Thompson River Bull Trout Enhancement and Recovery Plan

Thompson Falls Project No. 1869

Thompson Falls, Montana

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1.0 Introduction

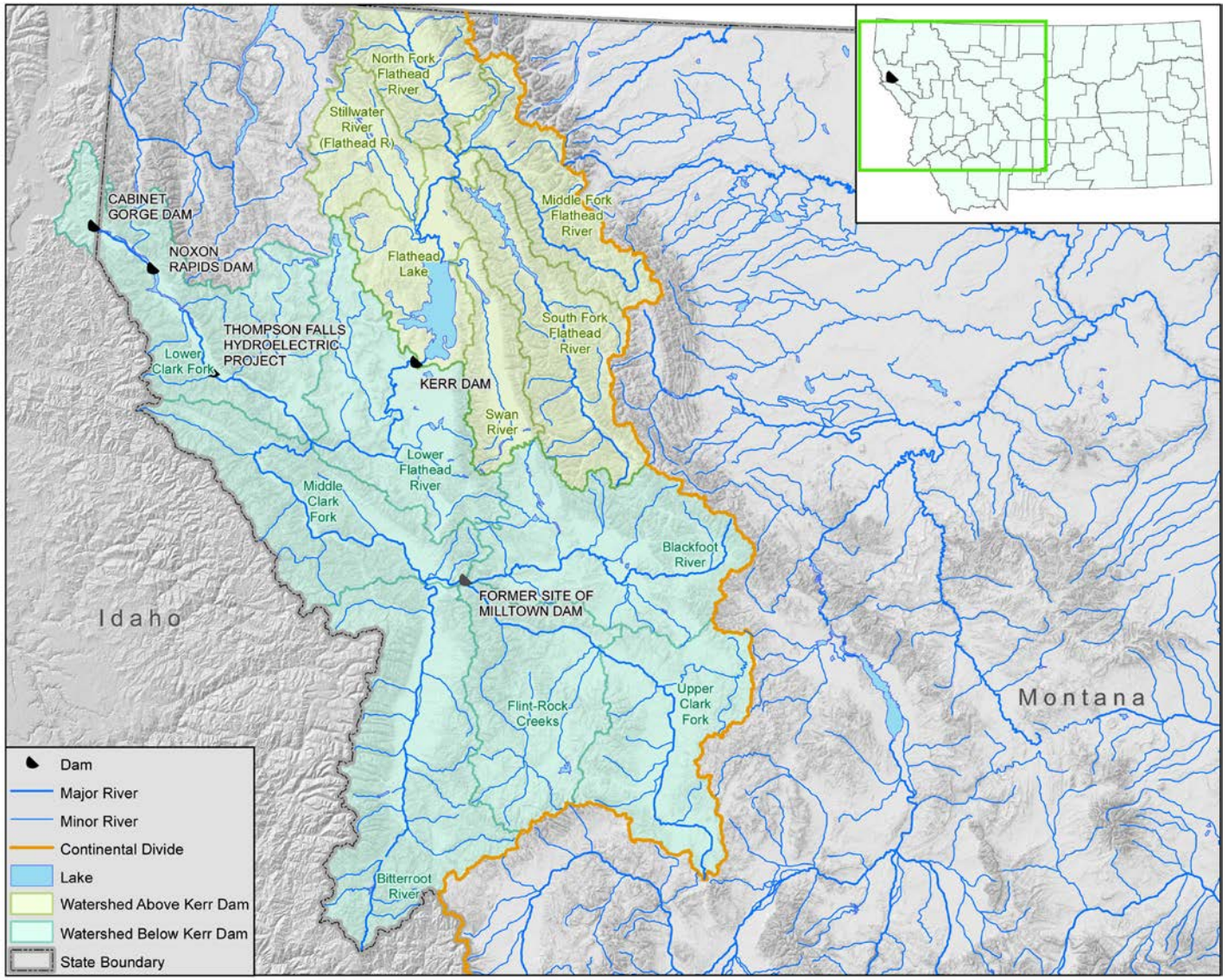
1.1 Background

PPL Montana is the owner of the 92.6 megawatt Thompson Falls Hydroelectric Project (Project) built in 1917 on the Clark Fork River near Thompson Falls, Montana (Photo 1). The Federal Energy Regulatory Commission (FERC or Commission) relicensed Thompson Falls Hydroelectric Project (FERC Project No. 1869) to the Montana Power Company (now PPL Montana) in 1979, and amended the license to include a new powerhouse in 1990. The current FERC license is scheduled to expire on December 31, 2025.

Photo 1: Thompson Falls Project, looking upstream.

The Project is located 6.3 miles downstream of the confluence of the Thompson River with the Clark Fork River. Immediately downstream of Thompson Falls Dam, Avista Corporation (Avista) owns and operates the Clark Fork River Projects, which includes two dams: Noxon Rapids Dam and Cabinet Gorge Dam (Figure 1-1). Noxon Rapids Reservoir extends upstream to the tailrace of Thompson Falls Dam.

Figure 1-1: Map of the Clark Fork River Drainage and the location of Thompson Falls Dam.



Upstream fish passage was blocked by the construction of Thompson Falls Dam (1917). Since the removal of Milltown Dam in 2008, there are no dams upstream of the Thompson Falls Dam or the Clark Fork River. The only major fish passage barrier upstream of Thompson Falls Dam is Kerr Dam on the Flathead River (Figure 1-1).

In 1998, the bull trout (*Salvelinus confluentus*) was federally-listed under the Endangered Species Act (ESA) as a threatened species (Federal Register, 1998). PPL Montana established an Interagency Technical Advisory Committee (TAC) with participation of the U.S. Fish and Wildlife Service (USFWS or Service); Montana Fish, Wildlife and Parks (MFWP); Avista; NorthWestern Energy; Montana Department of Environmental Quality (MDEQ); and the Confederated Salish and Kootenai Tribes (CSKT). The TAC has been advising PPL Montana on bull trout concerns in the Thompson Falls Project area (Project area); studies that are needed to further define bull trout issues in the Project area; and possible conservation measures since 2002.

The Project area extends beyond the Project boundary defined in the FERC license for the Thompson Falls Hydroelectric Project. The FERC boundary includes the powerhouses, dams, and the reservoir. As defined in the Biological Evaluation (PPL Montana, 2008) (BE), the Project area includes a broader Project vicinity as the potential 'impact area' for bull trout.

The USFWS designated bull trout critical habitat in 2005 (Federal Register, 2005) and revised the critical habitat designation in 2010 (Federal Register, 2010). The Project area is within the designated critical habitat for bull trout. Because bull trout are present within the Project area, a draft (BE) was prepared for the Thompson Falls Project (GEI, 2003) and submitted to the USFWS and FERC in 2003. The draft BE concluded that the Thompson Falls Project was likely to adversely affect bull trout. Issues identified in the draft BE included the lack of upstream adult fish passage, potential for delay or mortality during downstream passage, and potential water quality impacts from increases in total dissolved gas (TDG) during high spill time periods.

After 5 years of studies, PPL Montana filed a new BE discussing the effects of the Thompson Falls Project on bull trout and proposed conservation measures with the Commission on April 7, 2008 (PPL Montana, 2008). PPL Montana's BE identified several factors directly related to Project operation that negatively impact bull trout in the Clark Fork River. The potential for delay or mortality during downstream migration was identified as one potential source of bull trout "take." The BE recommended off-site habitat improvement as a mitigation measure for Project impacts on downstream fish passage. The BE suggested this as more sensible, less costly, and of greater benefit to bull trout, and other lower Clark Fork River fish, than any type of downstream trap and transport, or fish screening and bypass at Thompson Falls Dam.

1.2 Off-site Mitigation Funding

Included with the BE was a Memorandum of Understanding (MOU, 2008) signed by PPL Montana, the USFWS, MFWP, and the CSKT, which provides for the continuing operation of the TAC. The MOU also provides for the allocation of annual TAC funds by PPL Montana. As specified in the MOU, PPL Montana provides $100,000 per year for downstream passage measures. The fund was established in 2009 and will continue to be funded annually for 5 years. The MOU allows a maximum of $250,000 to accrue (from unspent or transferred annual TAC funds) in an adaptive management funding account (AMFA) for use by the TAC during the 5-year time period (2009-2013).

On November 4, 2008 the USFWS filed with the Commission a Biological Opinion (BO) (USFWS, 2008) and associated Incidental Take Statement, which includes reasonable and prudent measures and Terms and Conditions to minimize incidental take of bull trout. The USFWS concluded in its BO that the Thompson Falls Project is currently adversely affecting bull trout and PPL Montana's proposed conservation measures will reduce, but not totally eliminate, adverse impacts of the Project.

The USFWS's Biological Opinion Terms and Conditions 2 states that PPL Montana will,

> …provide annual funding to the TAC, as approved by the Services and specified in the Thompson Falls MOU, to conduct offsite habitat restoration or acquisition in important upstream bull trout spawning and rearing tributaries. The purpose is to boost recruitment of juvenile bull trout. This funding is provided to partially mitigate for incidental take of bull trout caused by downstream passage through the turbines and spillways. The annual $100,000 contribution specified for the first term of the MOU (2009-2013) is subject to renegotiation during succeeding terms of the MOU to run from 2014-2020.

PPL Montana established the TAC fund in 2009 and requests proposals annually for projects that address the goals and objectives of the TAC funding. Since 2009, there have been approximately 15 proposals submitted to the TAC requesting funding for various projects in the lower and middle Clark Fork River drainage. Of these proposals, 11 have qualified and been approved by the TAC for funding. Since 2009, the number of proposals received each year has declined.

1.3 Thompson Reservoir Monitoring Plan

Term 5a of the USFWS's Biological Opinion Terms and Conditions states that:

> During the first five years of the Phase 2 evaluation (2010 through 2015) PPL Montana, with TAC involvement and Service approval, will conduct a prioritized 5-year evaluation of factors contributing

> to the potential loss or enhancement of migratory bull trout passage through Thompson Falls Reservoir. Goals and objectives for this assessment and scientifically-based methodology will be developed through the TAC and approved by the Service no later than the end of 2010 and will focus at a minimum on better understanding temperature and water current gradients through the reservoir; travel time, residence time, and pathways that juvenile and subadult bull trout select in moving through the reservoir; and an assessment of impacts of predatory nonnative fish species on juvenile and subadult bull trout residing in or passing through the reservoir. The initial findings will be summarized and supported with scientifically based conclusions, no later than the end of 2015, with a goal of adaptively improving survival of juvenile bull trout in Thompson Falls Reservoir as they pass downstream or reside in the system. A second, more comprehensive summary of conclusions and recommendations regarding reservoir impacts will be submitted as part of the scientific review package by the end of 2020 (see TC1h).

In compliance with USFWS's Biological Opinion Terms and Conditions 5a, PPL Montana developed a 5-Year Reservoir Monitoring Plan (2011-2015) (Plan) (PPL Montana, 2010). The 5-Year Reservoir Monitoring Plan was developed with the TAC and approved by the USFWS in 2010. PPL Montana submitted the 5-Year Reservoir Monitoring Plan to the FERC on June 22, 2010. The FERC issued an order approving the Plan on February 9, 2011.

The goal of the 5-Year Reservoir Monitoring Plan is to gather information that will assist in developing recommendations to *maximize survival of outmigrant juvenile and adult bull trout through Thompson Falls Reservoir and Dam*. Additionally, there is assumed to be a large enough bull trout population present in the Thompson River drainage that will provide a reasonable sample size to study and gather more data to address the overall goal of the Plan.

The objectives identified in the Plan for the next 5 years (2010-2015) included:

1. Characterization of bull trout in the Thompson River drainage
2. Characterization of the affect that Thompson Reservoir has on bull trout emigrating from the Thompson River drainage (or elsewhere upstream, as these are not necessarily separable) and migrating downstream in the Clark Fork River

1.4 Goals and Objectives of this Plan

Due to the geographic proximity of the Thompson Falls Dam to the Thompson River and the duration that the Thompson Falls Dam has served as a fish barrier, the Thompson Falls Dam has likely had the greatest impact on bull trout in the Thompson River drainage. Therefore,

the Thompson Falls TAC has identified the Thompson River as a critical drainage to concentrate bull trout minimization measures and allocation of MOU funding.

The overall goal for the implementation of bull trout minimization measures is to "*boost recruitment of juvenile bull trout and partially mitigate for incidental take of bull trout caused by downstream passage through the turbines and spillways at Thompson Falls Dam*" (USFWS, 2008).

The objective of this document is to identify projects that focus on the recovery and enhancement of migratory bull trout in the Thompson River drainage. Recovery and/or enhancement of migratory bull trout concentrates on improving the expression of the migratory life history component, thus reducing the selection to residency life history traits that are likely caused or associated with fragmented habitats (e.g., dams, other barriers) or other limiting factors. Increasing the number of juvenile outmigrants is considered a key element to enhancing migratory life history expression in the Thompson River drainage.

In order to evaluate opportunities to enhance migratory bull trout in the Thompson River drainage, PPL Montana has completed an analysis identifying potential bull trout habitat patches and critical limiting factors. The results of this analysis will be used to:

3. Identify and prioritize potential bull trout habitat enhancement projects that focus on the recovery of bull trout
4. Identify subwatersheds that would benefit from additional studies or sampling
5. Identify subwatersheds that do not meet the criteria to support bull trout and should not be included on the priority list for further bull trout sampling or habitat improvement

Identifying potential bull trout habitat patches and critical limiting factors will assist in the process of identifying prospective projects to enhance bull trout habitat and recovery.

The following sections describe the methodologies used to identify potential bull trout habitat patches and limiting factors in the Thompson River drainage, the results of the analysis, and recommendations for bull trout enhancement projects.

2.0 Methods

2.1 Thompson River Drainage Data Review

The first objective in the Plan is characterization of bull trout in the Thompson River drainage. To address this objective, PPL Montana coordinated with several agencies and organizations to gather historic information (data and reports) on streams in the Thompson River drainage. Information was provided by Plum Creek Timber Company (Plum Creek), Avista, U.S. Forest Service (USFS), MDEQ, USFWS, and MFWP. The data were compiled into a database which currently includes information from 1973 through 2011.

The purpose of creating the Thompson River database was to compile a recent record of the existing information available for the streams within the Thompson River drainage. This information includes habitat surveys, temperature data, fisheries information, and other study/survey information for the Thompson River and its tributaries.

