (FRIMA) and the Mitchell Act. The project was temporarily halted due to foul weather conditions during winter and continued from 5 April through 26 May 2005. Four additional streams were surveyed during this time. This inventory tabulated fish passage barriers and water diversions encountered on private lands and addressed two constituents limiting anadromous salmonid populations:

1) Human-made barriers to fish passage (culverts, dams and fishways)
2) Salmonid mortality resulting from contact with unscreened or inadequately screened water diversions (pumps and gravity)

Data obtained from the barrier inventory and concurrent habitat survey will allow for correction prioritization of human-made fish passage barriers and noncompliant water diversions to ensure compliance with Washington State laws (RCW 77.55.060, RCW 77.55.040).

Productive habitat can become inaccessible for fish migration when human-made barriers are present. Such barriers include dams, culverts and noncompliant water diversions. Freedom to move upstream and downstream is paramount to obtaining access to suitable spawning gravel, maximizing carrying capacity. Resident trout are equally in need of full stream access to spawn, rear and maximize genetic interchange (Busby et. al., 2004).

Juvenile mortality occurs in unscreened or insufficiently screened diversions. Water diversion ditches resemble side channels in which juvenile salmonids normally find refuge. Consequently, when diversion head gates are shut, access back to the main channel is cut off and the channel or diversion ditch is subject to desiccation. Impingement or mutilation with non-maintained screens (i.e., gaps or oversized screen openings) also increases mortality of juveniles (WDFW, 2000).

For this report, locations of encountered barriers or partial barriers of fish passage are referred to as sites. The structure impeding passage at the specified site is identified as a feature. Features affecting fish passage or fish safety include culverts, dams, fishways, gravity diversions and pump diversions. A site may contain one or more features associated with it. For example, a dam may accompany a surface water diversion or be equipped with a fishway to facilitate fish passage.

The goal of this inventory is to identify and prioritize barriers for correction on private land and to assess the potential available habitat gain upstream of each barrier. This report summarizes the results of seven tributaries of the Methow, Twisp, and Chewuch Rivers that were surveyed by YIC. Accessible sections of Pearrygin Creek, Libby Creek, Gold Creek, Wolf Creek, Buttermilk Creek, Goat Creek and Poorman Creek are included in the assessment. Habitat data collected from these surveys provide a snapshot in time based on the seasonal flows in the Methow Watershed.

Methow Watershed Overview

Located in north central Washington State, the Methow Watershed belongs to an extensive system of watershed basins that were originally cataloged by the Washington Department of Ecology (WDOE)

in order to identify all significant watersheds within the state (Fig. 1). These basins are classified under Watershed Resource Inventory Areas (WRIA) and designated under Washington Administrative Code (WAC) 173-500-040 (Kim, 2004). Natural resource agencies and restoration groups use WRIA numbers to direct state and federal funding for implementation of salmonid habitat restoration projects (WDFW, 1997).

The Methow River is an influential tributary of the Columbia River, draining 1,805 square miles (mi^2). It is bordered by the Cascade Range to the west, the Buckhorn Mountains and the Okanogan Watershed (WRIA 49) to the east, Canada on the north and the Columbia River to the south (Golder Assoc, 2002). WDOE delineated this watershed into smaller units. Measurements stated in River Miles (RM) are approximated from the confluence. Lower Methow is defined from the mouth of the Methow River to the confluence with Twisp River (RM 0 - 40). Middle Methow continues from the Twisp River to the confluence with the Chewuch River (RM 40 - 50.2). Upper Methow extends from the Chewuch River to the headwaters (> 50.2 RM) near Mt. Hardy on the Okanogan/Skagit County line (Bucknell and Kauffman, 1976).

WDOE recognizes low instream flows and naturally occurring desiccation in some reaches of the Methow River Basin as a result of climatic and geological conditions (WSCC, 2004). The Methow River is fed through many tributaries, most of which are seasonally dry. Surveyed stream lengths and associated tributaries do not include seasonally dry creek beds.

Stream Selection Criteria

Streams of the Methow Watershed were selected for our inventory based on predetermined criteria. Streams must meet fish bearing criteria and be flowing at the time of survey to be considered in this inventory. Streams must have gradients less than 20 percent and an average ordinary high-water width in excess of 0.9 meters (m) (3 feet) to be considered fish bearing in Eastern Washington (WDFW 2000). Basin areas of qualified streams are found in Table 1. Streams not meeting these criteria were excluded from this inventory (Table 2). Due to funding restrictions, only streams that breached private parcels were considered.

Several streams were previously assessed by other agencies for existing barriers prior to this inventory. An abbreviated list of previously completed streams is found in Table 2. A comprehensive list of evaluated streams, including the major rivers of WRIA 48, can be found in Salmon, Steelhead and Bull Trout Habitat Limiting Factors for WRIA 48 (Andonaegui, 2000).

Anadromous salmonid utilization has been documented in Pearrygin, Gold, Libby, Wolf, Buttermilk, Goat, and Poorman Creek subwatersheds according to the Washington State Salmon and Steelhead Stock Inventory report (SASSI) (WDFW, 1993). These streams also support resident and migratory trout.

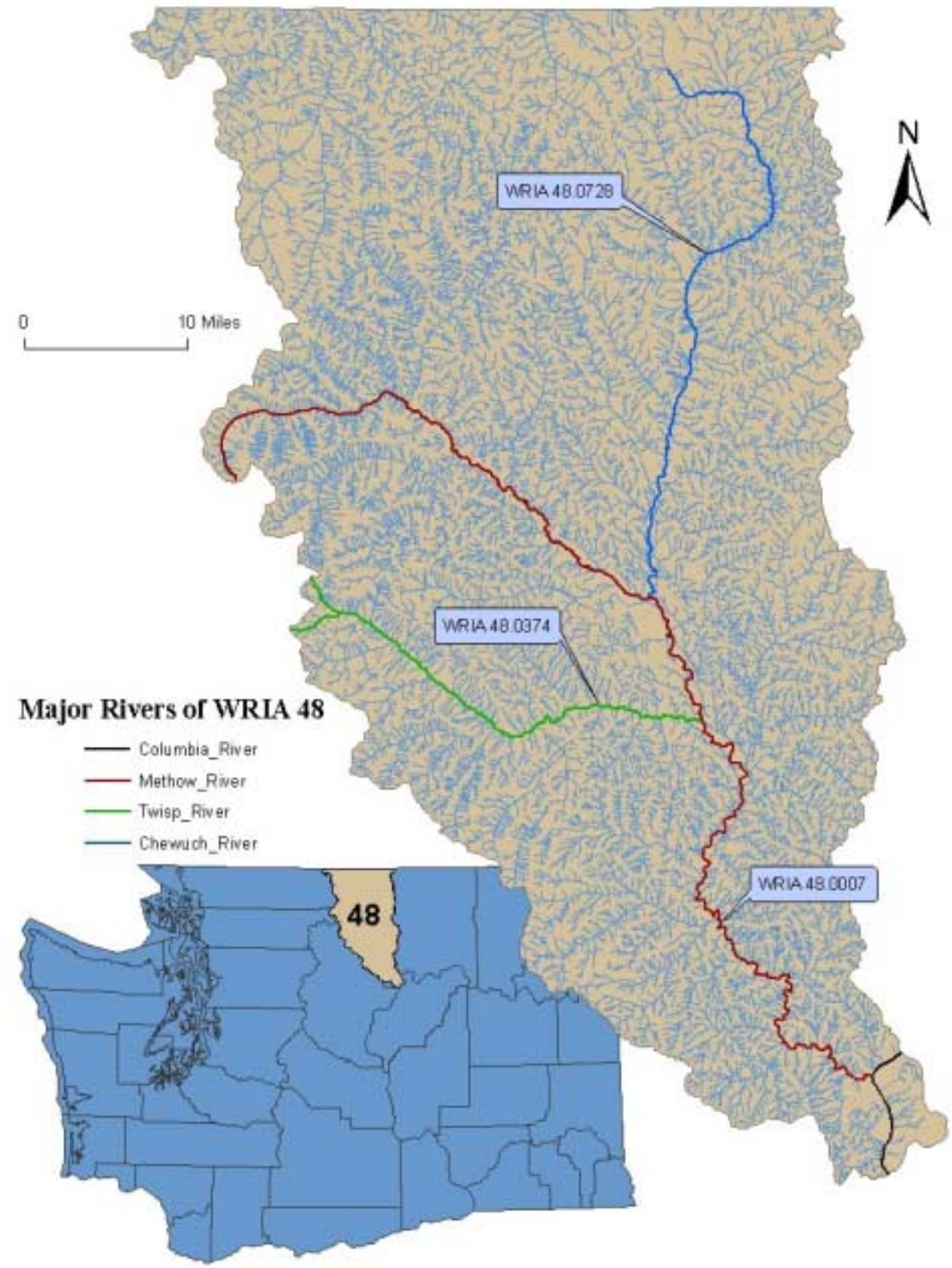


Figure 1. Methow Watershed (WRIA 48)

Table 1. Basin Areas of streams surveyed by YIC within WRIA 48

Tributary to the Methow River	**Subwatershed Basin Area (sq mi)**
Libby Creek	39.9
Gold Creek	88.3
Wolf Creek	40.0
Goat Creek	34.7
Tributary to the Twisp River	**Subwatershed Basin Area (sq mi)**
Buttermilk Creek	36.9
Poorman Creek	12.9
Tributary to the Chewuch River	**Subwatershed Basin Area (sq mi)**
Pearrygin Creek	11.5

Table 2. List of previously surveyed streams and excluded streams in WRIA 48

Surveyed Streams	**Streams Failing to Meet Criteria**
Little Falls Creek	Benson Creek
Little Boulder Creek	Texas Creek
Bear Creek	Cow Creek
Beaver Creek	Peter's Puddles
Cub Creek	Fawn Creek
Early Winters Creek	Newby Creek
Boulder Creek	Myer Creek
Frazer Creek	French Creek
Squaw Creek	Pete's Creek
Black Canyon Creek	Puckett Creek
Leecher Canyon Creek	
Ramsey Creek	

Pearrygin Creek Subwatershed Overview (WRIA 48.0730)

Pearrygin Creek subwatershed comprises the smallest drainage basin area (11.5 mi^2) of those surveyed during this inventory. Pearrygin Creek is the only Chewuch River tributary surveyed by YIC (Fig. 2). This creek, located downstream of Pearrygin Lake, is documented on USGS maps as "Lake Creek", but is assigned the same WRIA number as Pearrygin Creek (48.0730), located upstream of Pearrygin Lake. For continuity, this report refers to the entire stream system as Pearrygin Creek.

Pearrygin Creek is an unusual system due to its extensive interconnected irrigation ditches and use of Pearrygin Lake as a reservoir for summer irrigation. Surrounding land use is agricultural and recreational. Beginning at the onset of peak spring flow, water from the upper Chewuch River is diverted through the Chewuch Canal. This diversion is active six months per year during irrigation season. Approximately 400 m north of Bear Creek Rd, an extended section of siphoned canal bifurcates into the "Right Lateral Feeder" and the "Chewuch Ditch" before intersecting Pearrygin Creek. The Chewuch Ditch joins Pearrygin Creek below the lake and the Right Lateral Feeder crosses upper Pearrygin Creek before flowing into the lake (Boesel, pers. com.). The Right Lateral Feeder supplements flow into Pearrygin Lake.

Once Pearrygin Lake has reached full capacity, the retention dam is opened (May through October). Water flow shares the Pearrygin Creek streambed until rejoining the Chewuch Ditch wherein flow diverges from the creek and again becomes the Chewuch Canal (Fig. 2). Any incidental overflow of Pearrygin Lake is allowed to spill over the lake's retention dam and flow naturally through Pearrygin

Creek prior to irrigation season. The diversion is shut down in October, permitting natural flow of Pearrygin Creek throughout winter (Boesel, pers. com.).

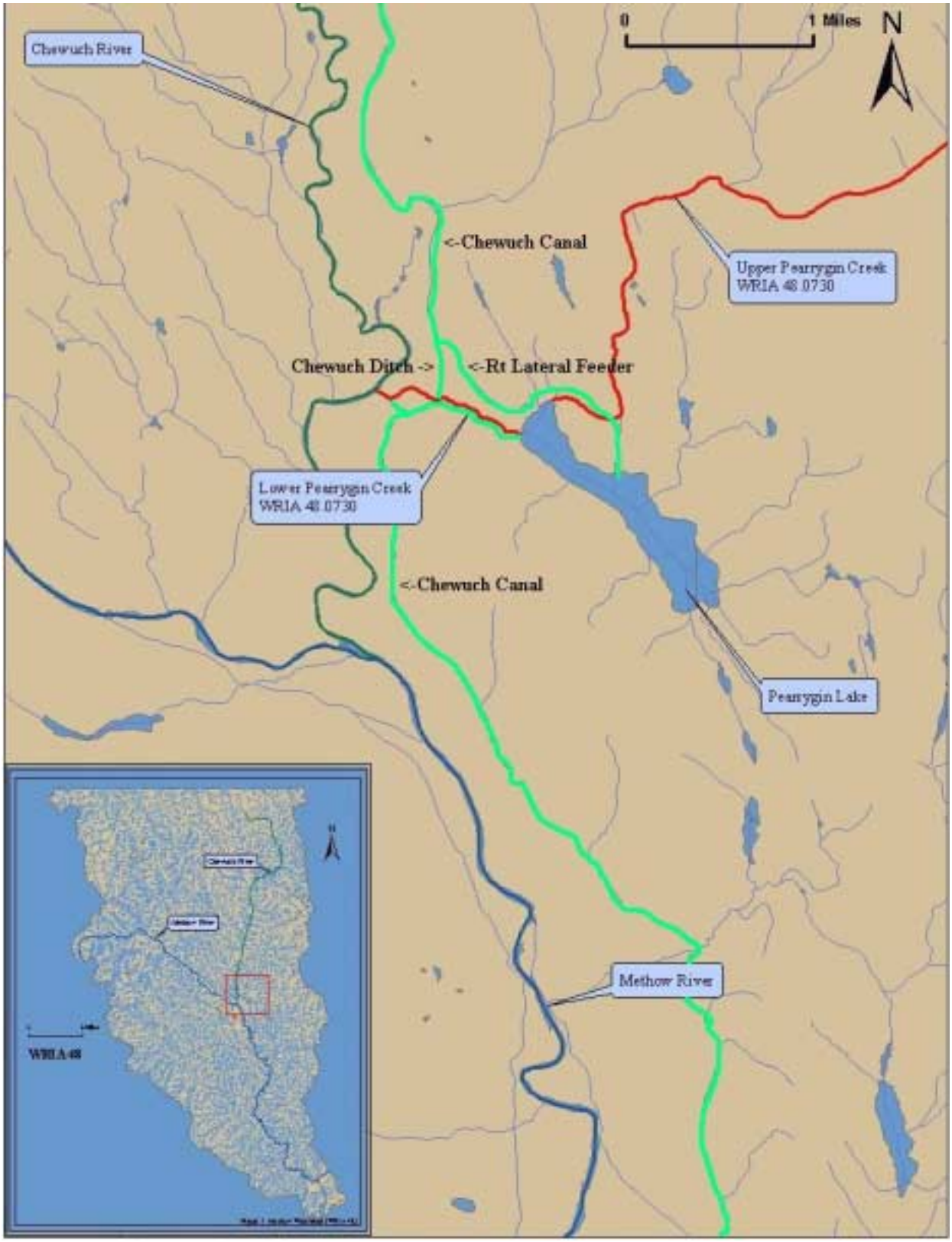


Figure 2. Pearrygin Creek Subwatershed

Libby Creek Subwatershed Overview (WRIA 48.0203)