The objective of the database is to provide resource managers with a record of what information currently exists and what type of studies have been completed in particular streams or stream reaches. A secondary objective of the database is to identify data gaps within the Thompson River drainage and to identify potential future studies/management objectives for resource managers (i.e., bull trout management). It is anticipated that the database will be updated periodically with information from future studies that are completed within the Thompson River drainage. The database was distributed to the TAC, USFWS, USFS, Plum Creek, and Avista.

2.2 Thompson River Drainage Planning

On February 1, 2012, the Thompson Falls TAC and others including USFS, Department of Natural Resources and Conservation (DNRC), and Plum Creek met with PPL Montana to review and discuss the Thompson River drainage database and potential on-the-ground projects. PPL Montana set up this meeting with the goal of identifying potential projects that the Thompson Falls TAC could fund as specified in the MOU and the BO that would improve bull trout habitat in the Thompson River drainage. PPL Montana developed a database of information, as described above, that identified where fisheries and habitat information has already been collected in the Thompson River drainage and where no data is available.

At the conclusion of the meeting, the group attending was unable to identify immediate habitat enhancement needs or known on-the-ground projects in need of funding to benefit bull trout. The development of a “Master Plan” (this document: Thompson River Bull Trout Enhancement and Recovery Plan, 2012) was proposed to specifically prioritize subwatersheds for projects focused on bull trout recovery/enhancement based on available

information compiled in the recently developed Thompson River drainage database. The goal of this document is to identify potential bull trout habitat patches, identify limiting factors, and develop recommendations for projects focused on migratory bull trout recovery.

2.3 Using GIS to Identify Potential Bull Trout Habitat

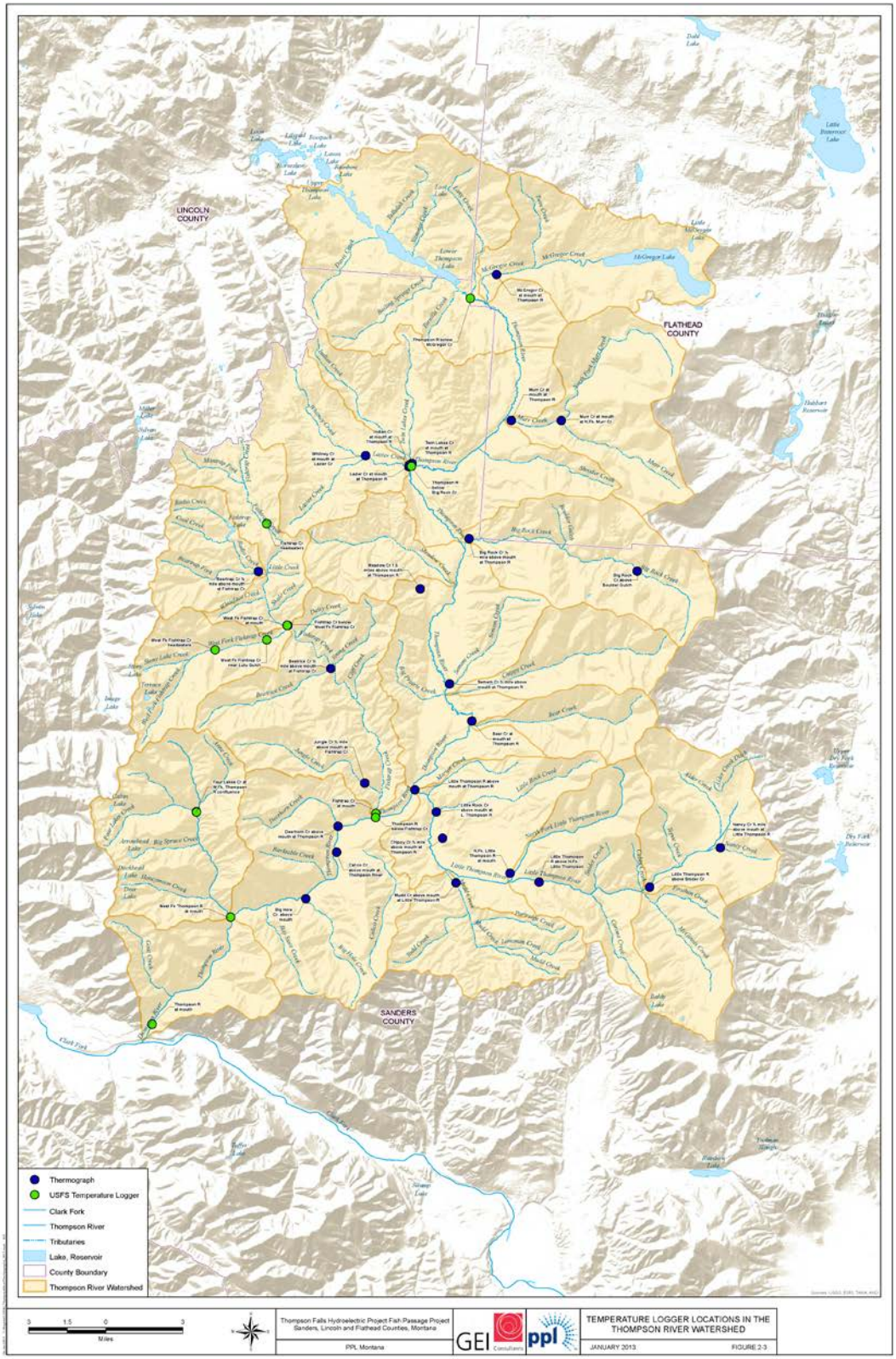
The delineation of potential bull trout patches or habitat areas focuses on the conditions and constraints to the reproductive (e.g., spawning and rearing areas) component of the life history cycle. Although migratory and large resident bull trout adults may extend their habitat use beyond their spawning and initial rearing tributaries, the reproductive portion of the life history is spent in the headwater streams (Rieman and McIntyre, 1993). To evaluate potential bull trout habitat in the Thompson River drainage at the subwatershed level, criteria and methodologies presented in Isaak et al. (2009) were utilized to delineate suitable bull trout patches or habitat areas.

Geographic information systems (GIS) software was used in the Thompson River drainage patch delineation of suitable or potential bull trout patches. Because several entities (private and public) are involved in data collection in the Thompson River drainage, the format or data collection process was not always uniform. Therefore, some modifications to the metrics or criteria presented by Isaak et al. (2009) to delineate potential bull trout patches were necessary. Below is a summary of the patch criteria used in conjunction with GIS to predict potential bull trout habitat in the drainage. Data used in this analysis included summer stream temperatures, stream width measurements, stream gradient, and presence of known manmade barriers.

Stream temperature is a strong predictor of presence of bull trout because of their coldwater habitat requirements (Rieman and McIntyre, 1993). Plum Creek provided stream temperature monitoring records for various locations in the Thompson River drainage that had been collected between late June and October from 1999 to 2011 (unpublished data). This was the most comprehensive dataset for stream temperature available in the drainage. The stream temperature metric used for mapping included the mean weekly maximum temperature for the dataset provided by Plum Creek. In addition, temperature loggers were deployed in the summer of 2012 to monitor stream temperatures in the mainstem Thompson River and several tributary streams (Figure 2-1). The goal was to have a more comprehensive dataset of summer stream temperatures in the Thompson River drainage, including areas previously monitored and areas with limited data, taken during the same time period. The mean weekly maximum temperature was separated into three categories based on bull trout thermal suitability (Isaak et al., 2009):

- Low thermal suitability (>17.5 °C)
- Medium thermal suitability (>15 and ≤ 17.5 °C)
- High thermal suitability (≤ 15 °C)

Figure 2-1: Location of temperature loggers deployed in the Thompson River drainage in 2012 by PPL Montana, MFWP and USFS.

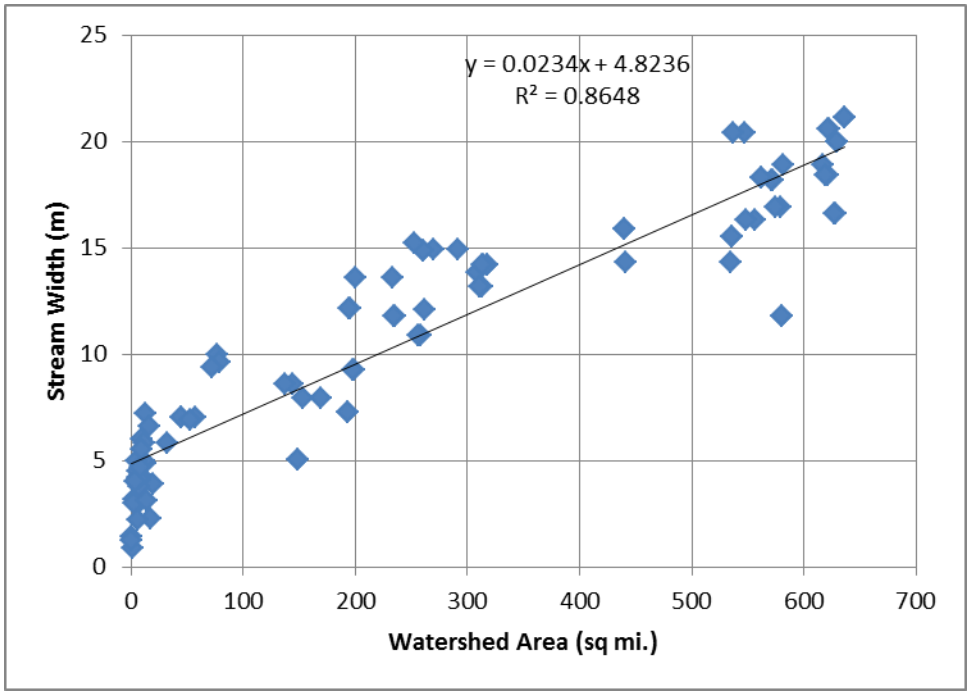


Temperature data collected by the USFS and MFWP were also used to assess the thermal suitability of the streams in the Thompson River watershed. This data set included single temperature readings collected during fish and habitat surveys. The single temperature readings were often in known bull trout areas (e.g., Big Rock Creek, West Fork Thompson River).

Bull trout are rarely found in streams less than approximately 1 to 2 meters (m) in width (Rieman and McIntyre, 1993). Therefore, streams less than 2 m in width were screened out as being unsuitable as bull trout habitat. There was a limited data set of stream widths available into the watershed, however, for example, in the Boise River basin, studies have found that watersheds of 400 hectares of contributing area was required for a stream to exceed 2 m (Isaak et al., 2009).

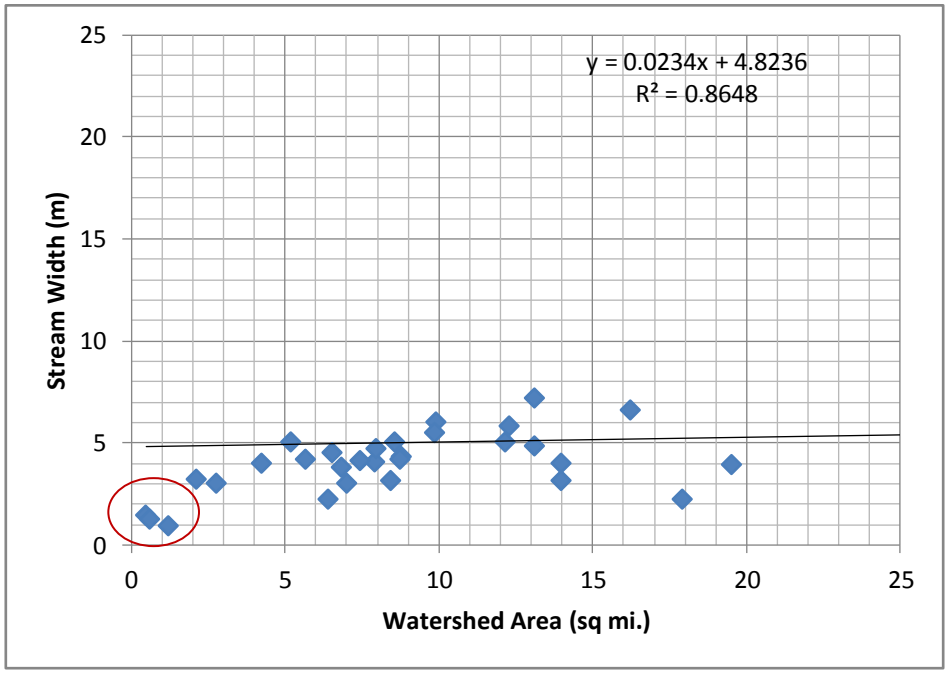
Therefore, drainage area was used as a surrogate for stream width for the habitat screening. Using GIS, the contributing area upstream of each available stream width measurement was calculated and used to establish a relationship between stream width and subwatershed size/contributing area (Figure 2-2). This information was used to extrapolate which subwatersheds are likely to support stream widths greater than 2 m.

Figure 2-2: Watershed area and stream width relationship for streams in the Thompson River watershed, Montana.



Although there is clearly a positive relationship between stream width and watershed area in the Thompson River watershed, there is quite a bit of scatter in the relationship for the smaller watersheds. In order to view a clearer picture of the relationship for smaller watersheds, the data was plotted on a smaller scale (Figure 2-3).

Figure 2-3: Watershed area and stream width relationship for watersheds less than 25 mi^2 in the Thompson River watershed, Montana.



It is apparent that watersheds less than 2 mi^2 rarely, if ever, produce streams larger than 2 m in width (note data points within the red circle on Figure 2-3). Therefore, watersheds less than 2 mi^2 were screened out as potential bull trout habitat.

Streams with steep slopes (exceeding 15-20%) are unlikely to provide primary spawning and rearing habitat and are more likely to consist of geologic barriers to migration. Digital elevation models in GIS were used to assess potential stream gradient and exclude areas of the Thompson River drainage where stream gradients exceed 15 percent.

The last criteria used in this analysis included known barriers to upstream fish movement in the drainage. The USFS (Lolo National Forest) provided a GIS layer with these data (unpublished data). The majority of the manmade barriers in the drainage are related to the existing road network. Additional information on barriers was supplied by Plum Creek.

The output of this GIS analysis of temperature, stream width, stream gradient, and fish migration barriers delineated the location of potential bull trout patches in the Thompson River drainage. These data were then compared to known bull trout locations to verify the process was, at a minimum, including known bull trout populations.

2.4 Ranking Criteria

The goal of the Project is to develop projects which will aid in restoring migratory bull trout in the Thompson River drainage. Therefore, the highest priority will be placed on (in order of importance):

1. Preserving the best quality migratory bull trout habitat
2. Improving, as needed, migratory bull trout habitat which is presently used by migratory bull trout
3. Extending the range of migratory bull trout

3.0 Study Area – Thompson River Drainage

3.1 Thompson River Drainage

The confluence of the Thompson River with the Clark Fork River is located approximately 6.3 river miles (RM) upstream of Thompson Falls Dam (Figure 3-1). Thompson River drainage is approximately 630 square miles with a stream network of 1,326 linear miles (Whitehorse Associates, 1997). Elevations in the drainage vary from 2,457 feet at the confluence with the Clark Fork River to 7,464 feet on Baldy Mountain in the southeast corner of the drainage. Annual precipitation in the watershed varies from less than 20 inches in the lowest bottom-lands to greater than 60 inches along the highest ridges (Whitehorse Associates, 1997).

The mainstem Thompson River is approximately 45 miles long. Two roads (present since the 1950s), County Road 56 and Forest Road 9991, run the entire length of the Thompson River from Montana State Highway 200 to U.S. Highway 2. These roads closely parallel the river on each side for the first 18 miles (MP 0.0 at Highway 200), then alternate to the other side by crossing the Thompson River and periodically paralleling or crossing the stream in the upper 20 miles (Copenhaver et al., 2005; Kutzman et al., 2005).

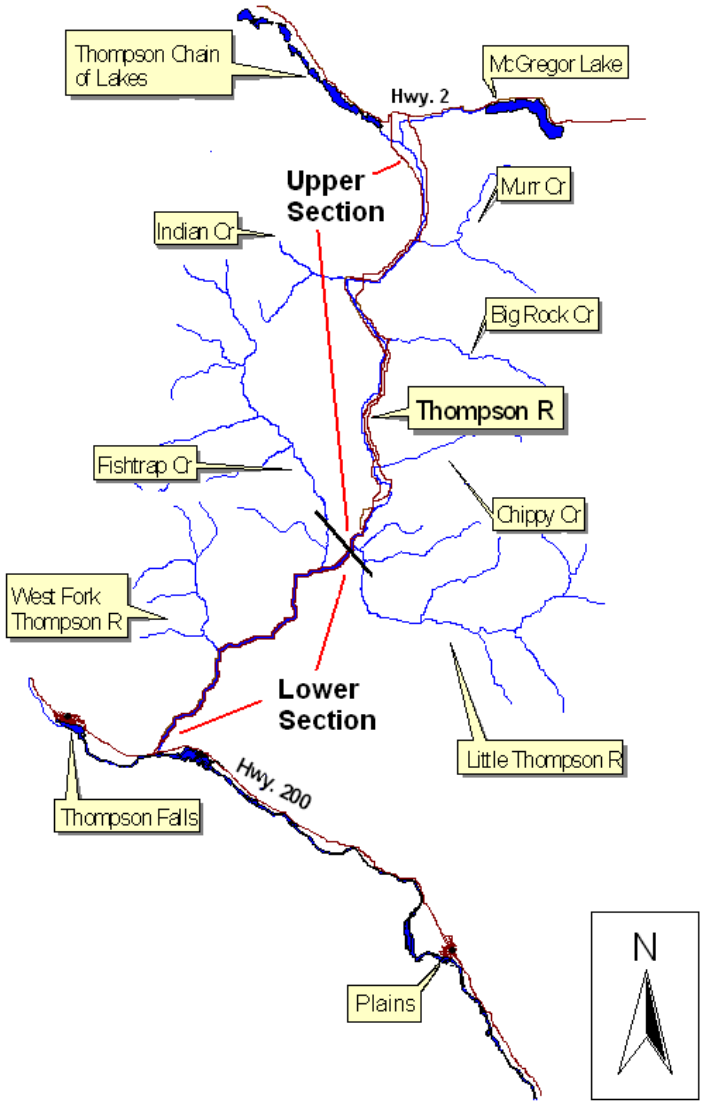
The Thompson River originates from the Thompson Chain of Lakes. The river consists of two very different sections. The upper section extends from the lakes to a bridge about 17 miles upstream of the mouth. This section is relatively low in gradient flowing through a wide valley. The upper half of the Thompson River drainage is characterized by a broad valley formed by glacial scour and deposits. Glacial till deposits and bedrock outcrops in the valley walls and channel bed are the primary geomorphic influences on stream dynamics.

The lower section, which includes the area from the 17-mile bridge to the mouth of the river, is higher in gradient, flowing through a confined canyon. The lower half of the drainage is generally a narrower valley with a greater frequency of bedrock outcrops and sections of high gradient channel, steep valley walls, and a few short gorge sections. The two roads paralleling the mainstem river primarily follow general morphologic characteristics of the valley wall or terraces. Where the valley is narrower, such as the first 17 miles of the drainage, the roads hug both the valley walls and the banks of the river. The roads leave the banks of the river only when the valley widens in the upper portion of the drainage. In the upper half of Thompson River drainage, the roads come within close proximity of the river mainly in those places that the channel abuts the valley wall or terrace.

The Thompson River has several major tributaries including the West Fork Thompson River, Fishtrap Creek, the Little Thompson River, Chippy Creek, and Big Rock Creek. The confluence of the Little Thompson River is near the 17-mile bridge, and both Fishtrap Creek and the West Fork Thompson River join the Thompson downstream of the mouth of the

Little Thompson River. Interestingly, the warmest water temperatures in the Thompson River occur just downstream from the confluence of the Little Thompson River and above the confluence of Fishtrap Creek. In most rivers and streams the warmest water temperatures occur near their mouths, but in the Thompson River, the coolest water temperatures occur near its mouth.

Figure 3-1: Illustration of the Thompson River drainage and tributaries. (*Source*: Katzman, 2006)



3.1.1 Geomorphology

The mountains in the Thompson River drainage were formed 70 to 90 million years ago. The collision between the North American continent and the Pacific Ocean floor resulted in a series of long ridges and valleys that trend north to south between parallel valleys (Alt and Hyndman, 1986). Glaciation has been an important influence to the current landscape in the

Thompson River drainage. In addition to continental glaciation, localized "alpine glaciers" affected numerous watersheds, specifically tributaries draining high-elevation lands in the southwest corner of the Thompson River drainage (Plum Creek, 1998b).

The Thompson River drainage basin is delineated into four general land-types. The drainage is comprised of alpine glaciated lands (15%), fluvial lands (51%), continental glaciated erosional lands (21%), and continental glaciated depositional lands (13%). Alpine glaciate lands are areas sculpted by alpine glaciation that occur on high ridges in the southern half of the basin where elevation is primarily 4,000 to 7,000 feet. Fluvial lands are shaped by fluvial processes and characterized by V-shaped canyons. Continental glaciated erosional lands are low mountains and hills that were shaped by the Cordilleran ice sheet and Glacial Lake Missoula. Continental glaciated depositional lands include areas with thick deposits of sediment left by continental glaciers and Glacial Lake Missoula (Plum Creek, 1998a).

3.1.2 Fisheries

The distribution of fish species found in the Thompson River varies as a result of the temperature gradient in the drainage. The lower portion of the river contains primarily a rainbow trout (*Oncorhynchus mykiss)* fishery, which is most popular with anglers. Brown trout (*Salmo trutta*), which also provide an important recreational fishery, tend to dominate the upper portion of the river where water temperatures are warmer. Westslope cutthroat trout (*Oncorhynchus clarkii lewisi*) are also captured by anglers in the Thompson River, but are more common in the tributaries to the river. Mountain whitefish (*Prosopium williamsoni*) are abundant in the mainstem and provide primarily a winter and spring recreational fishery. The area between the mouth of the Thompson River and the confluence of Fishtrap Creek serves as a migratory corridor for bull trout. Other species known to inhabit the drainage include brook trout (*Salvelinus fontinalis*), and other game fish and non-game fish such as suckers (*Catostomus* spp.) and sculpin (*Cottus* spp.) (Katzman, 2006).

3.1.3 Land Ownership

Within the drainage, landownership is roughly divided as 47 percent Lolo National Forest, 43 percent Plum Creek, 7 percent Montana State Lands, and 3 percent other private holdings. The lower third of the Thompson River watershed is primarily owned by the Lolo National Forest; the middle third is generally a checkerboard division of Lolo National Forest, Plum Creek, and Montana State landownership; and the upper third is primarily Plum Creek and other private lands. The lower two thirds of the drainage are managed primarily for timber harvest and recreational uses. The upper third is managed for timber harvest and recreation in the uplands, livestock grazing, and pasture land in the lowlands. There are cabin sites and permanent residences on both Montana State and private lands that dot the river corridor.

4.0 Bull Trout Life History and Critical Habitat

4.1 Bull Trout Life History

Bull trout have two distinct life history forms, resident and migratory. Resident fish are often found in smaller headwater streams where they reside year-round (Rieman and McIntyre, 1993). Migratory fish include both fluvial (riverine) and adfluvial (lacustrine or lake) forms. Fluvial bull trout reside in the mainstem rivers and migrate to headwater tributaries to spawn. Lower Clark Fork River adfluvial bull trout reside in Lake Pend Oreille, Cabinet Gorge Reservoir, or Noxon Reservoir and migrate to tributaries of the mainstem Clark Fork River to spawn (MBTSG, 1996). Migration to spawning tributaries is often blocked by the presence of Cabinet Gorge, Noxon Rapids, and/or Thompson Falls dams. The recent installation of the upstream fish passage facility at Thompson Falls Dam in 2011 provides a migratory corridor (when the ladder is in operation) for adult bull trout moving upstream from Noxon Rapids Reservoir. Adult bull trout residing below Cabinet Gorge and Noxon Rapids dams rely on Avista's Upstream Fish Passage program for upstream transport.

The general life history of adfluvial/fluvial bull trout involves mature adults migrating upstream to spawn in headwater streams during fall. Eggs overwinter in the spawning gravels, and fry emerge in the following spring. The length of time that juvenile bull trout spend in the tributaries is highly variable (GEI, 2005). Generally, migratory juvenile bull trout rear near spawning areas for 2 to 4 years (Rieman and McIntyre 1993), and juveniles migrate in spring or fall to the lake if adfluvial, or mainstem river if fluvial (Katzman and Hintz, 2003). Adult bull trout reach sexual maturity between 4 and 6 years and spawn in multiple years, although they do not necessarily spawn in consecutive years (Pratt, 1996).

Adfluvial and fluvial bull trout are generally much larger than resident fish due to an abundance of prey fish in lake and river systems (Pratt, 1996; Wydoski and Whitney, 2003). Resident adults generally range from 190 to 300 millimeters (mm). Migratory adults often exceed 600 mm in length (Pratt, 1996; Wydoski and Whitney, 2003).

4.2 Bull Trout Habitat Criteria

Bull trout are thermally sensitive species (Rieman and McIntyre, 1993; Selong et al., 2001). Stream temperatures less than 15 °C are often identified as critical for spawning, egg incubation, and early rearing (Dunham et al., 2003). Spawning generally occurs in the fall months when stream temperatures have fallen between 5 and 9 °C (McPhail and Murray, 1979). Optimum incubation temperatures are between 2 and 4 °C (McPhail and Murray, 1979) and optimum rearing temperatures are believed to be about 7 to 8 °C (Goetz, 1989). Selong et al. (2001) found growth for bull trout was maximized at 13.2 °C (in laboratory).

In addition to temperature, habitat characteristics such as channel and hydrologic stability, substrate composition, cover/shade, undercut banks, large wood debris, stream size and gradient, and presence of migratory corridors appear to influence bull trout distribution (Rieman and McIntyre, 1993).

5.0 Bull Trout Presence in the Thompson River Drainage

5.1 Thompson River Drainage Data Gaps

A summary of available data for tributaries in the Thompson River drainage was developed as a result of the Thompson River drainage data review. Table 5-1 summarizes the temperature, habitat, and fish data available, by stream, within the Thompson River drainage, prior to 2012. The table also identifies the streams/tributaries where bull trout have been documented.

Table 5-1: Summary of data available and bull trout presence in Thompson River drainage. x = data available; y= bull trout documented. Stream/Tributaries in green indicate no data is available for the subwatershed. 2012 = data available from 2012 only

Stream/Tributary Name	Temperature Data Available	Habitat Data Available	Fish Data Available	Bull Trout Present
Alder Creek	X	X	X	
Anne Creek	X	X	X	Y
Barktable Creek				
Basin Draw		X	X	N*
Bay State Creek				
Bear Creek	X	X	X	N
Beartrap Creek (Fork)	X	X	X	Y
Beatrice Creek	X	X	X	Y
Big Hole Creek	X			
Big Rock Creek	X	X	X	Y
Big Spruce Creek		X	X	Y
Boiling Springs Creek	X	X	X	
Calico Creek				
Chippy Creek	X	X	X	Y
Cliff Creek				
Cool Creek				
Corona Creek				
Daisy Creek				
Deerhorn Creek	X		X	Y
Fishtrap Creek	X	X	X	Y
Four Lakes Creek	X	X	X	Y
Goat Creek			X	No fish*
Honeymoon Creek	X		X	
Indian Creek	X		X	
Jungle Creek	X	X	X	Y
Lazier Creek	X	X	X	
Little Rock Creek			X	

Stream/Tributary Name	Temperature Data Available	Habitat Data Available	Fish Data Available	Bull Trout Present
Little Thompson River	X	X	X	Y (1977, only record)
Mantrap Creek		X	X	
Marten Creek			X*	N*
McGinnis Creek	X	X	X	
McGregor Creek	X	X	X	
Meadow Creek	2012 only		X	
Mudd Creek			X	
Murr Creek	X	X	X	Y (one fish recorded by Plum Creek)
Nancy Creek	2012 only			
North Fork Little Thompson River	X	X	X	
Priscilla Gulch				
Radio Creek		X	X	
Semem Creek	2012 only		X	
Shroder Creek	X		X	Y*
Tepee Creek	X		X	
Thompson River	X	X	X	Y
Twin Lakes Creek	X		X	
West Fork Fishtrap Creek	X	X	X	Y
West Fork Thompson River	X	X	X	Y
Whitney Creek	2012 only		No fish in upper reach*	
Young Creek		X	X	

* Information from B. Sugden, Plum Creek, personal communication, December 2012.