Libby Creek enters the Lower Methow River from the right bank at RM 26.5 (Fig. 3). Smith Canyon Creek is the first fish-bearing tributary entering Libby Creek from the left bank (RM 3.33). Continuing upstream, three non-fish bearing tributaries are found; Hornet Draw enters from the right bank at RM 4.6, Chimacum Canyon enters from the left bank at RM 5.6 and Nickel Canyon enters from the right bank at RM 7.2. Other significant fish bearing tributaries include Ben Creek (left bank entry at RM 6.5) and Mission Creek (left bank entry at RM 7.93). Libby Creek separates into North Fork (NF) and South Fork (SF) at RM 7.2. Both streams originate in adjacent headwater lakes.

The majority of land encircling Libby Creek has been designated as Okanogan National Forest; however, adjacent private parcels have seized most of the riparian habitat along the mainstem and significant tributaries. These private tracks are intermittently separated by USFS and state owned parcels. Much of the 39.9 mi^2 drainage has been heavily managed for timber harvesting and livestock grazing (Andonaegui, 2000). The Okanogan National Forest boundary originates near Ben Creek, and encompasses the remaining Libby Creek basin. Private land use along Libby Creek is residential on a seasonal basis.

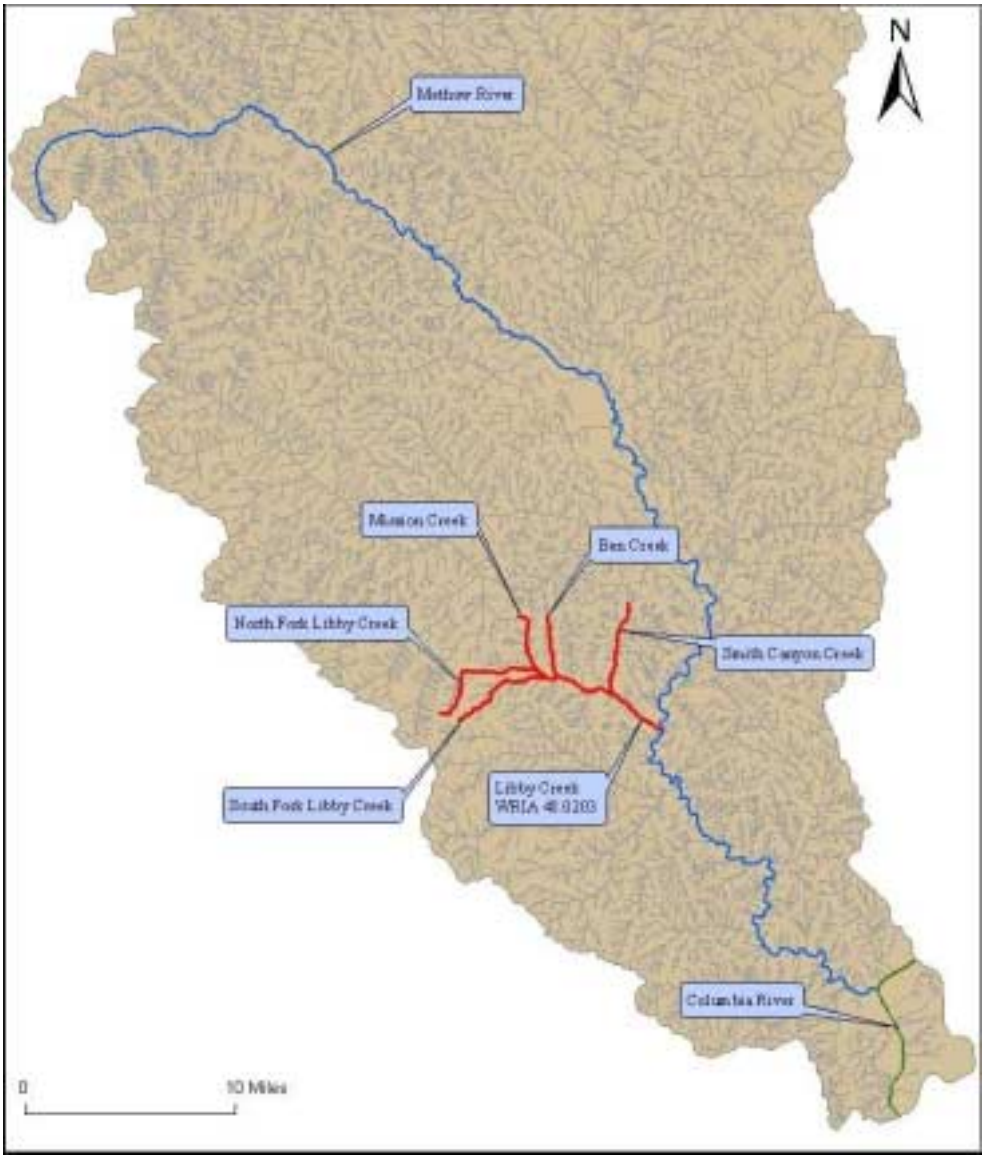


Figure 3. Libby Creek Subwatershed

Gold Creek Subwatershed Overview (WRIA 48.0104)

Gold Creek is the most southerly surveyed stream, located in the Lower Methow River at RM 21.5 (Fig. 4). SF Gold Creek is the first fish-bearing tributary entering Gold Creek (right bank RM 1.12). Rainy Creek is the only fish-bearing tributary to SF, which enters at RM 3.8 (LB entry). Middle Fork (MF) Gold Creek enters the main stem from the right bank at RM 3.41. A divergence occurs at RM 5.17 to form Foggy Dew Creek and NF Gold Creek. NF Gold Creek continues to its headwaters on the northern slope of Raven Ridge. The Foggy Dew Creek headwaters are located on the eastern slope of Sawtooth Ridge, which separates Okanogan County from Chelan County.

Acreage throughout the 88.3 mi^2 basin has been designated as Okanogan National Forest except for a few intermittent private parcels that lie along portions of the main stem and several tributaries. Private land use along Gold Creek is primarily residential.

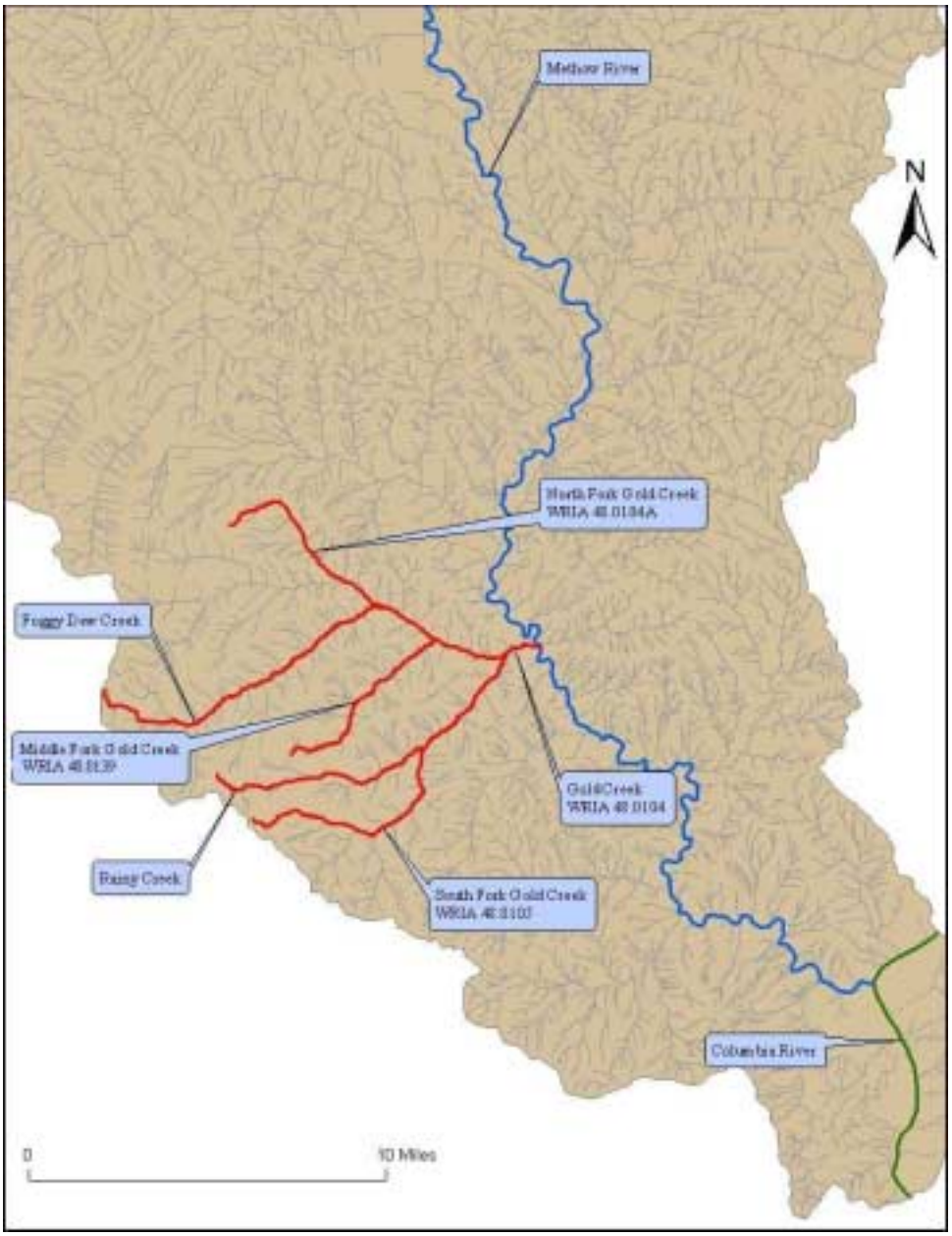


Figure 4. Gold Creek Subwatershed

Wolf Creek Subwatershed Overview (WRIA 48.1300)

Wolf Creek drains into the Methow River from the right bank at RM 52.8 just north of Winthrop (Fig. 5). This drainage basin encompasses approximately 40 mi^2. The first tributary is Little Wolf Creek, entering from the right bank at RM 3.10. North Fork Wolf Creek enters the mainstem from the left bank at RM 6.25. Potential salmonid use ends at RM 10.6 where a 3.7 m (12 ft) waterfall is located. This is also the location of South Fork Wolf Creek junction into the mainstem (RM 10.6).

The Okanogan National Forest envelops the majority of this system and is managed as wilderness from the boundary to the headwaters (Andonaegui, 2000). Private parcels line the riparian corridor for approximately two miles upstream of the confluence.

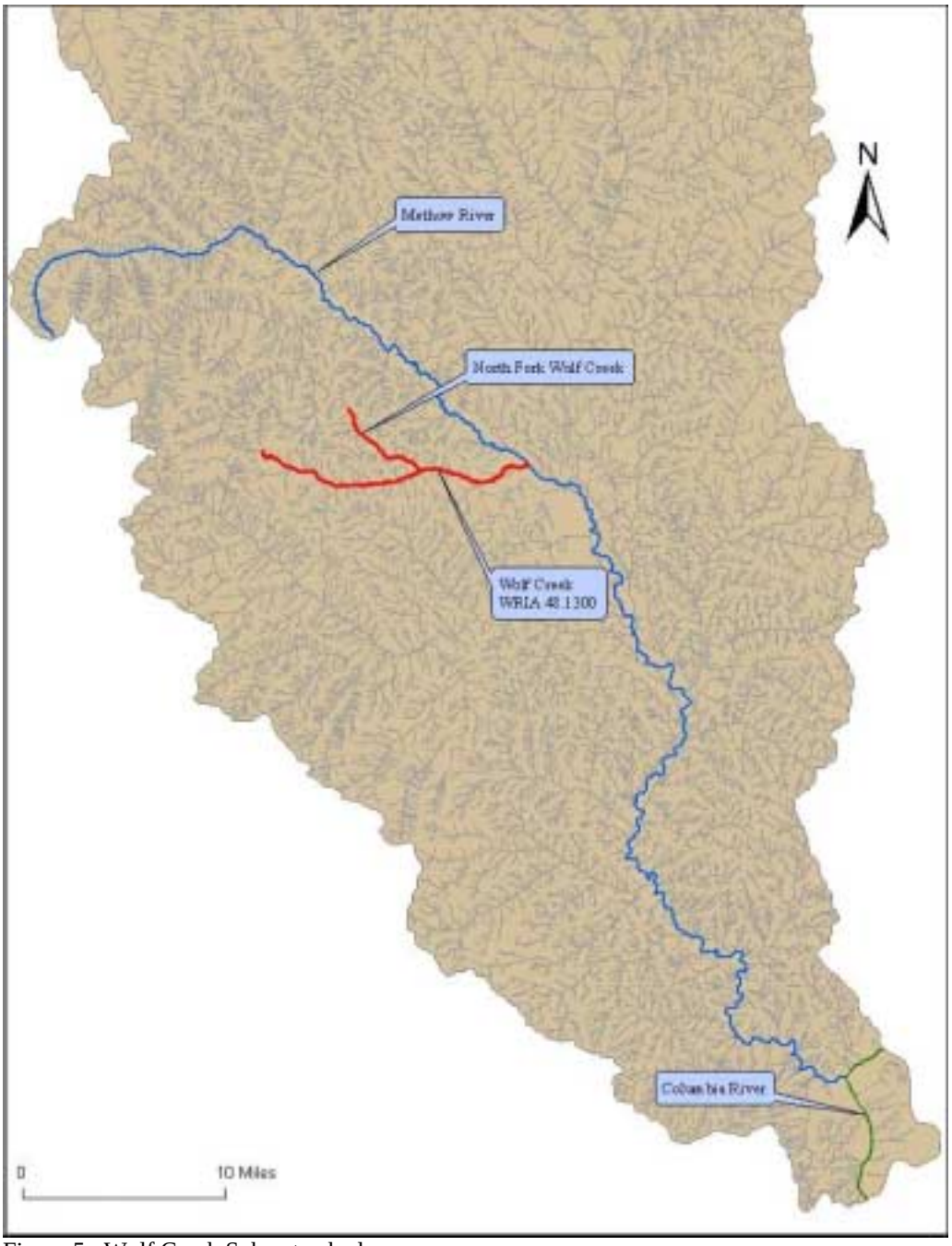


Figure 5. Wolf Creek Subwatershed

Buttermilk Creek Subwatershed Overview (WRIA 48.0466)

The confluence of Buttermilk Creek and the Twisp River occurs at RM 13.43 (Fig. 6). Buttermilk Creek forks into West Fork (WF) and East Fork (EF) at RM 2.61. Continuing on EF Buttermilk, Yoyo Creek enters from the right bank at RM 3.0. There are no major tributaries influencing WF Buttermilk Creek. The last named tributary is Black Pine Creek, a right bank entry at RM 3.81. Residential land use parcels are situated along the confluence for less than a mile. Okanogan National Forest envelops the bulk of this 36.9 mi^2 subwatershed.