The data review also identified where data gaps exist in the Thompson River drainage. Temperature data collected in 2012 helped to fill in some data gaps for summer water temperature. Fisheries or habitat data are unavailable for Bay State Creek, Big Hole Creek, Barktable Creek, Calico Creek, and Priscilla Creek. These are first order tributaries that drain into the Thompson River. In the Little Thompson River watershed, there is no data available for Corona Creek. In the Fishtrap Creek watershed, there are no data available for Daisy Creek, Cool Creek, or Cliff Creek. However, in Cool Creek there were some notes taken by the USFS during a July 2002 survey that indicate this tributary has very little water present near the confluence with Fishtrap Creek (GEI, 2005).

5.2 Current and/or Historic Bull Trout Presence

Table 5-2 provides a summary of bull trout life history and habitat types in streams where bull trout have been documented in the Thompson River drainage. Table 5-2 was developed

by reviewing available documents/literature for the Thompson River drainage and identifying documentation for bull trout habitat types within the drainage.

Bull trout are currently known to be present in the following areas of the Thompson River drainage:

- Fishtrap Creek and tributaries Beartrap (Fork) Creek, West Fork Fishtrap Creek, Beatrice Creek, and Jungle Creek
- West Fork Thompson River and tributaries Anne Creek, Four Lakes Creek, Big Spruce Creek
- Big Rock Creek
- Mainstem of the Thompson River

Bull trout presence in Little Thompson River watershed and Murr Creek watershed is believed to be rare. The following sections describe historic information available for the Murr Creek and Little Thompson River watersheds, as well as a brief summary of known bull trout presence in other watersheds (Fishtrap, West Fork Thompson, and Big Rock) and the mainstem of Thompson River.

Table 5-2: Summary of bull trout life history and habitat types in streams where bull trout have been documented in the Thompson River drainage.

Thompson River Drainage		Bull Trout Present (Y)	Known Bull Trout Habitat Type				Data	
Subwatershed	Stream Name		Spawning	Rearing	Over-wintering	Migratory Corridor	Source	Comments
Thompson River		Y			x	x	Bernall and Lockard, 2010; Copenhaver et al., 2005; MFWP, 2010a; Strohmayer, 2006; MFWP, 2005; MFWP, 2006; MFWP, 2007; MFWP, 2008; MFWP, 2009; MFWP, 2010b	Radio telemetry data from 2004 indicate overwintering in mainstem
West Fork Thompson River	**West Fork Thompson River**	Y	x	x	x	x	Liermann and Tholl, 2005; Liermann, 2003; Storaasli and Moran, 2011; Horn and Tholl, 2008; Liermann, Katzman, and Boyd, 2003; Moran, 2005; Land & Water, 2001; USFS, 2001; USFS, 1994; GEI, 2005; PPL Montana, 2012	Radio telemetry data from 2004 indicate overwintering in West Fork Thompson
	Big Spruce Creek	Y					USFS, 1991	
	Four Lakes Creek	Y	x	x			Storaalsi and Moran, 2011; Moran, 2005; PPL Montana, 2012	
	Anne Creek	Y					PPL Montana, 2012	Bull trout observations were during July survey
Fishtrap Creek	**Fishtrap Creek**	Y	x	x	x	x	Liermann and Tholl, 2005; Liermann, 2003; GEI, 2005; Moran, 2003; Moran, 2004; Moran, 2005; Storaasli and Moran, 2011; Horn and Tholl, 2008; Horn and Tholl, 2011; Liermann and Tholl, 2007;	Assume overwintering residents but can't confirm

Thompson River Drainage		Bull Trout Present (Y)	Known Bull Trout Habitat Type				Data	
Subwatershed	Stream Name		Spawning	Rearing	Over-wintering	Migratory Corridor	Source	Comments
							Liermann, Katzman, and Boyd, 2003; Sacry, 2006	
	Basin Draw	N					B. Sugden, Plum Creek, personal communication, December 2012	Bull trout present in Fishtrap Creek near Basin Draw, but not in Basin Draw
	Jungle Creek	Y	x	x			Storaasli and Moran, 2011; Liermann and Tholl, 2005; Horn and Tholl, 2008; Liermann and Tholl, 2007; Moran, 2005; Moran, 2004; GEI, 2005	
	Beatrice Creek	Y	x	x			Moran, 2005; Storaasli and Moran, 2011; USFS, 2005; Land and Water, 2005; GEI, 2005	
	West Fork Fishtrap Creek	Y	x	x			GEI, 2005; Storaasli and Moran, 2011; USFS, 2005.	
	Beartrap Fork	Y					PPL Montana, 2012	Bull trout observations were during July survey
Little Thompson River	**Little Thompson River**	Y					MFWP, 2010b; USFS, 2012	MFISH Fishing Log in 1977 identified one bull trout in LTR; since 1977 no specific dates or positive identification of bull trout in LTR (MFWP, 2010b)
Big Rock Creek	**Big Rock Creek**	Y					PPL Montana, 2011	Bull trout observed in several survey reaches during August survey
Murr Creek		Y					Plum Creek, 1998b	One adult bull trout observed in lower section (near confluence). Waterfall barrier prevents upstream movement of fish.

5.2.1 Mainstem Thompson River

In April 1973 a fisheries survey was completed in two sections of the Thompson River (Haugen, 1973). The sections included a 11,000-foot reach upstream of the confluence with the Little Thompson River (Township 23 North, Range 27 West, Sections 14 and 23) and a 9,000-foot reach near the confluence with Meadow Creek (Township 24 North, Range 27 West, Sections 12 and 13). The lower section near the Little Thompson River was approximately 17.5 miles upstream from the Thompson River confluence with the Clark Fork River. The confluence of Meadow Creek is located at approximately RM 30 of the Thompson River.

The downstream section (near Little Thompson River) was dominated by rainbow trout and mountain whitefish. Other species observed included bull trout, brook trout, sucker *sp*., longnose dace, and sculpins. The upstream section (near Meadow Creek) was dominated by rainbow trout, brook trout, and mountain whitefish with other species observed including bull trout, cutthroat trout, longnose dace, yellow perch, sculpins, and redside shiners. The upper section is the most upstream location documented for bull trout in the Thompson River. No bull trout population estimate was provided from the 1973 survey.

Currently, the MFWP has two established annual fish survey reaches in the Thompson River. The downstream section is called the Big Hole Section and the upstream section is called 19-mile Section. The MFWP has annually surveyed these reaches since 2003. The downstream section starts about 0.25 mile upstream of the confluence with Big Hole Creek and ends approximately 2 miles downstream. The upper section extends from RM 17 to RM 19, upstream of the confluence with the Little Thompson River. The upper section is approximately 10 to 12 miles downstream of the Meadow Creek section that was surveyed in 1973. Table 5-3 summarizes the number of bull trout collected in these two sections between 2005 and 2010. (Streamflows in 2011 were too high for electrofishing equipment.) During the 6-year period depicted in Table 5-3, a total of 49 bull trout were collected, 46 of them were found in the Big Hole section. These bull trout ranged in length from 133 mm to 488 mm, with the average length of 249 mm. Sampling is typically conducted in either June or July.

These data indicate that bull trout in the mainstem Thompson River are uncommon in both sampling locations, but are relatively more abundant in the downstream sampling area near the mouth. The upstream sampling site is upstream of the confluence with the Little Thompson River and contains a small number of bull trout.

Table 5-3: Summary of the number of bull trout collected during electrofishing in the Big Hole and 19-Mile sections of the Thompson River. (*Source:* unpublished data, MFWP)

Year	Big Hole	19 Mile	Total
2005	20	0	20
2006	5	0	5
2007	10	0	10
2008	3	0	3
2009	3	1	4
2010	5	2	7
Total	**46**	**3**	**49**

Additional information on radio telemetry studies and movement behavior of bull trout in the Thompson River and tributaries are discussed in Section 6. Additional discussions regarding potential limiting factors for bull trout distribution or presence in the mainstem is discussed in Section 8.1.

5.2.2 West Fork Thompson River

The West Fork Thompson River is a main tributary to Thompson River with its confluence approximately 6 miles upstream of the mouth of Thompson River. The watershed is approximately 22,735 acres (GEI, 2005). Radio telemetry studies, redd counts, and fisheries surveys indicate the West Fork Thompson River watershed provides critical habitat for bull trout spawning, rearing, and overwintering (GEI, 2005; PPL Montana, 2012). Redd surveys of the lower 5 miles are conducted each October.

In 2010, the West Fork Thompson River drainage was surveyed by MFWP between July 26 and 29 to obtain population estimates of fish species throughout the drainage. Electrofishing surveys were completed at seven locations within the West Fork Thompson River drainage, depicted on Figure 5-1. Five of the seven survey sites were located on the main stem of the West Fork Thompson River, and one site was located each on Four Lakes Creek and Anne Creek (PPL Montana, 2012). The 2010 sampling project was designed to sample five sections of the West Fork outside of the established Avista sections as well as four Lakes Creek and Anne Creek, two tributaries to the West Fork.

The average survey section length for the seven sites was 104 meters. Bull trout were captured at each of the survey locations, and bull trout densities were generally greater the further upstream the survey sites were located (Table 5-4). A total of 140 bull trout were captured, ranging in size from 70 to 251 mm. The majority of the bull trout were captured at Sites 1B, 2, Four Lakes, and Anne Creek (*see* Figure 5-1) (PPL Montana, 2012).

Figure 5-1: Site locations where 2010 fisheries surveys were completed in the West Fork Thompson River. (*Source*: PPL Montana, 2012)

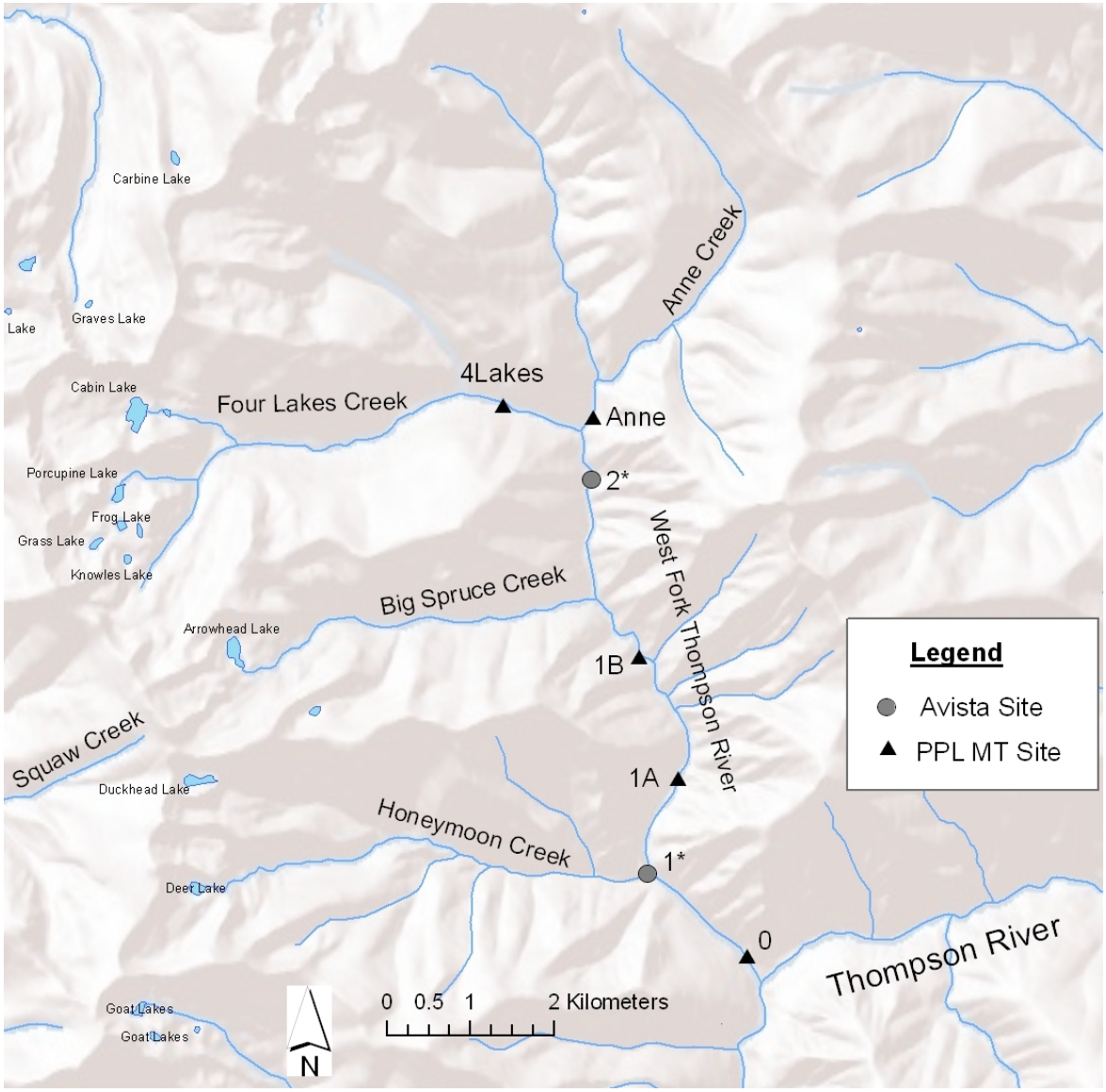


Table 5-4: Summary of density estimates for fisheries data collected during 2010 electro-fishing in the West Fork Thompson River. (*Source:* PPL Montana, 2012)

		Density Estimates (#/100 m) with 95% C.I.							
Site	**Section Length (m)**	**BULL**		**WCT**		**RB**		**RBxWCT**	
0	100	2.0	2.0–2.0	10.0	9.0–13.0	10.0	10.0–10.0	-	-
1	67	11.9	11.9–11.9	59.7	59.7–68.5	1.5	1.5–1.5	4.5	4.5–4.5
1A	122	9.0	9.0–9.0	44.3	36.9–49.2	-	-	-	-
1B	100	22.0	22.0–22.0	22.0	21.0–35.0	-	-	-	-
2	120	36.7	36.7–42.5	14.2	14.2–14.2	-	-	1.7	1.7–1.7
1.4, Four Lakes	118	24.6	24.6–27.1	26.3	26.3–26.3	-	-	-	-
Anne Creek	104	23.1	23.1–30.8	29.8	29.8–29.8	-	-	-	-

5.2.3 Fishtrap Creek

Fishtrap Creek is a fourth order tributary to the Thompson River and its watershed is approximately 60,000 acres (Land and Water, 2005). Bull trout are well documented in the Fishtrap Creek drainage based on redd surveys, fisheries surveys, telemetry studies, and genetic analysis. Through Avista's Upstream Fish Passage Program, genetic assignment of adult bull trout captured below Cabinet Gorge Dam to Fishtrap Creek indicate the migratory life history is still present in the drainage. Spawning locations have been documented in mainstem Fishtrap Creek (between Young Creek and Whiteface Creek), West Fork Fishtrap Creek, Beatrice Creek, and Jungle Creek (Land and Water, 2005; GEI, 2005; Liermann, 2003; Moran, 2005). Redd surveys have not included Beartrap Creek.

Most recently, a fisheries survey was completed by Avista in 2011 to obtain population estimates of fish species throughout the Fishtrap drainage (Figure 5-2). Avista completed electrofishing surveys in Fishtrap Creek, Jungle Creek, Beatrice Creek, West Fork Fishtrap Creek, and Beartrap Creek (Tholl and Kreiner, 2012).

In the mainstem of Fishtrap Creek, bull trout were present upstream of FTC 2.3 (near the headwaters). A total of 60 bull trout were observed during the 2011 survey and ranged in size from 63 to 254 mm. Bull trout densities varied between 1.6 and 14 fish per 100 m (Table 5-5).

A total of nine bull trout were captured in Jungle Creek (three at Site 1; six at Site 2), ranging in size from 137 to 239 mm (Tholl and Kreiner, 2012).

A total of 96 bull trout were captured in Beatrice Creek and ranged in size from 68 to 300 mm. Based on the results from the two sites, bull trout densities in Beatrice Creek were much greater at Site 1 (70 bull trout per 100 m) than Site 2 (18 bull trout per 100 m). (Tholl and Kreiner, 2012).

A total of 59 bull trout were captured at the survey locations in West Fork Fishtrap Creek, ranging in size from 81 to 300 mm. Based on the results from the three sites, bull trout density estimates were greatest, approximately 37 per 100 m, in the middle of the surveyed stream reach, at Site 2, compared to Site 1 and Site 3 with density estimates of 16.5 and 10.1 per 100 m, respectively (Tholl and Kreiner, 2012).

In Beartrap Creek, a total of 44 bull trout were captured in Site 1 and no fish were observed in Site 2. Bull trout ranged between 97 and 135 mm and estimated population was 46.4 fish per 100 m (Tholl and Kreiner, 2012).

Figure 5-2: Map of the 2011 Fishtrap Creek electrofishing survey locations. (*Source*: Avista, 2011)

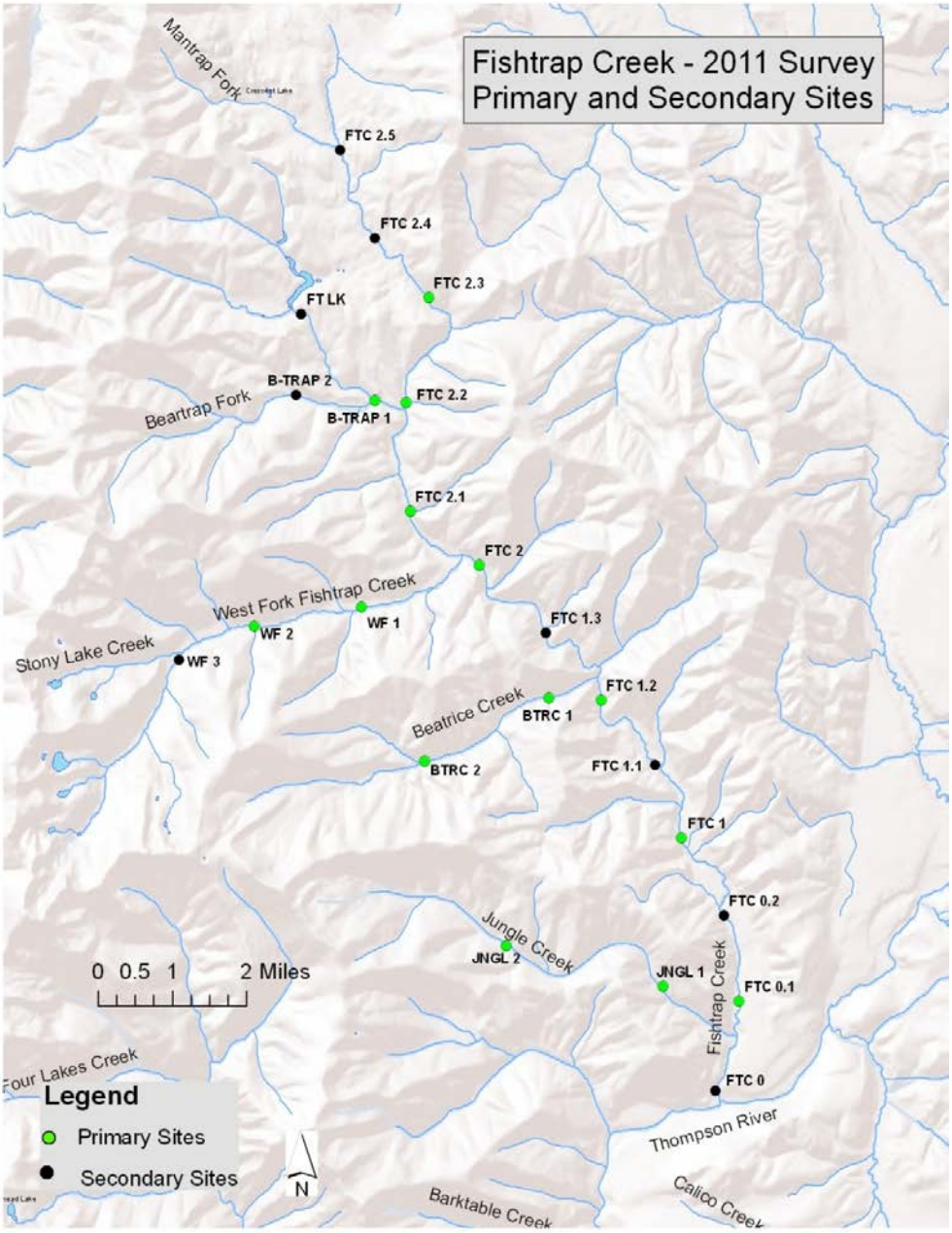


Table 5-5: Summary of density estimates for fisheries data collected during 2011 electro-fishing in Fishtrap Creek. (*Source:* Tholl and Kreiner, 2012)

		Density Estimates (#/100 m) with 95% C.I.							
Site	Section Length (m)	BULL		WCT		RB		RBxWCT	
1	128	1.6	1.6-1.6	26.6	25-29.9	-	-	1.6	1.6-1.6
2	90	12.2	-	84.4	52-127	1.1	1.1	-	-
1.1	130	3.1	3.1-3.1	16.9	16.2-19.6	0.8	0.8-0.8	-	-
1.2	100	14.0	13.0-17.1	50	47-55	-	-	2	2-2
2.1	107	4.7	4.7-4.7	17.8	17.8-18.7	-	-	-	-
2.2	103	11.7	11.7-13.1	49.5	45.6-56.3	-	-	-	-
2.3	100	11.0	10.0-14.9	75.0	71.0-81.3	-	-	-	-
2.4	110	-	-	52.7	50.0-57.7	-	-	-	-

5.2.4 Little Thompson River

After reviewing available fisheries information collected in the Little Thompson River drainage since 1991, it does not appear that there is a bull trout subpopulation currently present in the watershed.

There is historic information that suggests bull trout were potentially present in the Little Thompson River drainage. In the 1968 to 2011 fishing logs of the MFWP's Montana Fisheries Information System (MFWP, 2010b), there is a record from 1977 that indicates a single bull trout was captured between July and September (MFISH website: http://fwp.mt.gov/fishing/mFish/). During this period of time (1968 through 2011), the fishing logs report mostly rainbow trout, westslope cutthroat trout, and brook trout present with one brown trout recorded in 2009 (MFWP, 2010b). MFISH data was also available for two of the tributaries, Mudd Creek and Little Rock Creek, in Little Thompson River drainage. MFISH fishing logs from 1971 and 1972 identify westslope cutthroat trout and brook trout present in Mudd Creek (MFWP, 2010b). In addition, a genetics study in 1988 reported westslope cutthroat trout present in Little Rock Creek, but the report did not indicate whether other fish species were observed during the data collection effort (Huston, 1988).

Various fisheries surveys between 1991 and 2008 were completed by USFS (Lolo National Forest, unpublished data) in the mainstem of the Little Thompson River and several of its tributaries (Alder Creek, no name tributary to Alder Creek, Tepee Creek, McGinnis Creek, North Fork Little Thompson River). No bull trout were detected during USFS surveys completed between 1991 and 2008 in the Little Thompson River watershed. Plum Creek did detect adult bull trout in the Little Thompson River during their survey work in the 1990s (Plum Creek, 1997).

Several reports include statements that bull trout were likely historically present in the Little Thompson River. These statements appear to have been based on professional judgment rather than documented observations of bull trout. At this time, it appears the fishery in the

Little Thompson River drainage is primarily comprised of westslope cutthroat trout, brook trout, and rainbow trout. Note that there was a fish observed in Alder Creek 2008 by a USFS snorkeling crew that was initially identified as a bull trout. After genetic analysis of the fish, the fish was determined to be a brook trout (J. Mickelson, USFS, personal communication, May 8, 2012).

5.2.5 Big Rock Creek

Bull trout were first detected during the 2008 fisheries surveys completed by the USFS (unpublished data). Additional fisheries data on Big Rock Creek were collected by the MFWP between August 25 and 27, 2010. The objective of this work was to determine the extent of bull trout distribution in the drainage, roughly estimate numbers and identify life history forms, and collect genetic samples to add to the baseline dataset. Eleven sites were sampled with backpack electrofishing equipment to determine relative abundance and distribution of salmonids. Sites were located from the mouth (Site 1) to the headwaters (Site 11) and were spaced approximately 1 mile apart. Bull trout were captured in the lower eight sites. Westslope cutthroat trout were captured at all sites and were the only species found at Sites 9 through 11. Brown trout were only captured at Site 1. Bull trout densities appear to be relatively low, but consistent, within Sites 1 through 8. The number of bull trout captured at each of the Sites 1 through 8 varied between one to four bull trout with the greatest occurrence in Site 5. Size distribution of captured bull trout (range between 184 and 293 mm) are within the range of resident life history forms (PPL Montana, 2011).

5.2.6 Murr Creek

In 1998, Plum Creek completed a watershed analysis that included Murr Creek (Plum Creek, 1998b). As part of the fisheries survey completed in Murr Creek, Plum Creek documented one adult bull trout in the lower section (near the confluence, downstream of Section 9, Township 25N, Range 26 West). In the lower section of Murr Creek, brook, westslope cutthroat, and rainbow trout were also observed. In the upper section (upstream of Section 9, Township 25N, Range 26 West), only brook trout were observed and no fish were observed upstream of Section 11, Township 25N, Range 26 West (Plum Creek, 1998b). The 1998 report indicates there are a “fish-passage barrier cascade” in Section 9 and a “barrier falls” in Section 11 (Plum Creek, 1998b). At this time, there is no known bull trout subpopulation present in Murr Creek.

6.0 Migratory Bull Trout in the Thompson River Drainage

Prior to the construction of the fish ladder at Thompson Falls Dam, the dam prevented upstream migration to known bull trout tributaries in the Thompson River, the lower Flathead River (Jocko River and Mission Creek drainages) downstream of Kerr Dam, and the middle Clark Fork River drainage. Genetic data analyzed (since 2004) from adult bull trout collected at the base of Cabinet Gorge Dam in the lower Clark Fork River drainage have verified that the specific natal tributaries for some of the returning bull trout are upstream of Thompson Falls Dam (DeHaan et al., 2011; DeHaan and Bernall, 2012).

Since 2001, Avista has collected adult bull trout below Cabinet Gorge Dam and transported fish upstream based on genetic assignments; however, from 2001 through 2003, a limited number of bull trout were collected for upstream passage experiments and genetic assignments to tributary origin was not available (Bernall and Duffy, 2012). Since 2004, bull trout captured below Cabinet Gorge Dam have been genetically tested and assigned to a tributary of origin. Approximately 75 to 80 percent of the total numbers of bull trout captured below Cabinet Gorge Dam were assigned to upstream populations in Montana (Bernall and Duffy, 2012).

Between 2001 and 2011, Avista captured a total of 611 individual bull trout downstream of Cabinet Gorge Dam, including bull trout collected in 2010 and 2011 in the Twin Creek weir trap (S. Bernall, Avista, personal communication, June 2012). Of the 611 bull trout, 123 fish were identified, through genetic testing, as originating from tributaries upstream of Thompson Falls Dam (S. Bernall, Avista, personal communication, June 2012). Of the 123 bull trout having natal tributaries upstream of Thompson Falls Dam, 75 fish (61%) originated from the Thompson River drainage. In addition, five adult bull trout captured below Noxon Rapids Dam near Noxon Springs in 2001, 2002, 2003, and 2007 were also genetically tested and assigned to tributaries upstream of the Thompson Falls Dam (S. Bernall, Avista, personal communication, June 2012).

These data indicate downstream bull trout movements are not limited to the lower Clark Fork River and that the adfluvial migratory life history of bull trout still exists in the Lower Clark Fork River core area. However, the only method to retain the adfluvial migratory traits will be to continue bull trout passage over the dams in the lower Clark Fork River, thus allowing adult bull trout to return to their natal stream to spawn.

6.1 Movement Patterns

In the lower Clark Fork River, there appears to be a wide season for adult migration and movement in the tributaries (GEI, 2005). Adult bull trout have been documented to travel long distances to spawning areas (Schmetterling, 2003; Wydoski and Whitney, 2003), but

specific migration information for adult bull trout migrating to the Thompson River drainage is limited.