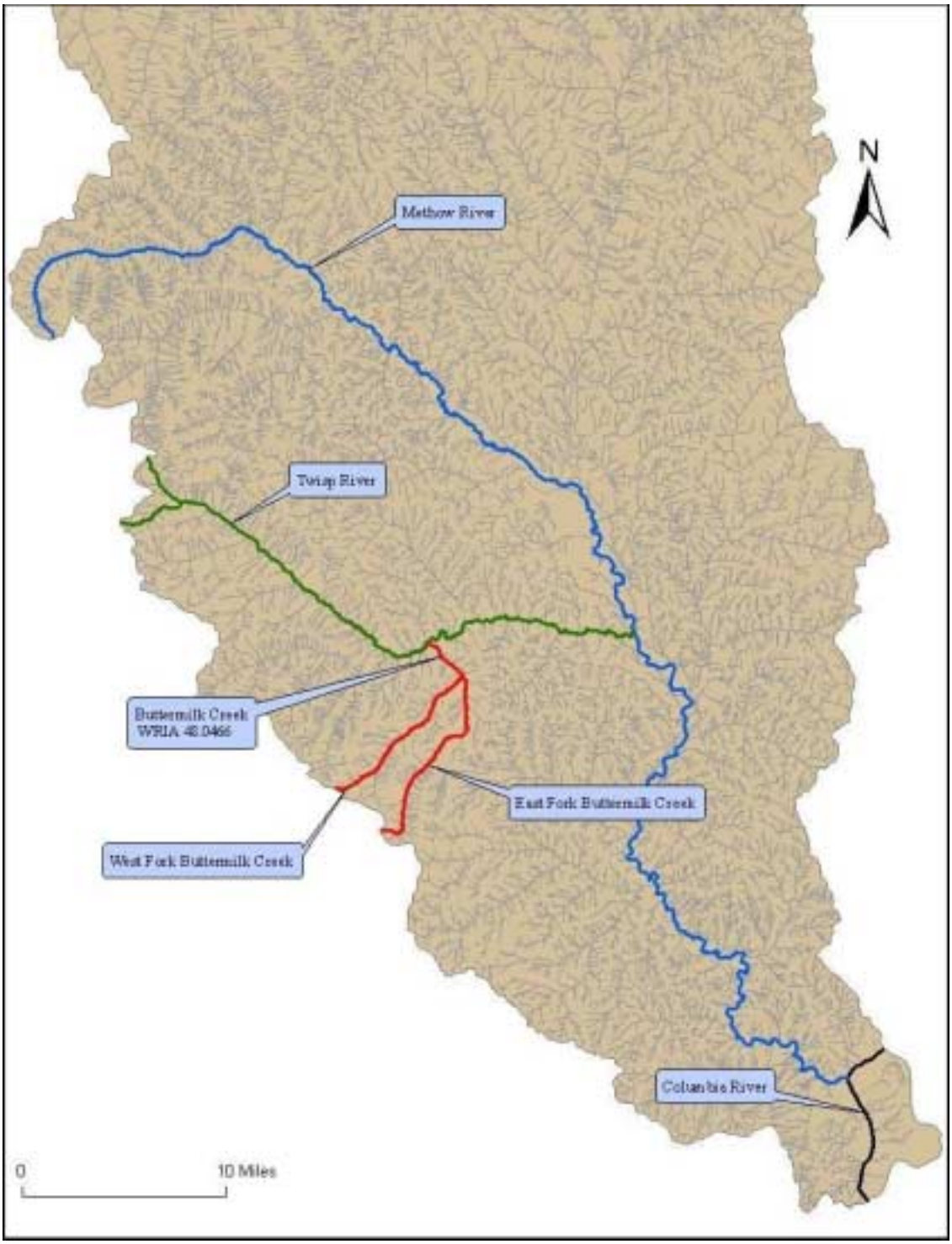


Figure 6. Buttermilk Creek Subwatershed

Goat Creek Subwatershed Overview (48.1364)

Goat Creek drains into the Methow River at RM 64, just southeast of Mazama (Fig. 7). This subwatershed encompasses an estimated 34.69 mi^2. Nine named tributaries drain into the Goat Creek, all lying within the Okanogan National Forest. The entire drainage, with the exception of some private land at the mouth, is designated Okanogan National Forest and managed to favor old growth and species which depend on late successional forest (Andonaegui, 2000).

Historically, lower Goat Creek, between the confluence and the Goat Creek Road Bridge, typically experiences dewatering or low flows during August and September. Recent enhancement in this area has alleviated dewatering by installing engineered log and boulder controls to retain bed load and slow stream flow. New riparian plantings line both banks.

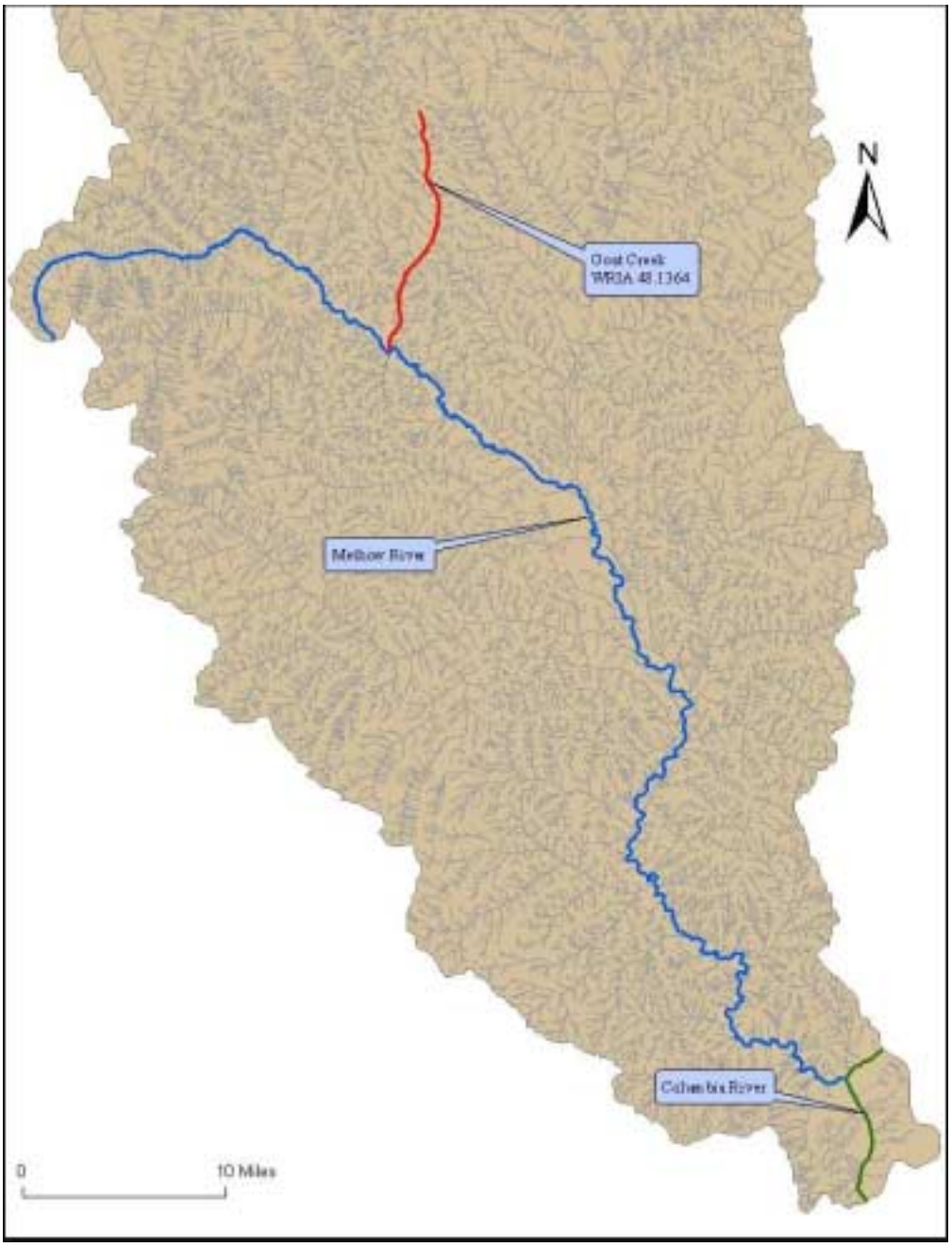


Figure 7. Goat Creek Subwatershed

Poorman Creek Subwatershed Overview (WRIA 48.0386)

Located east of Buttermilk Creek, Poorman Creek drains into the Twisp River at RM 4.66 (Fig. 8). This small watershed incorporates an estimated 12.9 mi^2. All tributaries are either non-fish-bearing or seasonal natural drainages. Residential land use parcels continue upstream from the confluence for approximately 1.4 mi. Okanogan National Forest envelops the majority of this subwatershed.

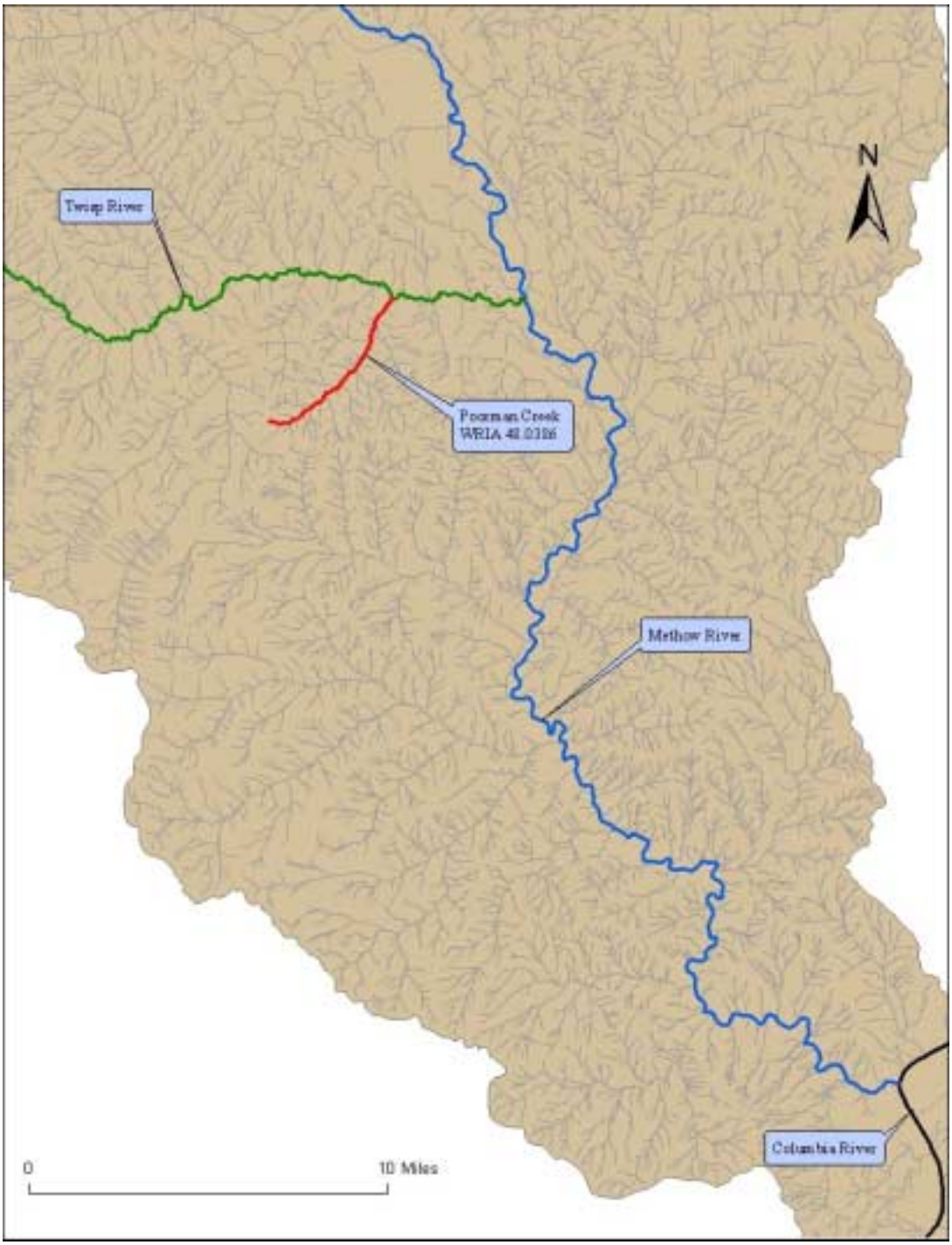


Figure 8. Poorman Creek Subwatershed

METHODS

Feature Inventory

Targeted streams were identified by name and WRIA number using USGS quadrangle maps and ArcMap software prior to commencement of fieldwork. Potential fish species utilization was determined from WDFW biologists, Salmon and Steelhead Stock Inventory (SASSI) maps and StreamNet data located in WDFW's network geographic information system (GIS) library.