Migratory bull trout are known to be present upstream in two tributaries of the Thompson River: West Fork Thompson River, and Fishtrap Creek (Liermann, 2003; Liermann et al., 2003). Trapping and telemetry studies completed since 2001 have monitored movement patterns of bull trout in the Thompson River drainage. The data indicate West Fork Thompson River and Fishtrap Creek provide important habitat for bull trout and the mainstem Thompson River serves as a corridor for migration and provides critical overwintering habitat. The following sections summarize the limited bull trout movement data that has been collected in the drainage.

6.1.1 Trapping Data

Liermann (2003) installed traps in Fishtrap Creek and West Fork Thompson River in 2002 and evaluated the upstream and downstream movement of bull trout in each watershed. Adult migratory bull trout (> 400 mm) were captured moving upstream between June/July and September. Migratory juvenile bull trout (< 250 mm) were consistently captured moving downstream in the fall (Liermann, 2003). However, the number of outmigrating juvenile bull trout varied greatly between years (Liermann, 2003).

Results showed that adult bull trout captured outmigrating in Fishtrap Creek were much larger than in West Fork Thompson River. Liermann (2003) suggested that Fishtrap Creek may have a higher recruitment potential because Fishtrap Creek drainage area (24,014 hectares) is much larger than the West Fork Thompson River drainage area (9,221 hectares).

6.1.2 Radio Telemetry Data

In 2001, a fish tracking study was conducted by PPL Montana and MFWP. Bull trout as well as other salmonids were captured either by angling or in the trap downstream of the Thompson Falls Dam Main Dam spillway, then radio tagged and transported upstream of Thompson Falls Dam. The two bull trout monitored were identified as bull trout 151.520 (Figure 6-1) and bull trout 150.992 (Figure 6-2).

Bull trout 151.520 was detected in the mainstem Thompson River in June, July, August, September, and early October 2001. October 2, 2001 was the last date of detection. During the summer months, the bull trout was most commonly near the mouth of Deerhorn Creek and immediately downstream of Fishtrap Creek.

Figure 6-1: Bull trout #151.520 movements in Thompson River drainage in 2001.

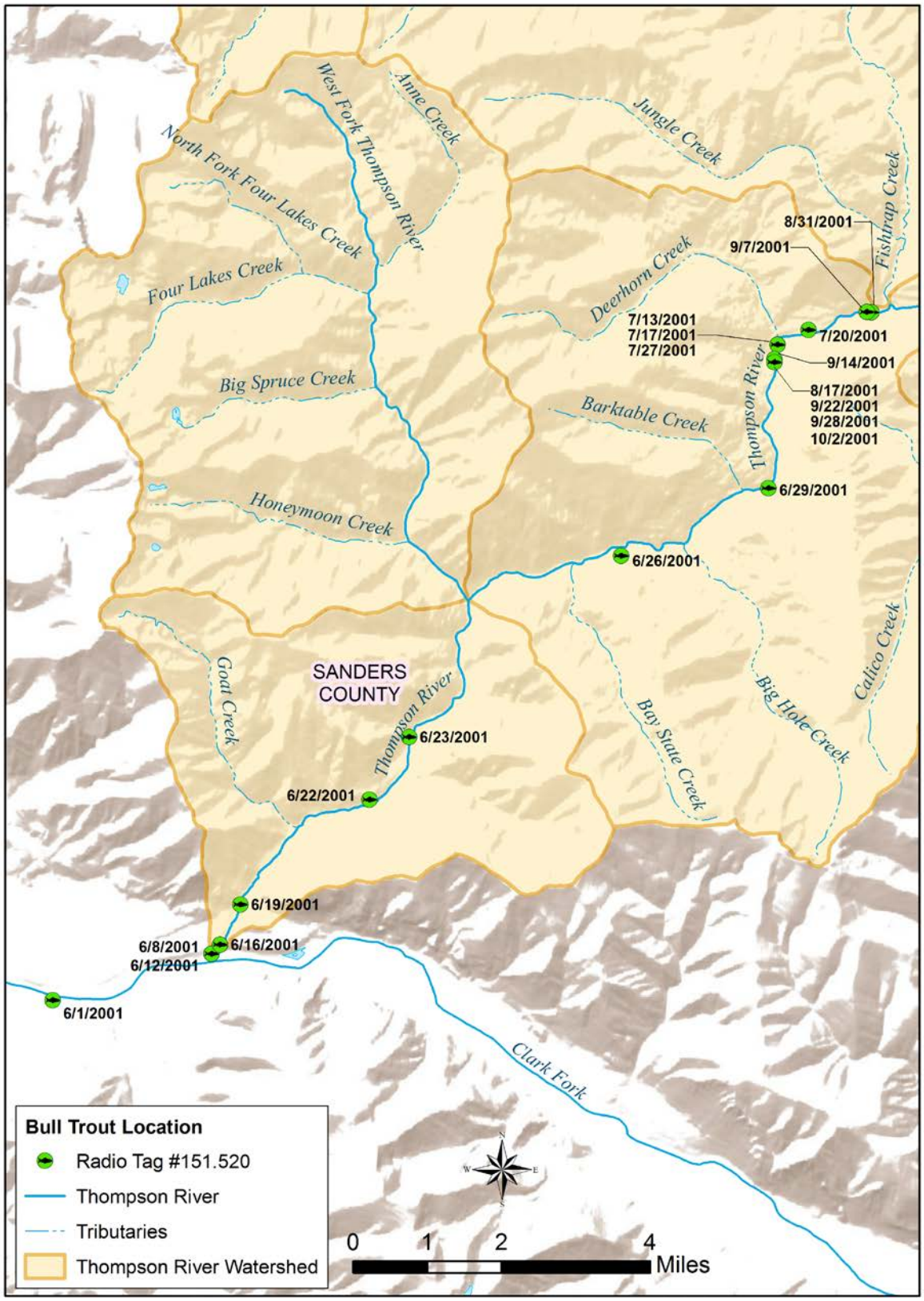
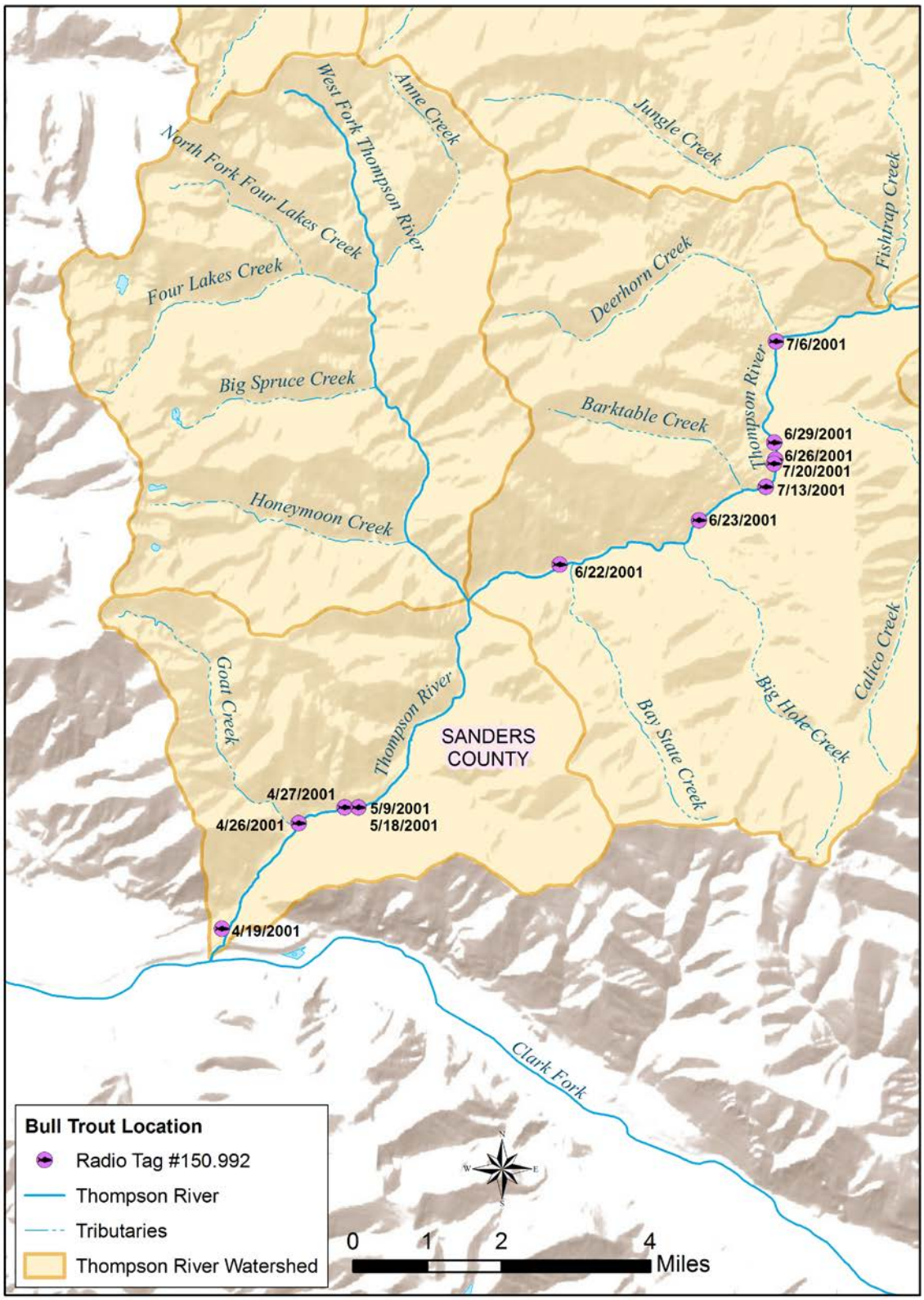


Figure 6-2: Bull trout #150.992 movements in Thompson River drainage in 2001.



Bull trout 150.992 was released in the Thompson River on April 19, 2001 and remained in the mainstem until August 3, 2001, which was the last record of detection. In June, July, and early August, the bull trout was generally found in the mainstem between the confluence with Bay State and Deerhorn creeks.

Both radio tagged bull trout migrated (*as shown in* Figures 6-1 and 6-2) into the Thompson River after being transported upstream of Thompson Falls Dam, moving an average of 26.5 km (16.5 miles). Bull trout 150.992 was transported above the Thompson Falls Dam on April 11 and bull trout 151.520 on June 1. Both bull trout moved upstream at an average rate of 0.3 km/day (0.2 mile/day). It took between 86 and 92 days for the bull trout to reach their upstream-most location. Neither of these two bull trout is known to have returned downstream past the dam. However, it should be noted that fish were tracked for an average of 100 days during the 2001 radio telemetry study. Some radio tagged fish may have moved downstream past the dam after the batteries died in the tags. For example, bull trout 150.992 was last tracked on August 3, 2001, before the start of the bull trout spawning season and well before downstream post-spawning movements would be expected to occur (GEI, 2003).

On May 3, 2002, PPL Montana and the MFWP captured a bull trout by angling downstream of the Thompson Falls Dam (PPL Montana and MFWP, unpublished data). A radio transmitter was implanted in the bull trout (414 mm, 568 grams) and the fish was released in the Thompson River on the same day it was captured. This fish was monitored between May 2002 and January 2004. In 2002 and 2003, the bull trout remained in the Thompson River drainage the entire year and was either detected in the mainstem of the Thompson River or in the West Fork Thompson River. Between May and mid-July 2002 (approximately 66 days), the bull trout was in the mainstem Thompson River near the confluence of the West Fork Thompson River. Between mid-July and mid-September (approximately 60 days), the bull trout was detected in the West Fork Thompson River and/or 4 Lakes Creek, which is part of the West Fork Thompson River basin. Between mid-September through mid-December 2002 (approximately 90 days), the bull trout was detected in the lower section of the West Fork Thompson River, near the mouth and was assumed to be hiding in a pool formed by a stump/debris. By December 20, 2002, the bull trout was back in the mainstem Thompson River, but remained near the confluence with the West Fork Thompson River. The bull trout was often located under large rocks between December 20 and 30, 2002. Between January 6 and November 3, 2003 (approximately 300 days), the bull trout remained in the mainstem Thompson River, but always within 0.6 to 1.2 miles from the confluence with the West Fork Thompson River. Between November 24 and January 9, 2004, the bull trout was detected in the Thompson Falls Reservoir near the footbridge. The last detection was on January 9, 2004.

The monitoring information from the bull trout tracked between May 2002 and January 2004 provides valuable information regarding movement patterns through the seasons and use of the Thompson River drainage. Movement patterns varied between the 2 years, but provide insight as to the variable uses of habitat and suitability of habitat in the drainage. In 2002, the bull trout was primary in the mainstem of the Thompson River during the spring months, and

then migrated into the tributary streams (West Fork Thompson) during the summer months before migrating back to the mainstem Thompson River in the fall and winter. It may be assumed that this bull trout may have spawned in the tributary in summer/early fall and overwintered in the mainstem Thompson River. In 2003, the bull trout remained in the mainstem Thompson River for the entire year before migrating into the Clark Fork River and downstream to Thompson Falls Reservoir in the winter. This movement indicates that bull trout may also utilize the mainstem Thompson River for year-round use *versus* only a migratory corridor or overwintering habitat.

In 2004, PPL Montana and the MFWP captured several salmonid species below the Thompson Falls Dam, implanted radio transmitters, and released the fish upstream of the dam to monitor movement. This study included the monitoring of three bull trout that were captured, tagged, and then released upstream in the Thompson River drainage. Of the three bull trout, two fish were repeatedly detected in the Thompson River drainage. The first bull trout (#148.500), 523 mm and 1,483 grams, was captured and released upstream in the Thompson River in mid-April 2004. This fish immediately migrated downstream into the Clark Fork River and Thompson Falls Reservoir. On April 30, 2004, the bull trout was redetected in the Thompson River drainage and was detected in the drainage through June 11 (approximately 43 days). On April 30, the bull trout was detected more than 11 miles upstream in the mainstem Thompson River. By May 12, the bull trout was detected near the confluence of Fishtrap Creek. The bull trout was last detected on June 11 in Fishtrap Creek.