YIC personnel walked Pearrygin, Libby, Gold, Wolf, Buttermilk, Goat and Poorman Creeks beginning at or near their confluence until reaching the USFS wilderness boundary. Human-made features encountered during the survey were identified and evaluated for fish passage (culverts, dams and fishways) or fish safety (pump diversions and gravity diversions) using methodologies described in *Fish Passage Barrier and Surface Water Diversion Screening Assessment and Prioritization Manual* (WDFW, 2000).

Some data reported below reflect surveys conducted by other government entities or community groups. Note: FRIMA funding did not provide for surveys to be conducted on state or federally owned lands; therefore, statistical analyses of collected survey data were used to quantify available habitat upstream of public land boundaries per *Fish Passage Barrier and Surface Water Diversion Screening Assessment and Prioritization Manual* (WDFW, 2000).

Each encountered feature received a unique Site ID number except for associated features (*e.g.* dam with diversion), which share a common Site ID. Geographic locations were recorded using either a Garmin GPS unit (Model GPS 12 XL) or Trimble GeoExplorer II in decimal degrees based on the WGS84 datum. Feature dimensions were measured with a Sokkia 7.1 m telescoping stadia rod. Slope and length of culverts were measured with a Laser Technology Inc. laser (Model Impulse LR) mounted on a monopod.

Fish passage features (culverts, dams and fishways) were evaluated for barrier/non barrier status. Culvert criteria determining Level A non-barrier status include an outfall drop less than 0.24 m **and** a pipe slope less than or equal to 1% when natural streambed material is **not** present throughout the pipe. Culverts also pass Level A assessment when streambed material **is** present throughout the pipe **and** the pipe diameter is greater than or equal to 75% of the average stream channel width. Culverts failing these criteria are evaluated as barriers.

Level B analysis results when barrier or non-barrier status cannot be determined by the Level A assessment. Level B analysis includes many other factors, including but not limited to, tidal influence, high fish passage design flow rate, water depth and velocity. The calculated depth and velocity must meet criteria for trout in WAC 220-110-070 to be classified as fish passable (WDFW, 2000).

Dams are considered barriers when the water height difference is greater than 0.24 m or 0.3 m in streams not utilized by chum salmon. Barrier status is always given to dams lacking water flow over the crest. Percent passability (0, 33, 67 or 100) was estimated for each barrier based on the severity of fish blockage. No fishways have been evaluated by YIC to date. Features not conforming to the above categories (bridges, fords, puncheons, etc.) were given Site ID numbers, described in detail, measured, evaluated for percent passability and classified as non culvert crossings (WDFW, 2000).

Surface water diversion features (gravity and pump diversions) must possess proper screen condition and mesh size to be compliant with criteria set forth by NOAA Fisheries, formerly National Marine Fisheries Service (NMFS), for the prevention of fry impingement and/or entrainment. Maximum size opening for screens encountered by salmonid fry is 3/32" measured at the widest cross-section (NMFS, 1995). Gaps between the structure and the screen must also meet the same criteria. Spaces greater than this allow fry to enter the diversion. Screens should be free from defects such as holes, dents or overall deterioration. Maximum approach velocity into diversions must not exceed 0.4 ft/sec (WDFW, 2000). Features not meeting the above requirements were recorded as noncompliant.

Diverted water flow can be determined by direct measurement, taken from the water right or derived by calculating ditch area. Flow via direct measurement was recorded when possible. Alternatively, converting ditch area (*A*) into cubic feet per second (*cfs*) then into gallons per minute (*gpm*) derived potential diversion flow rate (*Q*) for systems lacking flow where $Q = \frac{Aft2}{1} x \frac{0.75\,ft}{\text{sec}} x \frac{449\,gpm}{1cfs}$. Reference tables were used to estimate flow in submerged gravity fed pipes within closed systems based on the orifice equation. Extensive barrier inventory criteria can be found in *Fish Passage Barrier and Surface Water Diversion Screening Assessment and Prioritization Manual* (WDFW, 2000).

Habitat Assessment

The goal of this inventory was to identify and prioritize barriers for correction on private land; therefore, habitat assessments were performed to quantify and qualify potential available habitat gain upstream of barrier sites. YIC conducted habitat assessments on Pearrygin, Libby, Gold, Wolf, Poorman, Buttermilk and Goat Creeks concurrently with feature evaluations. Only streams containing human-made barriers were further evaluated for habitat gain.

Surveys began with a downstream check for anadromous accessibility. This distance, from the mouth of each stream to the first encountered human-made barrier, was measured to the nearest tenth meter using a hip chain with three-strand, biodegradable thread. Gradient, channel description, predominant flora, canopy and instream cover were also noted, as well as land use conditions that may affect stream or water quality. Surveyed stream lengths are reported as a total of the downstream check plus the available upstream habitat.

Stream sampling began immediately upstream of the first encountered barrier. Sampling frequency was predetermined based on the overall stream length estimated from USGS quadrangle maps (1:24,000). For streams greater than 1.6 kilometers (1 mi) in overall length, 60 m of every 320 m were sampled. For streams less than 1.6 kilometers (1 mi), 30 m of every 160 m were sampled. Both methods yield approximately 20% sampling (WDFW, 2000). YIC strived to collect a minimum of two samples per reach. The first two pools and riffles in each sample were recorded for length, wetted width, ordinary high water width, water depth and substrate strata. Lengths of each additional pool and riffle were measured until reaching the end of the sample section.

Sampling was repeated until stream characteristic changes warranted breaking reach wherein a new sample began. A reach is any section of stream with similar physical characteristics. Conditions for breaking reach are additional human-made barriers, changes in habitat use, substrate type or gradient (sustained over 160 m). Tributary input greater than or equal to 20% of the parent stream flow also necessitates breaking reach (WDFW, 2000). Each crewmember independently determined qualitative spring influence, instream cover, juvenile abundance and % canopy of each reach before collectively assigning descriptors as per the methodology.

Sampling continued until reaching the headwaters or until the survey was terminated. Surveys are terminated when a natural point barrier is detected (waterfall > 3.7 m), when sustained gradient is greater than 20% for 160 m or when the channel width becomes less than 0.9 m (WDFW, 2000). For this project, surveys were also terminated when reaching the boundary between private and public land ownership.

Habitat Quality Modifiers (HQM) assign values related to the quality of spawning and rearing habitat available for fish use and are classified as good to excellent, fair, poor or no value and are recorded as 1, 0.67, 0.33 or 0, respectively. Spawning modifiers are determined by the instream substrate composition suitable for spawning. Rearing modifiers are determined by riparian vegetation abundance, channel morphology, instream cover, seasonal flow and water temperature. Extensive HQM criteria may be found in *Fish Passage Barrier and Surface Water Diversion Screening Assessment and Prioritization Manual* (WDFW, 2000).

Prioritization

Data analyses were performed using MS Excel spreadsheets designed by WDFW to generate a Fish Passage Priority Index (PI) number for each fish passage barrier and a Screening Priority Index (SPI) number for each water surface diversion. Index numbers consolidate variables that affect project feasibility into unique values that provide guidance when selecting projects for funding. Calculated values can be modified in response to new available data. The PI value for each barrier was calculated using the formula:

$$PI = \sum_{\text{all species}} \sqrt[4]{[(BPH)xMDC]}$$

Where:

B = Proportion of fish run expected to gain access due to site improvement (inverse of assigned percent passability)

P = Production potential per m^2 (values are species specific)

H = Habitat gain in m^2 (calculated from the physical habitat survey and gives greater weight to projects that have greater available spawning and rearing habitat upstream)

M = Mobility Modifier (gives greater weight to species that are highly mobile and capable of increased productivity once habitat access is restored)

D = Species Condition Modifier (gives greater weight to less healthy stocks)

C = Cost Modifier (reflects project cost, giving greater weight to those less costly)

As the PI number increases, potential improvement or utilization by fish stocks increases, and consequently, higher priority is given for correction of the feature.

The SPI value for each noncompliant diversion was calculated using the formula:

$$SPI = \sum_{\text{all species}} \sqrt[4]{[(QP)xMDC]}$$

Where:

Q = Flow in gallons per minute

P = Production potential per m^2 (values are species specific)

M = Mobility Modifier (gives greater weight to species that are highly mobile and capable of increased productivity once habitat access is restored)

D = Species Condition Modifier (gives greater weight to less healthy stocks)

C = Cost Modifier (reflects project cost, giving greater weight to those less costly)

The SPI reflects potential juvenile fish mortality due to diverted flow, wherein increasing the flow rate raises the SPI and, consequently, increased mortality occurs. Diversions with higher SPI values receive greater priority for correction.

Extended Threshold Determination (ETD)

An ETD is conducted to estimate the amount of available habitat upstream or downstream of a barrier when an extensive physical survey is not feasible. Pool, riffle, rapid and pond areas (m^2) are extrapolated from physical sample data, taken during a survey, based on the ratio of remaining basin area to channel width and stream gradient. An ETD results in populating adjusted production areas for each fish species potentially utilizing the stream. These data are added to actual physical data collected in the field to capture the full spawning and rearing potential of the stream system. The generated PI reflects additional usable habitat upstream or downstream that could not be physically sampled.

All data and photos were entered into a WDFW statewide Fish Passage and Diversion Screening Database (FPDSI) for agency personnel review. Site photos were taken using a Kodak DC5000 Zoom digital camera.

RESULTS

Feature Inventory

YIC walked 30.3 linear kilometers (18 mi) in seven streams scattered throughout the Methow Valley. Fifty features were documented in Pearrygin, Libby, Gold, Wolf and Poorman Creeks, collectively (Table 3). No features were documented in Gold Creek (main stem), Buttermilk Creek or Goat Creek; therefore, further habitat sampling was not warranted in these systems. Dams accounted for the highest percentage of encountered man-made features (40%) followed by gravity diversions (30%), culverts (26%) and pump diversions (4%)(Fig. 9). Twenty-nine passage features are classified as barriers. Four dams were considered 100% passable because the water surface difference was less than 0.30 m at each. Sixteen water diversions were classified as noncompliant due to improper screening. One small garden pump in Poorman Creek met screening compliance.

Table 3. Numbers and types of features encountered during inventory.

Feature	# Documented	# Barriers	# Noncompliant
Culverts	13	13	
Dams	20	16	
Gravity diversions	15		15
Pump diversions	2		1
TOTAL	**50**	**29**	**16**

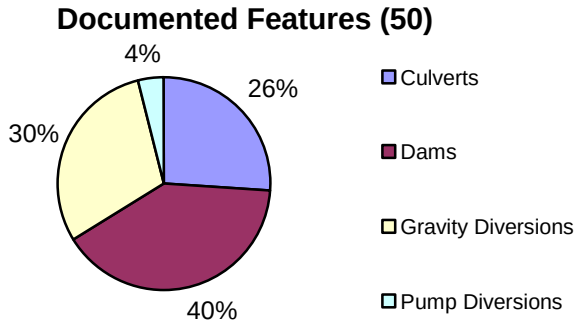


Figure 9. Feature percentages identified during inventory.

Prioritization

YIC surveyed available stream habitat in Pearrygin, Libby, SF Gold, MF Gold, Wolf and Poorman Creeks. Table 4 lists the SPI assigned to each surface water diversion, site number, location, potential species utilization, diversion type, associated dam, ditch area and flow. Table 5 lists the PI value assigned to each fish passage feature, site number, location, potential species utilization, feature type, passability, additional upstream and downstream barriers, basin area, survey length and habitat gain. Habitat values reflect potential gain assuming that all upstream barriers are corrected. Appendix II lists detailed information for all sites identified during this inventory, as well as those identified by other state and local groups.

Pearrygin Creek: YIC surveyed 1,462 m (0.9 mi) of Pearrygin Creek from its confluence with the Chewuch River to Pearrygin Lake. YIC identified three barrier culverts between the crossing of E. Chewuch Rd and the outlet dam at Pearrygin Lake (Fig. 10). Site 960300, a county-owned culvert under E. Chewuch Rd, received the highest PI at 32.32 (Table 5) and blocks 19,345 m (12 mi) of upstream habitat for fish use. Barrier status was given to this culvert due to an excessive slope (8.3%) and boulders blocking the inflow, causing the area to backwater.

One gravity diversion and one pump diversion were also identified. Site 960302, an unscreened gravity diversion on the Chewuch Canal, received the higher SPI of 13.85 (Table 4). The canal diverts approximately 2.4 cfs (1,078 gpm) of water from May to October for residential irrigation. Flow downstream of this site received 0.4 cfs (180 gpm) for fish use at time of survey. Creek flow upstream of 960302 could not be determined because the canal and streambed occupy the same space. The small irrigation pump (960305) lacks any screening on the intake pipe, posing a mutilation threat to juvenile salmonids. ESA listed Spring Chinook and Summer Steelhead, as well as Coho, Bull Trout/Dolly Varden, Brook Trout and resident Rainbow/Cutthroat Trout could potentially benefit from barrier corrections on Pearrygin Creek.

WDFW personnel surveyed the Pearrygin Lake access point and 15,190 m (9.4 mi) through and above the Methow Wildlife Area in 1999. Two culverts, 980649 (PI 20.75) and 980603 (PI 16.46), and one dam/diversion, 980604 (PI 14.76), were identified (Table 5). YIC completed ETDs for Pearrygin Lake and a 2,791 m (1.7 mi) riparian corridor between Pearrygin Lake and the Wildlife Area purchased by WDFW in February 2005.

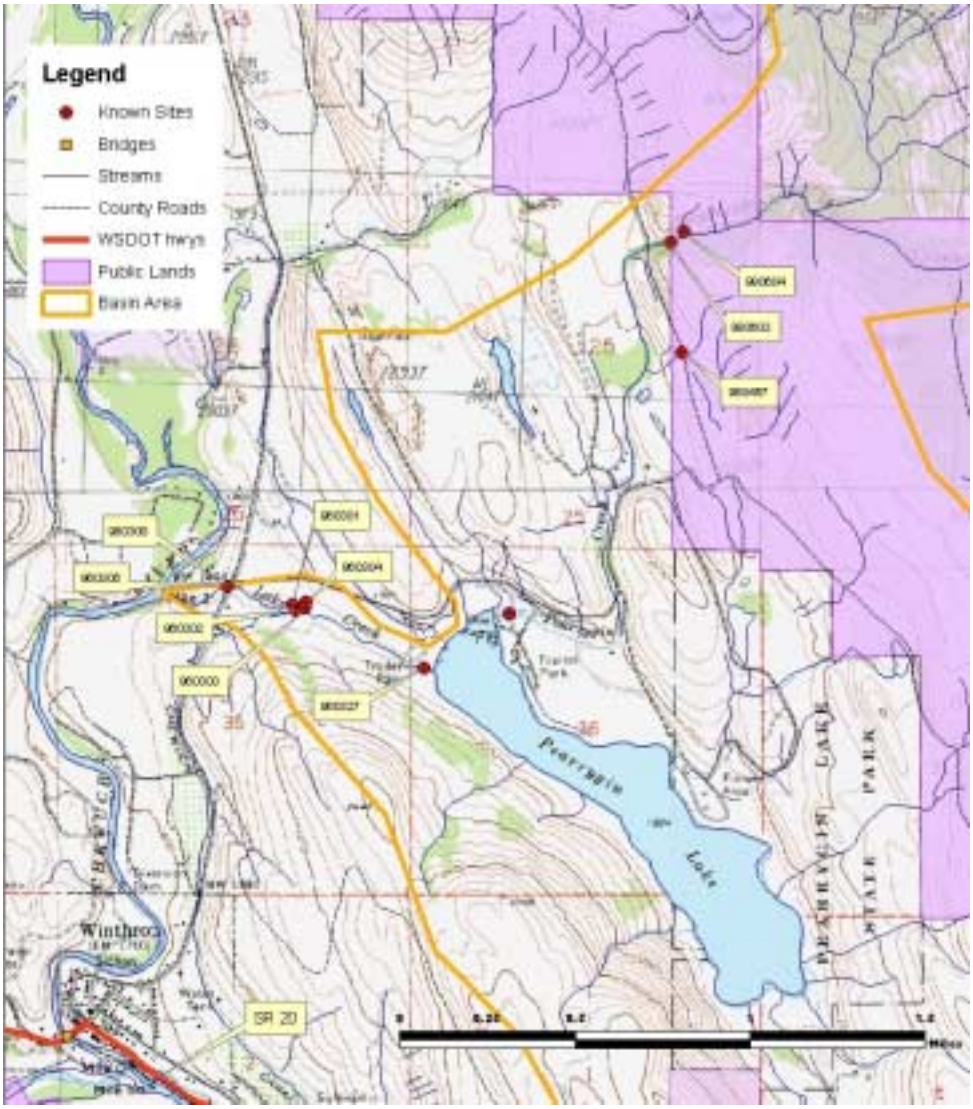


Figure 10. Pearrygin Creek known sites.

Libby Creek: YIC surveyed 9,517 m (5.9 mi) of Libby Creek, including the tributary Smith Canyon Creek. YIC identified two fish passage features and one screening feature on mainstem Libby Creek (Fig 11). Site 960307, a dam and gravity diversion, received a PI of 13.48 and an SPI of 5.28, respectively (Tables 4 and 5). This unscreened gravity diversion may remove up to 3.3 cfs (1,522 gpm) from Libby Creek based on diversion ditch area. The ditch was not flowing at the time of survey. The associated rock fill dam had an excessive water surface difference of 0.87 m. Correction of all barriers in the Libby Creek basin would open 25,833 m (16.1 mi) of habitat for depressed Summer Steelhead and resident Rainbow/Cutthroat Trout. Smith Canyon Creek contains four documented culverts (Fig 11). Site 960310 received the highest PI at 5.33 (Table 5). Trout were seen in several pools upstream of the culverts.

ETDs were completed for tributaries Ben Canyon Creek, SF Libby Creek, NF Libby Creek and Mission Creek totaling 17,042 m (10.6 mi) of fish-bearing habitat above the USFS boundary. Okanogan Conservation District (OCD) identified five barrier culverts on USFS land (Fig 11). Barrier falls terminate main stem anadromous access 16,166 m (10 mi) from the mouth of Libby Creek.

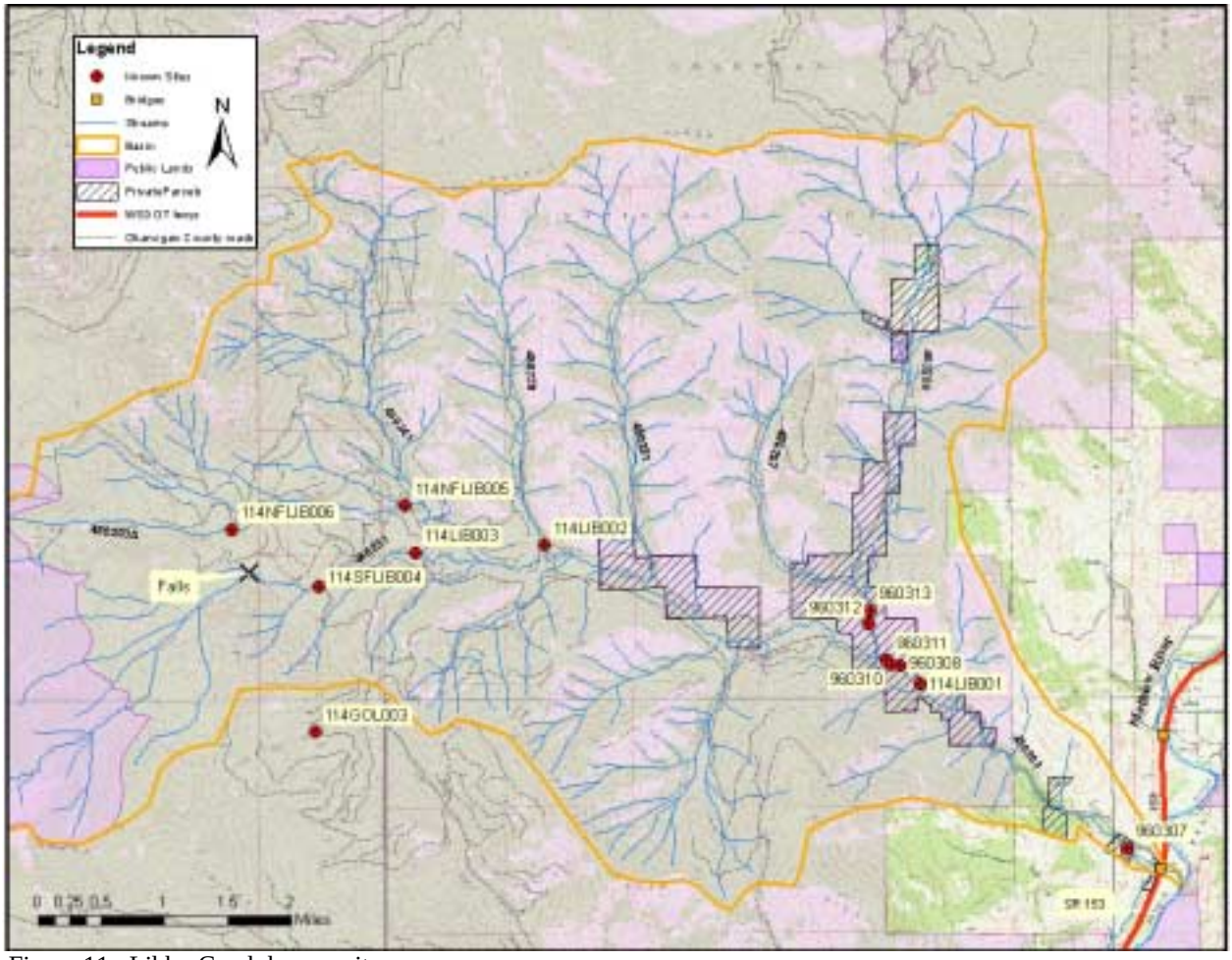


Figure 11. Libby Creek known sites.

Gold Creek: YIC walked 3,900 m (2.4 mi) of Gold Creek beginning approximately 1,500 m (0.9 mi) from the mouth to the USFS boundary. A downstream landowner denied YIC access to the lower reaches and the confluence. No upstream barriers were found on mainstem Gold Creek. Two tributaries, South Fork and Middle Fork were also surveyed. Each are reported as individual systems.

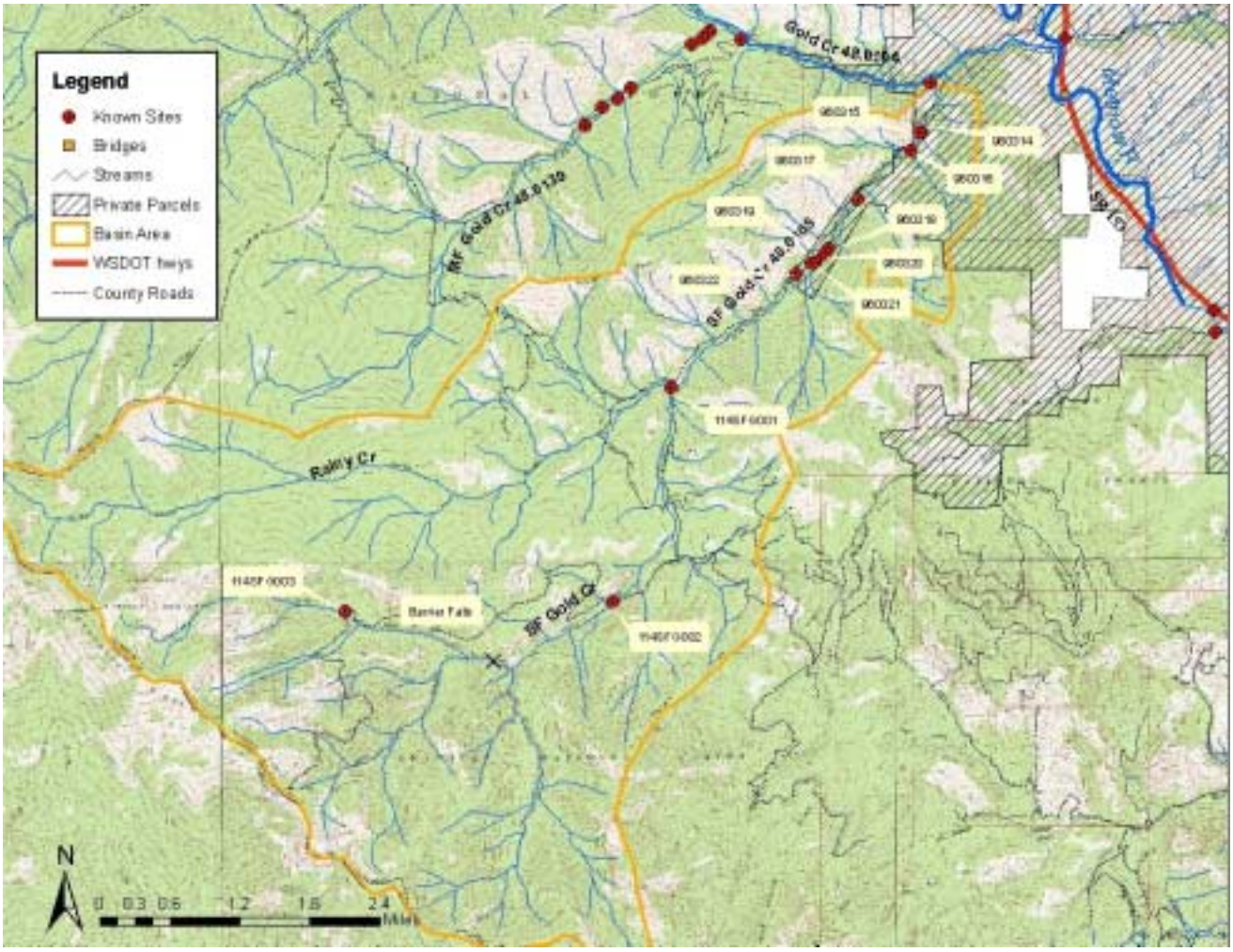


Figure 12. SF Gold Creek known sites.

SF Gold Creek: YIC surveyed 3,887 m (2.4 mi) on SF Gold Creek. ETDs were completed for an additional 14,860 m (9.2 mi), including Rainy Creek. Barrier falls terminate SF Gold Creek anadromous access 11,354 m (7.1mi) upstream from the mouth. OCD documented three sites on SF Gold Creek above the USFS boundary (Fig 12). Habitat above Site 114SFG003 is utilized by resident trout only, because the culvert is located above the falls.

YIC identified nine fish passage and five screening features in SF Gold Creek (Fig 12). Two dams, 960315 and 960319, were evaluated as 100% passable and not assigned PI values. Site 960317, a dam and gravity diversion, received the highest PI of 13.48 and an SPI of 6.22 (Tables 4 and 5). This unscreened gravity diversion may remove up to 2.4 cfs (1,078 gpm) of water from the stream based on diversion ditch area. The associated rock fill dam has an excessive water surface difference of 0.67 m. Correction of this site could open 16,427 m (10.2) of habitat upstream for ESA listed Summer Steelhead, resident Rainbow/Cutthroat and Bull Trout/Dolly Varden. Correction of the three remaining sites downstream (960314, 960315, 960316) could gain 17,859 m (11.1 mi) of total habitat in this system.