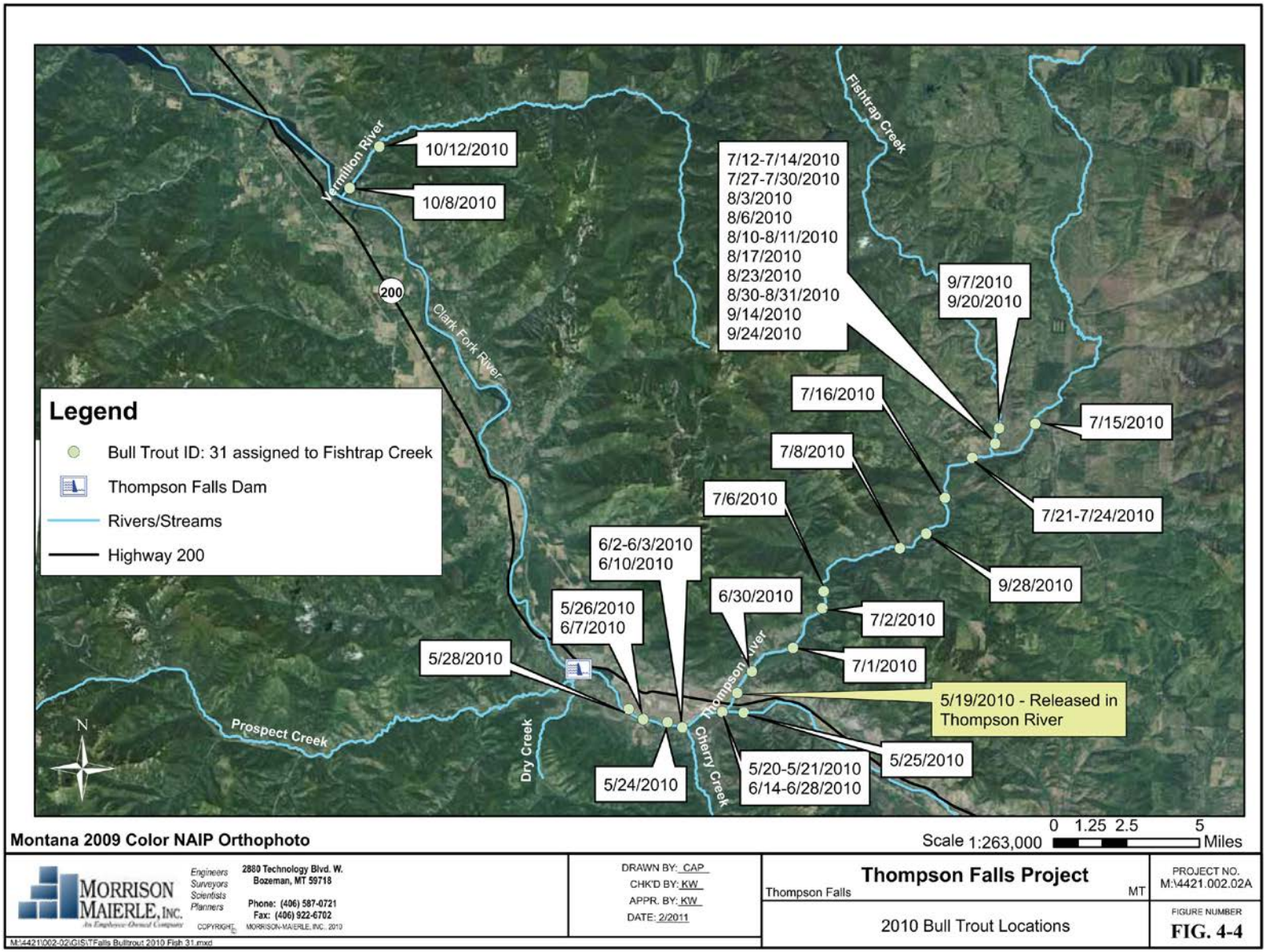
The second bull trout (#148.540), 487 mm and 1,225 grams, was captured and released upstream in the Thompson River on April 7, 2004. As was observed by the first bull trout, the second bull trout also immediately migrated downstream to the Thompson Falls Reservoir, but was later detected in the lower reaches of the Thompson River, about 8 days later (April 16). By late April and early May, the second bull trout was near the confluence of Fishtrap Creek and at times was detected in the mainstem Thompson River just upstream of Fishtrap Creek. The bull trout spent approximately 20 days in the Thompson River. Between May 14 and August 27, 2004, the second bull trout was in the Fishtrap Creek drainage. Over half of the time (approximately 62 of the 110 days), the bull trout was in West Fork Fishtrap Creek. The transmitter was found in a dry overflow channel on September 1.

There have been other examples that support the presence of bull trout migratory behavior and use of the Thompson River drainage. For example, one bull trout collected on June 11, 2009 by hook and line sampling in the Clark Fork River below Cabinet Gorge Dam was released in the Thompson River June 15, 2009. It was 710 mm in length and weighed 3,686 grams. This fish was recaptured during electrofishing in Fishtrap Creek (a tributary of the Thompson River) on July 21, 2009. It appeared to be paired up with another bull trout, based on visual observation.

In 2010, Avista trapped, radio tagged, and transported five bull trout upstream into the Thompson River from downstream of Cabinet Gorge Dam (PPL Montana, 2011). Only one

of the five fish (bull trout 31) moved upstream into the Thompson River drainage during the bull trout spawning season (*see* Figure 6-3 from PPL Montana, 2011). Bull trout 31 was released in the Thompson River on May 19 and migrated back to the Clark Fork River and remained in the Clark Fork River for approximately 39 days (May 20-June 28) until redetected in the lower Thompson River. Bull trout 31 was primarily located in the mainstem of the Thompson River in July with a few days in lower Fishtrap Creek (July 12-14, July 27-30). The furthest upstream location that bull trout 31 was detected in the mainstem Thompson River was just upstream of the confluence with Fishtrap Creek. During the month of August, bull trout 31 was only detected in Fishtrap Creek. In September, bull trout 31 moved between Fishtrap Creek and the mainstem Thompson River with the last detection of this bull trout in the Thompson River on September 28. Within 10 days, bull trout 31 was detected downstream of Thompson Falls Dam, in the Vermilion River. In summary, bull trout 31 migrated into the Thompson River drainage at the end of June and migrated to its likely natal stream, Fishtrap Creek, in July. The fish remained in or near Fishtrap Creek during the summer months prior to outmigrating to the Clark Fork River in late September/early October.

Figure 6-3: Bull trout #31 movements in Thompson River drainage in 2010.



7.0 Results of the Bull Trout Habitat Analysis

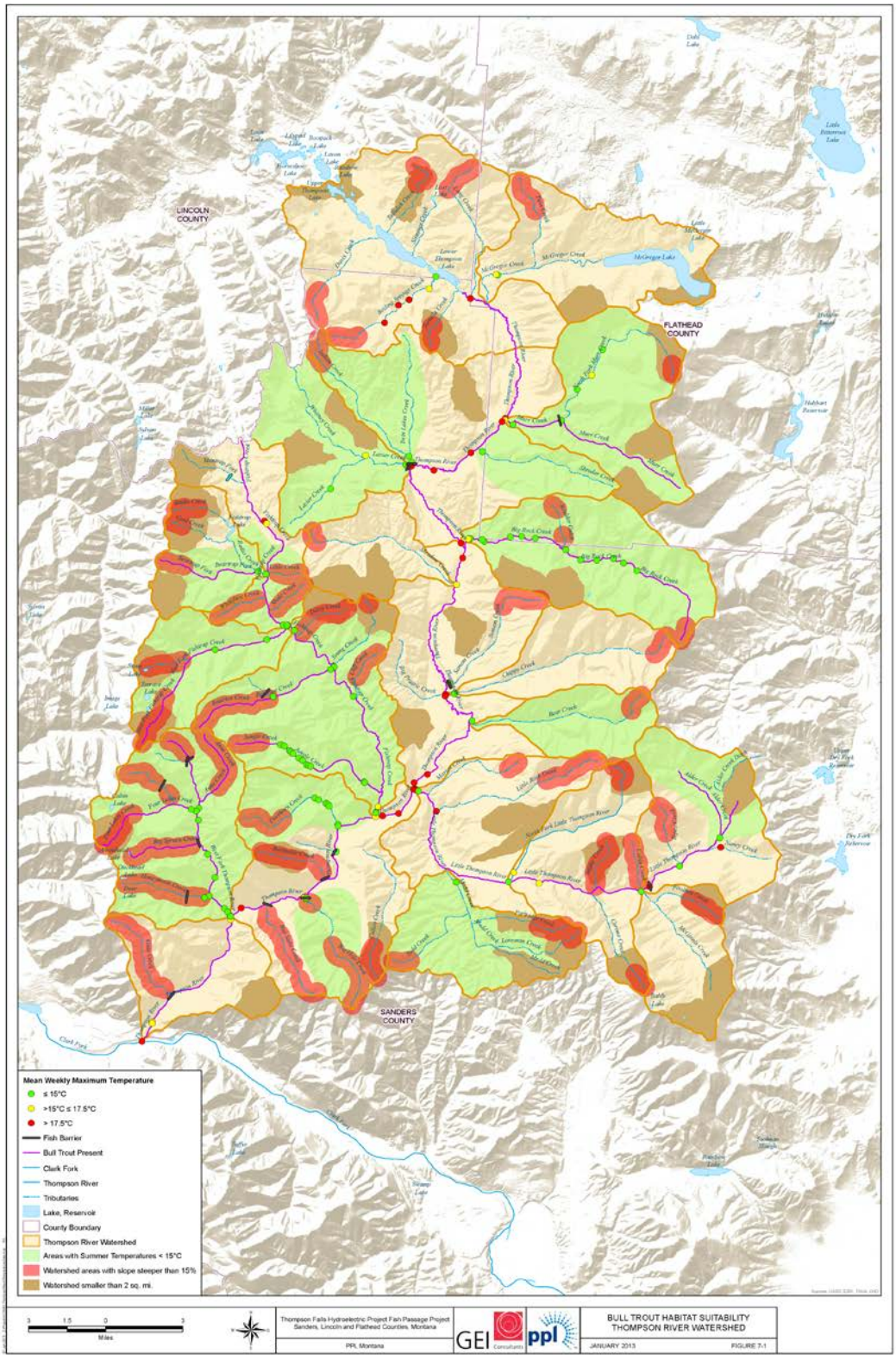
Figure 7-1 shows the results of the mapping analysis done in the Thompson River. On Figure 7-1, green dots indicate locations where the maximum weekly maximum temperature (MWMT) was found to be 15 ^{o}C or less. A stream with a MWMT in this range is thermally suitable for bull trout in the summer months. Yellow dots indicate temperatures greater than 15 ^{o}C but less than or equal to 17.5 ^{o}C. This temperature range is marginal for bull trout summer use. Red dots are the MWMT in excess of 17.5 ^{o}C, with low thermal suitability for bull trout in the summer. The map includes data collected in 2012, as well as data gathered in previous years by other researchers.

The watersheds shaded in green are those that, in general, appear to be thermally suitable for bull trout in the summer. It should be noted that the decision to shade a watershed in green was somewhat subjective. Some watersheds have localized areas that may, or may not, be thermally suitable for bull trout. In addition, there is variation from year to year. Some locations may have borderline conditions, where water temperatures are suitable in cool years but marginal or unsuitable in warm years. Therefore, the decision to shade a watershed in green was made based on the preponderance of the evidence.

Watersheds smaller than 2 mi^2 were shaded in brown. These are watersheds estimated to be too small to produce a stream of sufficient size to support bull trout.

Portions of streams which are estimated to be in excess of 15 percent slope are shaded in red. The decision about the red shading was also subjective. Many streams have short reaches of steep slope, but are not, overall, steep. Therefore, the determination of which streams were “too steep” was based on the overall character of the stream reach.

Figure 7-1: Results of bull trout habitat suitability analysis, Thompson River drainage, Montana.



7.1 Thompson River

The MFWP deployed temperature monitors in four locations in the mainstem Thompson River in the summer of 2012 (Table 7-1). In late summer 2011, the USFS also deployed temperature monitors in four locations in the mainstem Thompson River, which remained in place until October 2012. None of the sites monitored were thermally suitable for bull trout, although the most downstream two sites (at the gaging station and at the mouth) were in the marginal range. The monitoring site below McGregor Creek had the highest MWMT recorded in the mainstem, at 25.3^{o}C.

Table 7-1: Temperature monitoring in mainstem Thompson River 2012.

Location	Latitude	Longitude	Date Start	Date End	MWMT
Below McGregor Creek	N.47.00727	W.115.01083	8/24/2011	10/11/2012	25.3
Below Big Rock Creek	N.47.91057	W.115.05023	8/24/2011	10/11/2012	20.3
Above Chippy Creek	N.47.78369	W.115.00819	7/6/2012	9/25/2012	19.0
Above Fishtrap Creek	N.47.71478	W.115.04034	7/6/2012	9/25/2012	19.8
Below Fishtrap Creek[1]	N.47.71195	W.115.05930	8/24/2011	10/12/2012	
Above West Fork Thompson River	N.47.65531	W.115.16588	7/6/2012	9/25/2012	17.7
At Gaging Station	N.47.58759	W.115.23302	7/6/2012	9/25/2012	16.7
At Mouth	N.47.58679	W.115.23294	8/23/2011	10/10/2012	16.9

These results confirm the conclusions of prior researchers. The summer stream temperature data collected by Plum Creek show the temperature in the mainstem is generally elevated compared to the contributing tributaries (Figure 7-2, Plum Creek unpublished data). Stream temperatures in Thompson River also increased moving up the drainage.

The USFS monitored water temperature in the mainstem Thompson River at 11 locations in 2004 (Table 7-2). The MWMT was in excess of 15 ^{o}C at all locations, and eight of the 11 sites recorded the MWMT in excess of 17.5 ^{o}C. Water temperature downstream of the confluence of Fishtrap Creek, which is located between RM 15 and 16, is much cooler than water temperature upstream of Fishtrap Creek. In 2004, the MWMT in the Thompson River at RM 16 (upstream of Fishtrap Creek) was 22.5 ^{o}C, while the MWMT at RM 15 (downstream of Fishtrap Creek) was 16.4 ^{o}C (Figure 7-3 and Table 7-2).