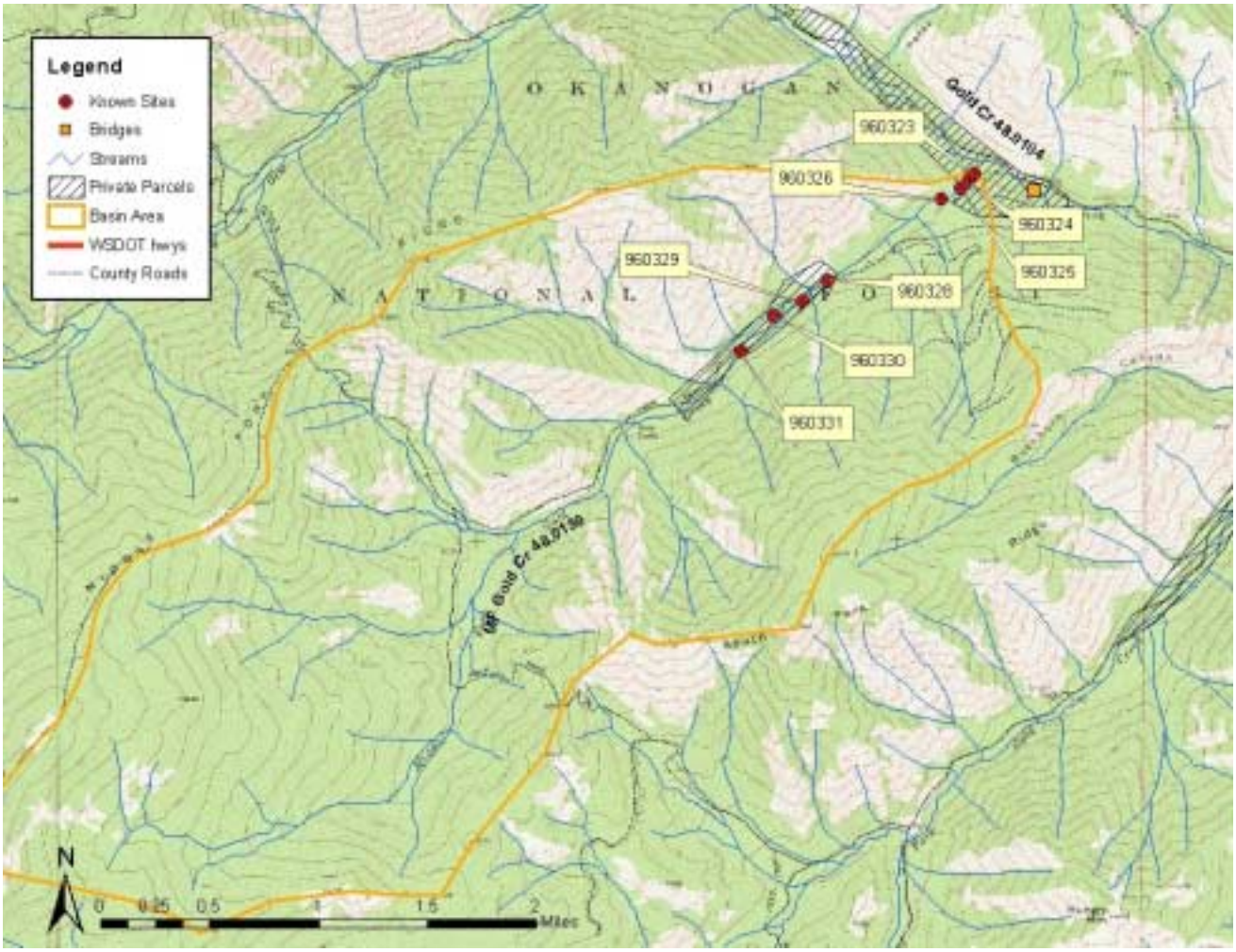


Figure 13. MF Gold Creek known sites.

MF Gold Creek: YIC surveyed 3,352 m (2.1 mi) on MF Gold Creek and identified eight passage and three screening features (Fig 13). Site 960323, dual culverts under a private drive, received a PI of 7.05 (Table 5). Excessive slopes (4% and 5%) make these pipes barriers to fish passage. Correction of this site could gain 3,228 m (2 mi) of habitat should all upstream barriers be corrected. A dam and gravity diversion 2,514 m (1.6 mi) further upstream (Site 960331) collects freshwater for several adjacent residents. An SPI could not be generated for the diversion, because the intake is located within the dam, making flow immeasurable. The associated dam is a passage barrier due to a water surface difference of 1.0 m and received a PI of 5.04 (Table 5). MF Gold Creek becomes non-fish-bearing at 3,352 m (2.1 mi) when the ordinary high water (OHW) width drops below 0.9 m.

Wolf Creek: YIC surveyed 3,200 m (2 mi) on Wolf Creek from the mouth to the USFS boundary. ETDs were completed for an additional 19,120 m (11.9 mi), including NF Wolf Creek. Barrier falls terminate mainstem anadromous access 17,230 m (10.7 mi) from the mouth. NF Wolf Creek becomes non-fish bearing (OHW < 0.9 m) 585 m from the confluence with Wolf Creek.

YIC identified one passage and two screening features (Fig 14). A gravity diversion, Site 960332, received an SPI of 13.61 (Table 4). Approximately 2.2 cfs (1,007 gpm) of water are diverted from the stream. Flow feeds two ponds used for rearing tribal hatchery Coho before returning, unobstructed, to Wolf Creek. A barrier culvert connects the two ponds, restricting adult fish use to the lower pond. The ditch intake lacks a fish bypass screen and exceeds the maximum approach velocity of 0.4 ft/sec. Another gravity diversion located 299 m upstream received a higher SPI

(15.09), based on ditch area, but was not flowing at the time of survey. The single dam was evaluated as 100% passable. An unsurveyed diversion ditch is located approximately 5,105 m upstream of Site 960332. Many juvenile trout were observed during the survey as well as and a pair of spawning adults. Correction of sites on Wolf Creek would open 20,629 m (12.8mi) of habitat upstream for ESA listed Spring Chinook and Summer Steelhead, reintroduced tribal hatchery Coho, resident Rainbow/Cutthroat Trout and Bull Trout/Dolly Varden.

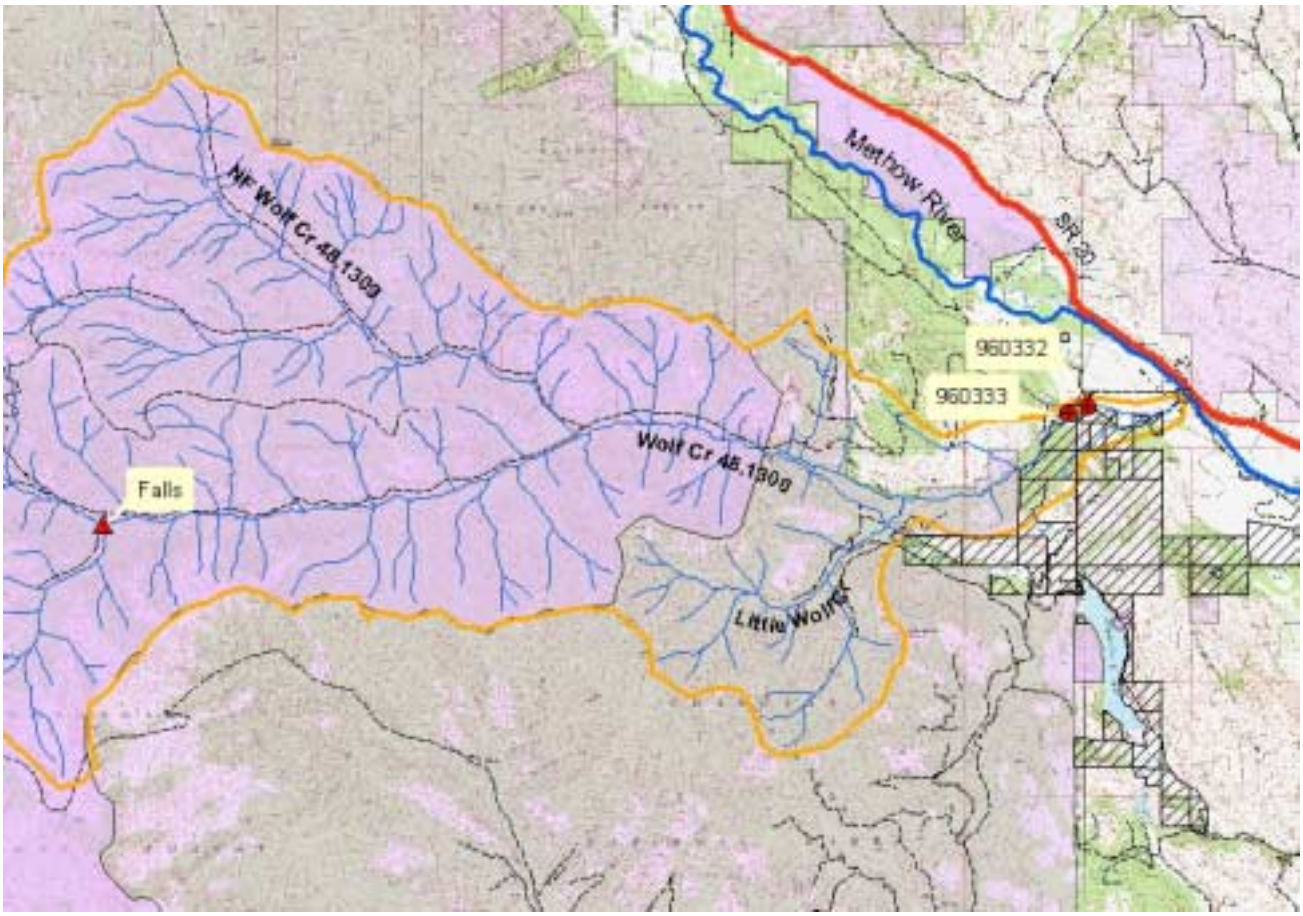


Figure 14. Wolf Creek known sites.

Poorman Creek: YIC surveyed 2,379 m (1.5 mi) on Poorman Creek from its confluence with the Twisp River to the USFS boundary. An ETD was completed for an additional 2,835 m (1.8 mi) of public land upstream. No documented sites exist upstream of the USFS boundary. All tributaries were mapped as non-fish bearing (OHW < 0.9 m). YIC identified five fish passage and three fish screening features (Fig 15). Site 960341 (dam/diversion) and Site 960342 (culvert) received identical PI values of 13.44 (Table 5). Site 960341, a rock fill and metal dam, has an excessive water surface difference of 0.32 m. The associated gravity diversion has a screen but fails to meet the 3/32" maximum screen opening criteria. The county-owned culvert (960342) has an excessive slope of 3.4%, reducing fish passage by one third. Correction of these sites could open 4,901 m (3 mi) of habitat upstream for fish use. Site 960343 (unscreened gravity diversion) received an SPI of 3.36 (Table 4). This diversion removes up to 3.6 cfs (1,594 gpm), based on physical measurements, for an ornamental pond at a nearby residence. Two other diversions (960340 and 960341) were immeasurable.

Potential species benefiting from correction include Sockeye, ESA listed Spring Chinook, Summer Steelhead and resident Rainbow/Cutthroat Trout. Poorman Creek flows through several large,

successive beaver ponds before returning to a confined channel. Species utilization is reduced to resident trout upstream of the beaver ponds based on channel width and gradient. Numerous juveniles were observed in and above the ponds.

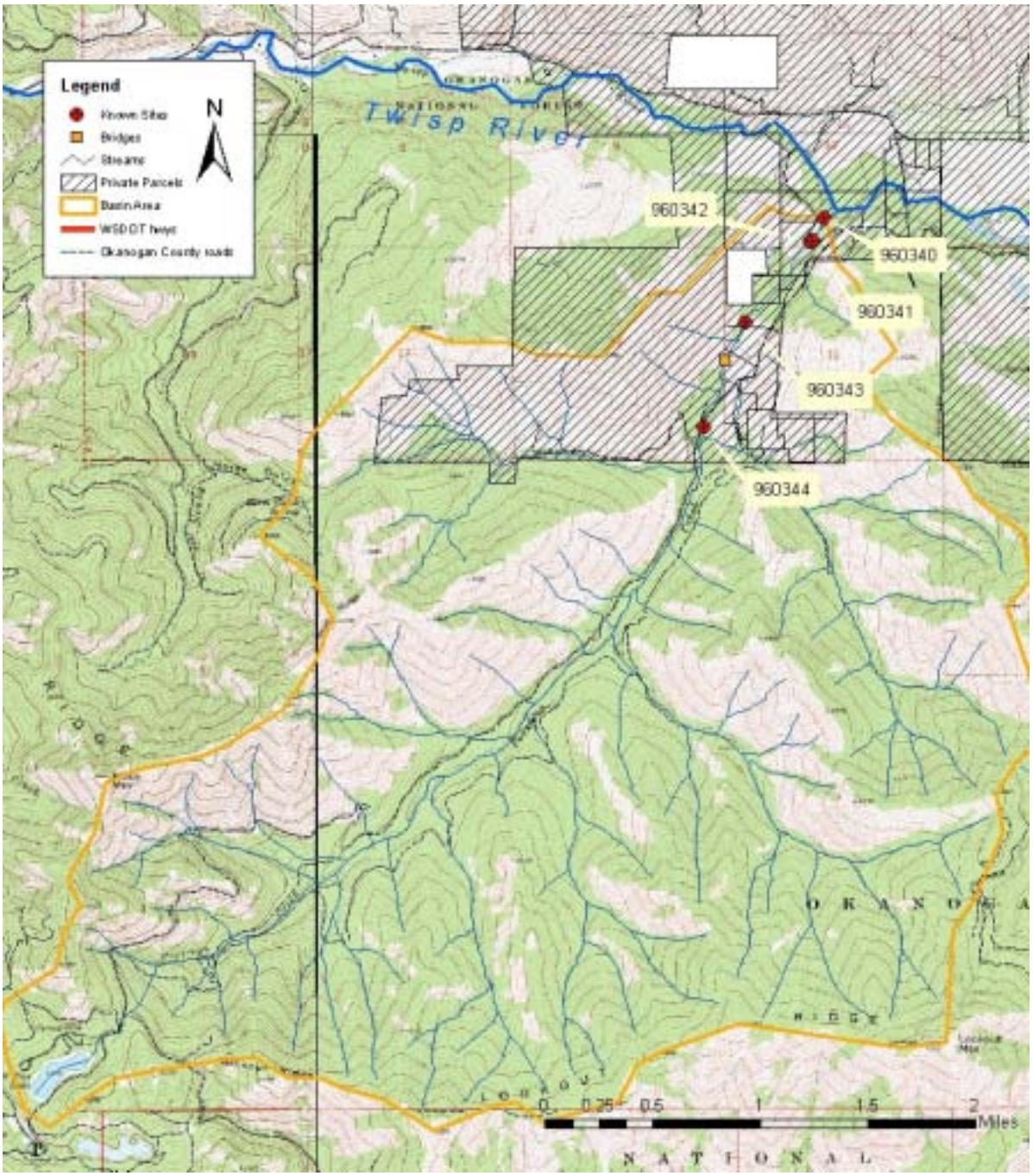


Figure 15. Poorman Creek known sites.

Table 4. Screening Priority Index values for noncompliant water surface diversions on fish bearing streams within WRIA 48.

Site ID	Stream	Tributary to	Potential Species Utilization	Diversion Type	Associated Dam	Basin Area (m2)	Ditch Area (ft2)	Flow (gpm)	Screening Priority Index (SPI)
960302	Pearrygin Cr	Chewuch R	CO, CK, ST, RT, BT	Gravity	No	11.34	3.2	1078	13.85
960305	Pearrygin Cr	Chewuch R	CO, CK, ST, RT, BT	Pump	No	11.37	pipe	*	*
960307	Libby Cr	Methow R	ST, RT	Gravity	Yes	39.8	4.52	1522	5.28
960315	SF Gold Cr	Gold Cr	SH, RT, BT	Gravity	Yes	27.41	2.3	789	5.76
960317	SF Gold Cr	Gold Cr	SH, RT, BT	Gravity	Yes	25.16	3.2	1078	6.22
960319	SF Gold Cr	Gold Cr	SH, RT, BT	Gravity	Yes	24.48	pipe	*	*
960321	SF Gold Cr	Gold Cr	SH, RT, BT	Gravity	Yes	24.35	pipe	*	*
960322	SF Gold Cr	Gold Cr	SH, RT, BT	Gravity	Yes	24.17	pipe	*	*
960325	MF Gold Cr	Gold Cr	ST, RT	Gravity	Yes	8.95	pipe	*	*
960326	MF Gold Cr	Gold Cr	ST, RT	Gravity	Yes	8.93	pipe	*	*
960331	MF Gold Cr	Gold Cr	ST, RT	Gravity	Yes	7.08	pipe	*	*
960332	Wolf Cr	Methow R	CO, CK, ST, RT, BT	Gravity	Yes	39.28	5.9	1007	13.61
960333	Wolf Cr	Methow R	CO, CK, ST, RT, BT	Gravity	No	39.23	4.5	1522	15.09
960340	Poorman Cr	Twisp R	SO, CH, ST, RT	Gravity	Yes	12.7	pipe	*	*
960341	Poorman Cr	Twisp R	SO, CH, ST, RT	Gravity	Yes	12.62	pipe	*	*
960343	Poorman Cr	Twisp R	RT	Gravity	Yes	12.47	5.9	1594	3.36

SO = sockeye, CO = coho, CK = chinook, **SH** = steelhead, **RT** = rainbow/cutthroat trout, **BT** = bull trout/dolly varden, * = no data

Table 5. PI correction values of passage barriers on fish bearing streams within WRIA 48.

Site ID	Stream	Tributary To	Potential Species Utilization	Feature Type	Passable %	Additional Barriers		Basin Area (m2)	Survey Length (m)	Habitat Gain (m)	Priority Index (PI)
						Downstream	Upstream				
960300	Pearrygin Cr	Chewuch R	CO, CK, ST, RT, BT	Culvert	33	0	8	11.37	19345	19345	32.32
960301	Pearrygin Cr	Chewuch R	CO, CK, ST, RT, BT	Culvert	33	2	6	11.34	18836	18836	32.05
960303	Pearrygin Cr	Chewuch R	CO, CK, ST, RT, BT	Culvert	33	4	4	11.34	18836	18836	32.05
960327	Pearrygin Cr	Chewuch R	CO, CK, ST, RT, BT	Dam	33	5	3	11.17	18246	18246	31.86
960307	Libby Cr	Methow R	SH, RT	Dam	33	0	10	39.80	25833	25833	13.48
960308	Libby Cr	Methow R	SH, RT	Dam	67	1	9	36.72	22661	22661	9.61
960310	Smith Canyon Cr	Libby Cr	SH, RT	Culvert	33	2	3	7.81	1673	1673	5.33
960311	Smith Canyon Cr	Libby Cr	SH, RT	Culvert	67	3	2	7.81	1578	1578	4.4
960312	Smith Canyon Cr	Libby Cr	SH, RT	Culvert	33	4	1	7.73	980	980	5.41
960313	Smith Canyon Cr	Libby Cr	SH, RT	Culvert	33	5	0	7.71	917	917	4.75
960314	SF Gold Cr	Gold Cr	SH, RT, BT	Dam	67	0	13	27.41	17859	17859	10.74
960315	SF Gold Cr	Gold Cr	SH, RT, BT	Dam	100						
960316	SF Gold Cr	Gold CR	SH, RT, BT	Dam	67	2	11	27.25	17527	17527	10.65
960317	SF Gold Cr	Gold Cr	SH, RT, BT	Dam	33	3	9	25.16	16427	16427	12.13
960318	SF Gold Cr	Gold Cr	SH, RT, BT	Dam	67	5	8	24.66	15599	15599	9.85
960319	SF Gold Cr	Gold Cr	SH, RT, BT	Dam	100						
960320	SF Gold Cr	Gold Cr	SH, RT, BT	Dam	33	7	6	24.43	15349	15349	11.62
960321	SF Gold Cr	Gold Cr	SH, RT, BT	Dam	33	8	4	24.35	15244	15244	11.56
960322	SF Gold Cr	Gold Cr	SH, RT, BT	Dam	67	10	2	24.17	14988	14988	9.56
960323	MF Gold Cr	Gold Cr	SH, RT	Culvert	33	0	7	9.04	3228	3228	7.05
960324	MF Gold Cr	Gold Cr	SH, RT	Culvert	33	1	6	9.04	3228	3228	7.05
960325	MF Gold Cr	Gold Cr	SH, RT	Dam	67	2	5	8.95	3038	3038	5.84
960326	MF Gold Cr	Gold Cr	SH, RT	Dam	33	3	4	8.93	2862	2862	6.88
960328	MF Gold Cr	Gold Cr	SH, RT	Culvert	67	4	3	7.93	1714	1714	4.63
960329	MF Gold Cr	Gold Cr	SH, RT	Culvert	67	5	2	7.50	1398	1398	4.47
960330	MF Gold Cr	Gold Cr	SH, RT	Dam	33	6	1	7.35	1131	1161	5.1
960331	MF Gold Cr	Gold Cr	SH, RT	Dam	0	7	0	7.08	713	713	5.04
960332	Wolf Cr	Methow R	CO, CK, ST, RT, BT	Dam	100						
960340	Poorman Cr	Twisp R	SO, CH, ST, RT	Dam	100						
960341	Poorman Cr	Twisp R	SO, CH, ST, RT	Dam	67	2	4	12.62	4901	4901	13.44
960342	Poorman Cr	Twisp R	SO, CH, ST, RT	Culvert	67	4	3	12.62	4901	4901	13.44
960343	Poorman Cr	Twisp R	RT	Dam	33	5	1	12.47	4040	4040	4.55
960344	Poorman Cr	Twisp R	RT	Culvert	33	7	0	11.73	3166	3166	4.13

SO = sockeye**, CO =** coho, **CK** = chinook, **SH** = steelhead, **RT** = rainbow/cutthroat, **BT** = bull trout/dolly varden

DISCUSSION

Pearrygin Creek Summary

The dynamic water utilization program circumscribing Pearrygin Creek makes this system more complex than others in the Methow Watershed. The 1,462 m extent of lower Pearrygin Creek has been heavily impacted by seasonal water diversion into the Chewuch Canal. Flows may cease entirely during summer months, rendering reaches from the Pearrygin Lake outlet to E. Chewuch Rd of little use for rearing juvenile fish. Spawning habitat quality was reported as fair in the lower reaches and poor in reaches between the last culvert and Pearrygin Lake due to heavy fines accumulation. Rearing habitat quality was reported as good to excellent as long as sufficient water remains in the stream below the Chewuch Canal diversion.

YIC encountered three barrier culverts and two water diversions on Pearrygin Creek. An important step in restoring the salmonid access in Pearrygin Creek would be to replace the barrier culvert at Site 960300 (Fig. 16). Site 960301, a pump diversion immediately upstream of 960300 could easily become compliant by adding properly sized screen material and reducing the approach velocity. The unscreened gravity diversion (960302) located on the Chewuch Canal requires the addition of a fish bypass and proper screening for compliance (Fig. 17). The connection of Chewuch Canal into Pearrygin Creek (960304 and 960303) should be screened to prevent adult and juvenile salmonids and resident species from entering the irrigation ditch. Water management revisions in Pearrygin Lake and the Chewuch Canal should precede fish passage enhancement efforts in Pearrygin Creek.

Libby Creek Summary

Libby Creek offers restoration groups potential to make great strides in stream enhancement. Extensive habitat could be reclaimed for fish utilization with relatively few corrections needed. At the forefront are Sites 960307 and 960308. Problems associated with site 960307 (Fig. 18) include, but are not limited to, an extreme water surface difference (0.87 m), plunge pool absence and lack of a fishway. The primary use of this dam is to impound water for irrigation as determined by the presence of an adjacent noncompliant gravity diversion (960307)(Fig. 19).

Site 960308 lies approximately 3,000 m upstream of 960307. This dam creates a recreational swimming hole that could easily be partially breached, allowing juvenile fish to pass. Extensive upstream spawning and rearing habitat was assessed as good to excellent, making these sites worthy of further consideration for correction.

Restoration efforts in Libby Creek have already begun. An undersized barrier culvert Libby Creek Rd, identified in 2001, was replaced in 2003 with an 11 m bottomless arch, structural plate steel culvert, opening over 23,000 m (14.3 mi) of habitat. Habitat production potential upstream warrants continued restoration and barrier correction efforts in Libby Creek.

Smith Canyon Creek is a resident fish-use only stream at this time due to limited salmonid access. Problems that warrant attention on Smith Canyon Creek begin at its confluence with Site 960310 (Fig. 20). An excessive outfall drop (0.5 m) and a log blocking the culvert intake were noted during inventory. All three remaining private drive culverts are slope and outfall drop barriers to fish passage. Several landowners along lower Smith Canyon Creek expressed interest in enhancing the area to facilitate fish passage. YIC was denied access to approximately 438 m of stream along Smith Canyon Creek starting at RM 0.47. YIC was informed of an alleged noncompliant gravity diversion

located on the denied parcel through personal communication with an adjacent landowner. Visual contact confirmed this statement.

Gold Creek Summary

Gold Creek has a long history of conflict between individual landowners and natural resource agencies. Active litigation regarding one gravity diversion has impacted YIC inventory efforts. As a result, a barrier inventory and habitat assessment could not be conducted for reaches between the mouth and 1500 m upstream.

SF Gold Creek

Several established gravity diversions interspersed with dams impact flow in SF Gold Creek. A dam created for irrigation impoundment (960314), is located furthest downstream and evaluated as 67% fish passable. Problems associated with this dam include absence of a plunge pool and lack of a fishway. This feature could easily be breached to allow greater passage. Upstream substrate composition is good to excellent, signifying potential spawning habitat. In addition, rearing habitat was considered good to excellent because adequate pool habitat and instream cover are present.

A gravity diversion with an associated dam (960317) received the highest SPI and PI for SF Gold Creek (Fig. 21). Problems associated with this diversion are lack of a head gate and fish bypass screen. Water was actively being diverted at the time of evaluation without the required measures in place for prevention of fish impingement or mutilation. The associated dam is constructed of primarily boulders and spans the entire stream width. No fishway is present. A notable problem with the dam is the excessive water height surface difference (0.67 m), reducing passability to 33%. Upstream spawning and rearing habitat was considered good to excellent.

Landowners along this riparian corridor expressed concern with the lack of fish utilizing the stream and a willingness to enhance the area. Most corrections could be completed with volunteer labor and little financial consequence.

MF Gold Creek

MF Gold Creek is approximately one half the size of SF Gold Creek as measured by the ordinary high water on both. This stream supports resident trout and potentially Summer Steelhead from Gold Creek. Correction/removal of dual culverts near its confluence would improve access for salmonids seeking rearing habitat (Fig. 22). Upstream, a newly built dam and gravity diversion (960331) provide the primary fresh water source for several residents downstream (Figs. 23 and 24). The angle of the spillway is too steep to be considered a fishway, justifying an improvement. The associated gravity diversion is currently screened within the face of the spillway.

Wolf Creek Summary

The Habitat Limiting Factors report for WRIA 48 documents four water diversions on Wolf Creek. All originate on private land with the exception of the Wolf Creek Reclamation District (WCRD) diversion, which diverts Little Wolf Creek on a year round basis. This tributary no longer reaches Wolf Creek (Andonaegui, 2000). YIC assessed all but the WCRD diversion.

The first of two gravity diversions inventoried on Wolf Creek (960332) supplies water for two established fish rearing ponds. The diversion intake creates a vortex into an unscreened, submerged pipe feeding the upper pond (Fig 25). The velocity is too extreme for juvenile fish species. A barrier culvert with an excessive outfall drop separates the rearing ponds (Fig 26). Flow exits the lower pond through an unobstructed ditch then rejoins Wolf Creek. The landowner has been very

forthcoming with suggestions to improve both the diversion and the culvert, and he also stated that adult Coho, trout, ESA listed Spring Chinook and Summer Steelhead have been observed in the lower pond. Detailed information regarding these ponds for reintroduction of yearling Coho can be found in Yakima Nation's "Coho Salmon Species Plan" (CSSP) for the Mid-Columbia Basin. (Andonaegui, 2000).

The next encountered gravity diversion appears to be no longer in use (960333). Compliant screening could easily be added if operational status changed. An additional gravity diversion is located upstream of 960333 and has a compliant paddlewheel-driven rotating drum screen installed. This diversion was not generating enough flow to be operational at the time.

The lower reaches of Wolf Creek experience periods of reduced fish access during summer low flows. On multiple occasions reaches downstream of 990332 have dried up. These conditions prohibit the upstream migration of Bull Trout and endangered Spring Chinook salmon, affecting access to rearing and spawning habitat (Andonaegui, 2000). This stream potentially supports Summer Steelhead, ESA listed Spring Chinook, reintroduced tribal hatchery Coho, resident Rainbow/Cutthroat Trout and Bull Trout/Dolly Varden.

Poorman Creek Summary

Poorman Creek is heavily shaded with Red Osier Dogwood and Snowberry that provides excellent instream cover for rearing juvenile fish. The streambed in the lower reaches consists of impacted gravel and fines. Flow is reduced considerably during the summer months but withstands dewatering during this period.

The first gravity diversion/dam on Poorman Creek (960340) may possibly be unintentionally in use. The pipe appears not maintained and the cover has been washed down stream. Removal is recommended. The second of two dams encountered on Poorman Creek was assessed as 67% fish passable due to the excessive dam height of 0.50 m and lack of a sufficient plunge pool (960341). A 0.38 m diameter, corrugated steel diversion pipe is embedded across half of the channel and acts partly as a dam as well as an intake for a gravity diversion. This diversion appears to be shut down and should be removed or breached to allow greater passage.

A crucial feature requiring replacement is the barrier culvert under Poorman Creek Cutoff Rd (Fig. 27). This culvert has an excessive slope as well as an excessive hydraulic drop into the culvert. These problems impede passage of salmonids.

Site 960343 greatly reduces the flow of Poorman Creek by diverting up to 3.6 cfs (1,594 gpm) to accommodate a private pond at a downstream residence (Fig. 28 and 29). The diversion requires the installation of a screening device to meet with compliance guidelines. The associated dam spans the entire stream and has neither a fishway nor an adequate plunge pool.

Beaver activity influences the flow of approximately 365 lineal meters of Poorman Creek between sites 960342 and 960343. Direct observation confirms that this area provides extensive rearing habitat for resident trout species. Poorman Creek potentially supports resident Rainbow/Cutthroat Trout, Sockeye, ESA listed Spring Chinook and Summer Steelhead.

Figure 16. Site 960300, a culvert on Pearrygin Creek under E. Chewuch Rd, has an excessive slope.

Figure 17. Site 960302 is a gravity diversion for the lower Chewuch Canal on Lake Creek that lacks a fish bypass screen.

Figure 18. Site 960307, on Libby Creek, is a dam for the right bank gravity diversion shown below. The stadia rod extends full span of the dam.

Figure 19. Site 960307 is a gravity diversion associated with the dam shown above. This feature is noncompliant due to the lack of a bypass screen.

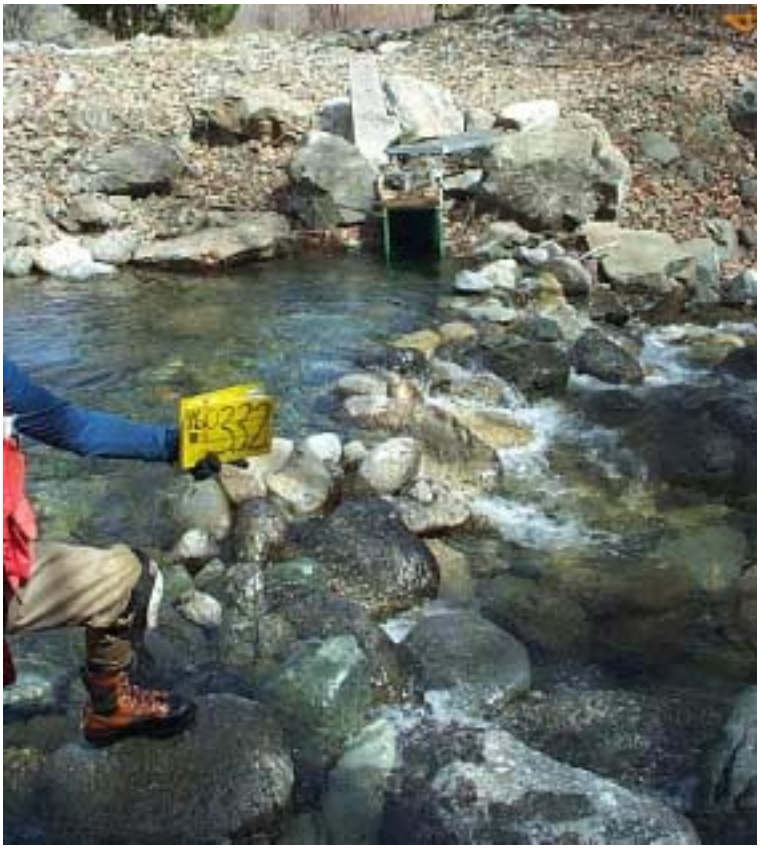
Figure 20. Site 960310 is located at the confluence of Smith Canyon Creek and Libby Creek. An excessive outfall drop fish makes this feature a fish passage barrier.

Figure 21. Site 960317 is a right bank diversion with an associated dam on SF Gold Creek. This feature is noncompliant because it lacks a fish bypass screen.

Figure 22. Site 960323 consists of two culverts located under a private drive on MF Gold Creek. Excessive slope makes these pipes partial barriers to fish passage.

Figure 23. Site 960331 is a piped gravity diversion that provides residents with fresh water.

Figure 24 (below). This newly constructed dam for the above diversion lacks a fish bypass screen, making this site a fish passage barrier.



Figures 25 and 26. Site 960332 is a left bank gravity diversion and dam located on Wolf Creek. Two rearing ponds fed by this diversion are connected with a culvert attached to a collection box pictured below. Adult salmon congregate below this pipe. Excessive velocity makes this site a safety barrier for juvenile fish.

Figure 27. Site 960342 is located on Poorman Creek under a county maintained road. Excessive slope makes this pipe a barrier.

Figures 28 and 29. Site 960343, a dam (left) and diversion (right) are located on Poorman Creek. An excessive outfall makes the dam a partial barrier to fish passage. The noncompliant diversion feeds an ornamental pond at a nearby residence and lacks a fish bypass screen.

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APPENDIX I

Comprehensive List of Structures Inventoried in the Methow Watershed

Comprehensive list of features identified by YIC during the Methow Valley Fish Passage and Surface Water Diversion Inventory on targeted streams. The list is grouped by creek beginning at the furthest downstream site. Latitude/Longitude are in decimal degrees (WGS84). Easting/Northing are State Plane Coordinates in feet (NAD27, Washington South).

Stream Name	Tributary To	Site ID	WRIA #	Feature Type	Status	Identified By	Downstream Check Length (m)	Upstream Survey Length (m)	Habitat ETD Length (m)	Gain Total (m)
Pearrygin Cr	Chewuch R	960300	48.0730	Culvert	Barrier	WDFW (YIC)	363	1099	18246	19345
Pearrygin Cr	Chewuch R	960305	48.0730	Pump	Noncompliant	WDFW (YIC)	363	1099	18246	19345
Pearrygin Cr	Chewuch R	960301	48.0730	Culvert	Barrier	WDFW (YIC)	397	702	18246	18948
Pearrygin Cr	Chewuch R	960302	48.0730	Gravity	Noncompliant	WDFW (YIC)	509	590	18246	18836
Pearrygin Cr	Chewuch R	960303	48.0730	Culvert	Barrier	WDFW (YIC)	509	590	18246	18836
Pearrygin Cr	Chewuch R	960304	48.0730	Culvert	Unk	WDFW (YIC)				
Pearrygin Cr	Chewuch R	960327	48.0730	Dam	Barrier	WDFW (YIC)	1099	0	18246	18246
Pearrygin Cr	Chewuch R	980649	48.0730	Culvert	Barrier	WDFW (WLA)			15190	15190
Pearrygin Cr	Chewuch R	980603	48.0730	Culvert	Barrier	WDFW (WLA)			10254	10254
Pearrygin Cr	Chewuch R	980304	48.0730	Dam/Gravity	Both	WDFW (WLA)			10190	10190
Libby Cr	Methow R	960307	48.0203	Dam/Gravity	Both	WDFW (YIC)	726	8791	17042	25833
Libby Cr	Methow R	960308	48.0203	Dam	Barrier	WDFW (YIC)	3172	5619	17042	22661
Libby Cr	Methow R	114LIB001	48.0203	Culvert	Fixed	OCD				
Libby Cr	Methow R	114LIB002	48.0203	Culvert	Barrier	OCD				
Libby Cr	Methow R	114LIB003	48.0203	Culvert	Barrier	OCD				
NF Libby Cr	Libby Cr	114NFLIB005	48.0203A	Culvert	Barrier	OCD				
NF Libby Cr	Libby Cr	114NFLIB006	48.0203A	Culvert	Barrier	OCD				
Smith Canyon Cr	Libby Cr	960310	48.0206	Culvert	Barrier	WDFW (YIC)	3228	1673	0	1673
Smith Canyon Cr	Libby Cr	960311	48.0206	Culvert	Barrier	WDFW (YIC)	3383	1578	0	1578
Smith Canyon Cr	Libby Cr	960312	48.0206	Culvert	Barrier	WDFW (YIC)	3886	980	0	980
Smith Canyon Cr	Libby Cr	960313	48.0206	Culvert	Barrier	WDFW (YIC)	4044	917	0	917
SF Gold Cr	Gold Cr	960314	48.0105	Dam	Barrier	WDFW (YIC)	888	2999	14860	17859
SF Gold Cr	Gold Cr	960315	48.0105	Dam	OK	WDFW (YIC)	962	2925	14860	17785

Stream Name	Tributary To	Site ID	WRIA #	Feature Type	Status	Identified By	Downstream Check Length (m)	Upstream Habitat Gain		
								Survey Length (m)	ETD Length (m)	Total (m)
SF Gold Cr	Gold CR	960316	48.0105	Dam	Barrier	WDFW (YIC)	1220	2667	14860	17527
SF Gold Cr	Gold Cr	960317	48.0105	Dam/Gravity	Both	WDFW (YIC)	2320	1567	14860	16427
SF Gold Cr	Gold Cr	960318	48.0105	Dam	Barrier	WDFW (YIC)	3148	739	14860	15599
SF Gold Cr	Gold Cr	960319	48.0105	Dam/Gravity	OK/Noncompliant	WDFW (YIC)	3257	630	14860	15490
SF Gold Cr	Gold Cr	960320	48.0105	Dam	Barrier	WDFW (YIC)	3398	489	14860	15349
SF Gold Cr	Gold Cr	960321	48.0105	Dam/Gravity	Both	WDFW (YIC)	3503	384	14860	15244
SF Gold Cr	Gold Cr	960322	48.0105	Dam/Gravity	Both	WDFW (YIC)	3759	128	14860	14988
SF Gold Cr	Gold Cr	114SFG001	48.0105	Culvert	Barrier	OCD				
SF Gold Cr	Gold Cr	114SFG002	48.0105	Culvert	Barrier	OCD				
MF Gold Cr	Gold Cr	960323	48.0139	Culvert	Barrier	WDFW (YIC)	124	3228	0	3228
MF Gold Cr	Gold Cr	960324	48.0139	Culvert	Barrier	WDFW (YIC)	124	3228	0	3228
MF Gold Cr	Gold Cr	960325	48.0139	Dam/Gravity	Both	WDFW (YIC)	314	3038	0	3038
MF Gold Cr	Gold Cr	960326	48.0139	Dam/Gravity	Both	WDFW (YIC)	490	2862	0	2862
MF Gold Cr	Gold Cr	960328	48.0139	Culvert	Barrier	WDFW (YIC)	1638	1714	0	1714
MF Gold Cr	Gold Cr	960329	48.0139	Culvert	Barrier	WDFW (YIC)	1954	1398	0	1398
MF Gold Cr	Gold Cr	960330	48.0139	Dam	Barrier	WDFW (YIC)	2191	1161	0	1161
MF Gold Cr	Gold Cr	960331	48.0139	Dam/Gravity	Barrier/Unk	WDFW (YIC)	2639	713	0	713
Gold Cr	Methow R	960335	48.0104	Bridge	OK	WDFW (YIC)				
Gold Cr	Methow R	960336	48.0104	Bridge	OK	WDFW (YIC)				
Wolf Cr	Methow R	960346	48.1300	Bridge	OK	WDFW (YIC)				
Wolf Cr	Methow R	960332	48.1300	Dam/Gravity	OK/Noncompliant	WDFW (YIC)	1691	1509	19120	20629
Wolf Cr	Methow R	960333	48.1300	Gravity	Noncompliant	WDFW (YIC)	1990	1210	19120	20330
Wolf Cr	Methow R	960334	48.1300	Bridge	OK	WDFW (YIC)				
Buttermilk Cr	Twisp R	960337	48.0466	Bridge	OK	WDFW (YIC)				
Goat Cr	Methow R	960338	48.1364	Bridge	OK	WDFW (YIC)				
Goat Cr	Methow R	960339	48.1364	Bridge	OK	WDFW (YIC)				
Poorman Cr	Twisp R	960340	48.0386	Dam/Gravity	OK/Noncompliant	WDFW (YIC)	47	2332	2835	5167
Poorman Cr	Twisp R	960306	48.0386	Ford	OK	WDFW (YIC)				
Poorman Cr	Twisp R	960341	48.0386	Dam/Gravity	Both	WDFW (YIC)	266	2066	2835	4901
Poorman Cr	Twisp R	960342	48.0386	Culvert	Barrier	WDFW (YIC)	266	2066	2835	4901
Poorman Cr	Twisp R	960345	48.0386	Pump	OK	WDFW (YIC)				

Stream Name	Tributary To	Site ID	WRIA #	Feature Type	Status	Identified By	Downstream Check Length (m)	Upstream Habitat Gain		
								Survey Length (m)	ETD Length (m)	Total (m)
Poorman Cr	Twisp R	960343	48.0386	Dam/Gravity	Both	WDFW (YIC)	1127	1205	2835	4040
Poorman Cr	Twisp R	960309	48.0386	Bridge	OK	WDFW (YIC)				
Poorman Cr	Twisp R	960344	48.0386	Culvert	Barrier	WDFW (YIC)	2001	331	2835	3166