The Thompson River is unusual in its temperature pattern. Most typically, streams are coldest at their headwaters, and gradually warm in a downstream direction. The Thompson River has a series of lakes in the headwaters. The large surface area of the lakes results in warm water temperatures. Therefore, water temperature in the headwaters of the Thompson River is relatively warm. Plum Creek recorded the MWMT at RM 50 (upstream of the McGregor Creek confluence, just downstream from Lower Thompson Lake) to be 21.5 ^{o}C in

[1] Temperature monitor malfunctioned, no data available.

1995 (Figure 7-2). The USFS recorded an MWMT in the Thompson River downstream of McGregor Creek of 25.3^{o}C. The influence of cool water inflows from Twin Lakes Creek is apparent in the data collected by the USFS in 2004 (Table 7-2) (Copenhaver et al., 2005). However, none of the tributaries of the upstream portions of the Thompson River have a large enough cold water volume to cool the mainstem Thompson River to a sufficient extent to bring the MWMT into the suitable or marginal range for bull trout. Thus, the entire mainstem upstream of Fishtrap Creek is in the unsuitable summer temperature range for bull trout.

Figure 7-2: Summer stream temperatures in the Thompson River and tributaries, 1995–2012. (*Source:* USFS, unpublished data, MFWP unpublished data, PPL Montana unpublished data, Plum Creek, unpublished data)

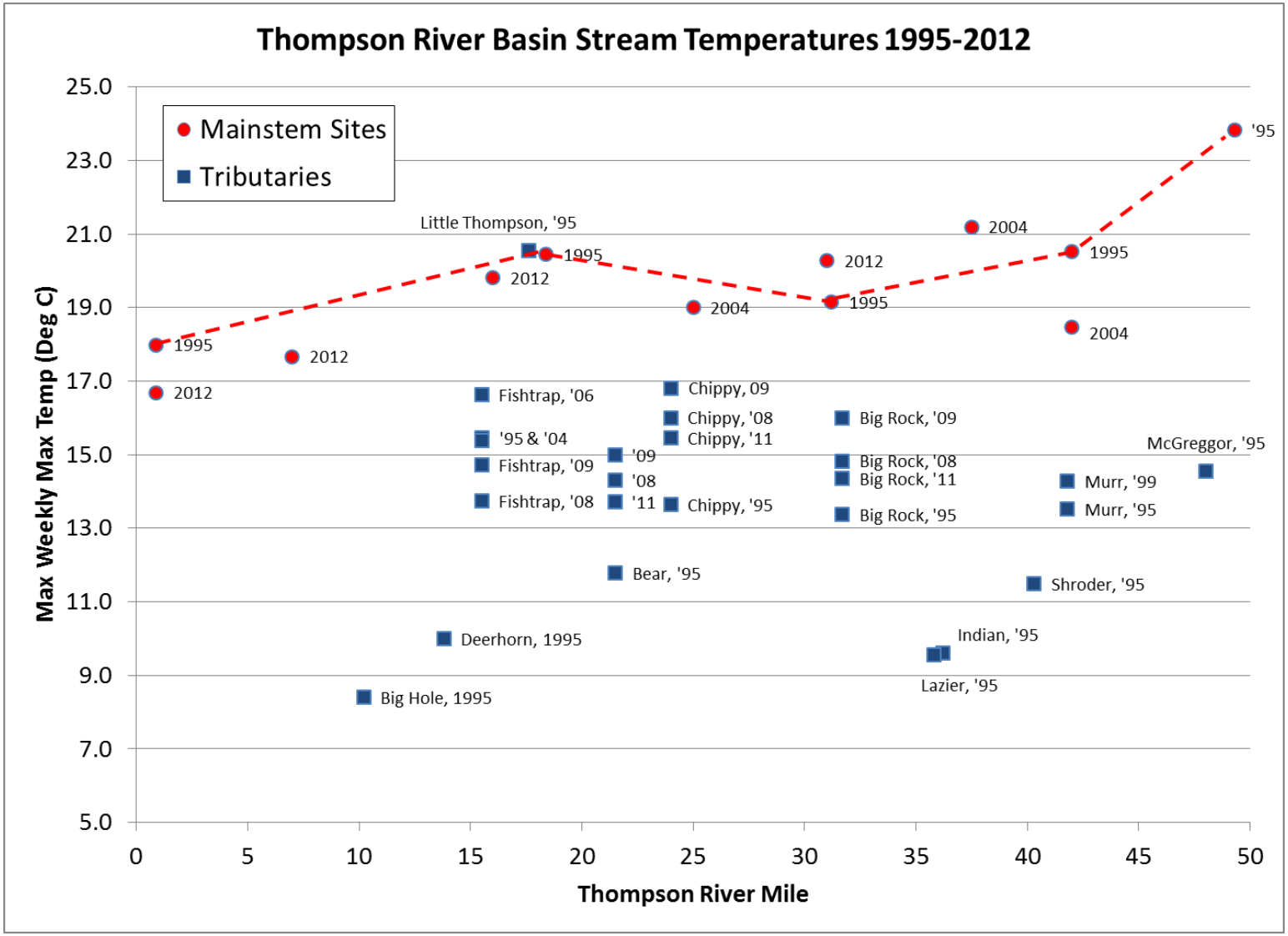
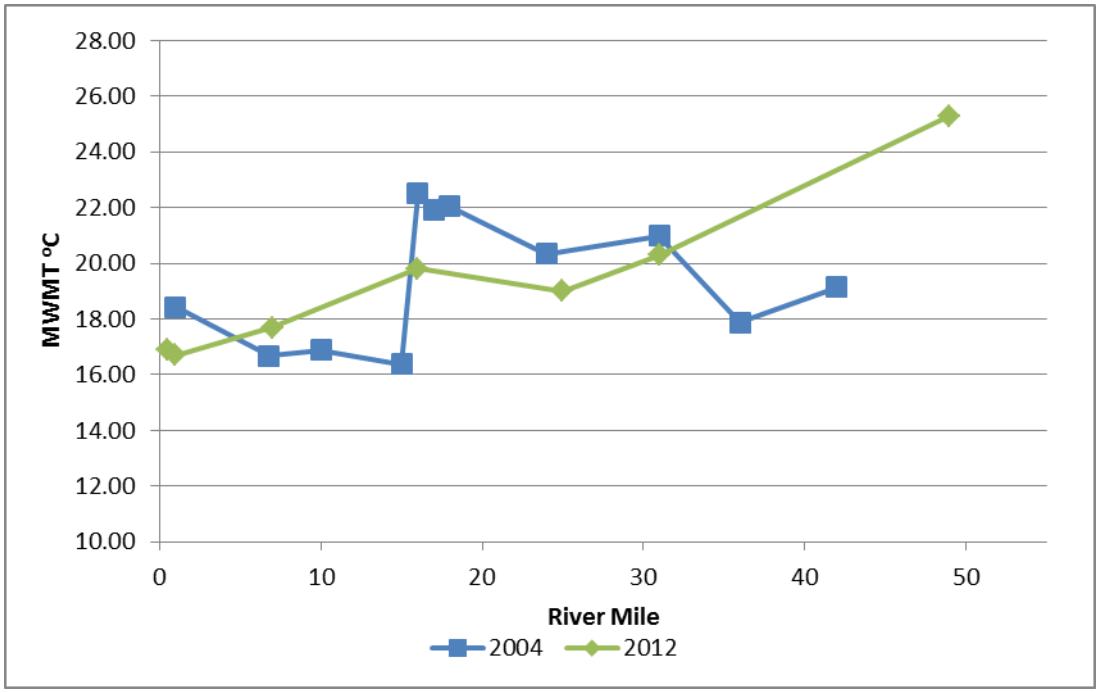


Figure 7-3: Maximum weekly maximum stream temperature in the Thompson River by river mile, 2004 and 2012. (*Source:* Copenhaver et.al., 2005; USFS unpublished data, 2012; MFWP unpublished data, 2012)



Either Fishtrap Creek has sufficient volume to cool the mainstem Thompson River, or there are coolwater springs that enter the Thompson River near the Fishtrap Creek confluence. In any event, some portions of the mainstem downstream of Fishtrap Creek is have marginal summer water temperatures for bull trout in at least some years (Table 7-1 and 7-2).

Table 7-2: MWMT in the Thompson River, 2004. (*Source:* Copenhaver et al., 2005)

Location	RM	Start Date	Stop Date	MWMT °C
At Gage Station	1	06/19/04	11/03/04	18.4
Below West Fork Thompson Confluence	7	07/01/04	10/13/04	16.7
Below Big Hole Creek Confluence	10	07/01/04	10/13/04	16.9
Below Fishtrap Creek Confluence	15	07/01/04	10/13/04	16.4
Above Fishtrap Creek Confluence	16	06/19/04	11/03/04	22.5
Below Little Thompson River Confluence	17	07/09/04	10/13/04	21.9
Above Little Thompson River Confluence	18	06/19/04	11/03/04	22.0
Below Chippy Creek Confluence	24	07/09/04	10/13/04	20.3
Below Big Rock Creek Confluence	31	07/09/04	10/13/04	21.0
Below Twin Lakes Creek Confluence	36	07/09/04	10/13/04	17.9
Below Murr Creek Confluence	42	07/09/04	10/13/04	19.1

Table 7-3: MWMT in tributaries of the Thompson River, 2004. (*Source:* Copenhaver et al., 2005)

Location	Date Start	Date End	MWMT °C
West Fork Thompson River, Mouth (T1)	07/01/04	10/13/04	12.2
Big Hole Creek, Mouth (T2)	07/01/04	10/13/04	8.8
Fishtrap Creek, Trap site (T3)	06/01/04	10/13/04	15.7
Little Thompson River, Mouth (T4)	07/09/04	10/13/04	21.8
Chippy Creek, Mouth (T5)	07/09/04	10/13/04	14.8
Big Rock Creek, Mouth (T6)	07/09/04	10/13/04	15.3
Twin Lakes Creek, Mouth (T7)	07/09/04	10/13/04	10.6

7.2 West Fork Thompson River

In August 2011, the USFS deployed two temperature monitors in the West Fork Thompson River. One of the monitors was lost, but the monitor at the mouth of the West Fork Thompson River recorded an MWMT of 11.1 ^{o}C. Prior water temperature data collected in the West Fork Thompson River also indicated that this stream has summer water temperatures that are suitable for bull trout (*see* Figure 7-1). As described in Section 5.2.2 the West Fork Thompson River provides critical habitat for spawning, rearing, and overwintering bull trout. Radio telemetry has confirmed the use of the watershed by migratory bull trout.

While there are some headwater portions of the West Fork Thompson River that may be too steep or small to support bull trout, the majority of the watershed is suitable for bull trout (Figure 7-1).

7.3 Fishtrap Creek

PPL Montana monitored water temperature in the Fishtrap Creek drainage in three locations in 2012, at Jungle Creek, Beartrap Creek, and Beatrice Creek. All three sites had MWMT considerably less than 15 ^{o}C (Table 7-4). The USFS monitored water temperature in Fishtrap Creek from August 2011 until October 2012. These readings indicate that Fishtrap Creek is has suitable summer water temperatures for bull trout, except at the headwaters site, which was marginal.

These results are consistent with the data collected by others in the Fishtrap Creek drainage, which generally indicates that MWMT are less than 15 ^{o}C drainage-wide, with the exception of a few readings in the marginal range near the mouth and marginal to unsuitable readings in the headwaters (RM 16 and above) (Figure 7-1).

Table 7-4: Temperature monitoring in Fishtrap Creek drainage, 2012. (*Source:* PPL Montana unpublished data 2012; USFS unpublished data, 2012.)

Location	Latitude	Longitude	Date Start	Date End	MWMT °C
Jungle Creek at mouth	N.47.73085	W.115.07045	7/3/2012	9/19/2012	10.1
Beartrap Creek at mouth	N.47.84534	W.115.17197	7/2/2012	9/19/2012	12.5
Beatrice Creek at mouth	N.47.79300	W.115.10578	7/2/2012	9/19/2012	9.9
Fishtrap Creek at mouth	N.47.71424	W.115.05936	8/24/2011	10/12/2012	14.1
Fishtrap Creek below West Fork Fishtrap Creek (RM 10.5)	N.47.81630	W.115.14420	8/23/2011	10/12/2012	6.6
Fishtrap Creek at Headwaters (RM 16)	N.47.87257	W.115.16793	8/23/2011	10/11/2012	17.3
West Fork Fishtrap Creek at Mouth	N.47.81625	W.115.14474	8/23/2011	10/11/2012	12.3
West Fork Fishtrap Creek near Lulu Gulch	N.47.80728	W.115.16080	8/23/2011	10/11/2012	11.8
West Fork Fishtrap Creek Headwaters	N.47.79955	W.115.20328	8/23/2011	10/11/2012	11.3
Replicate located in West Fork Fishtrap CK Headwaters	N.47.79955	W.115.20328	8/23/2011	10/11/2012	11.4

Summer stream temperatures collected in the Fishtrap Creek watershed by Plum Creek between 1995 and 2009 are shown in Figure 7-4. Stream temperatures in upper Fishtrap Creek at RM 18 are considerably warmer than stream temperatures measured downstream, although only one data point is available for Fishtrap Creek at RM 18. The Land and Water (2005) report commented that stream temperatures in upper Fishtrap Creek are warmer than in downstream areas as a result of natural conditions associated with natural meadows, and low-gradient beaver affected streams. USFS data collected at approximately RM 16 has also found warmer-than-optimal summer water temperatures in the headwaters of Fishtrap Creek (Figure 7-1 and Table 7-4).

The mean MWMT over the period of record in mainstem Fishtrap Creek is displayed in Table 7-5 for those sites where data has been collected by Plum Creek over multiple years. Water temperatures in the mainstem at RM 11 near West Fork Fishtrap are notably cooler than any other monitored section of Fishtrap Creek and are consistently less than 15 ^{o}C. The MWMT at other sites on Fishtrap Creek fluctuate around 15 ^{o}C MWMT. Inter-annual variation in MWMT in Fishtrap Creek is approximately 3 to 4 ^{o}C (Figure 7-4). In cooler years, such as 2008 and 2009, the MWMT at all sites in Fishtrap Creek are less than 15 ^{o}C.

Tributaries including Jungle, Beatrice, West Fork Fishtrap, and Beartrap are cooler than the mainstem, and MWMT is consistently less than 15 °C (Figure 7-4 and Table 7-4). Overall, summer water temperatures are in the optimal range for all of the tributaries of Fishtrap Creek where temperature has been monitored, and most of the mainstem in many years.

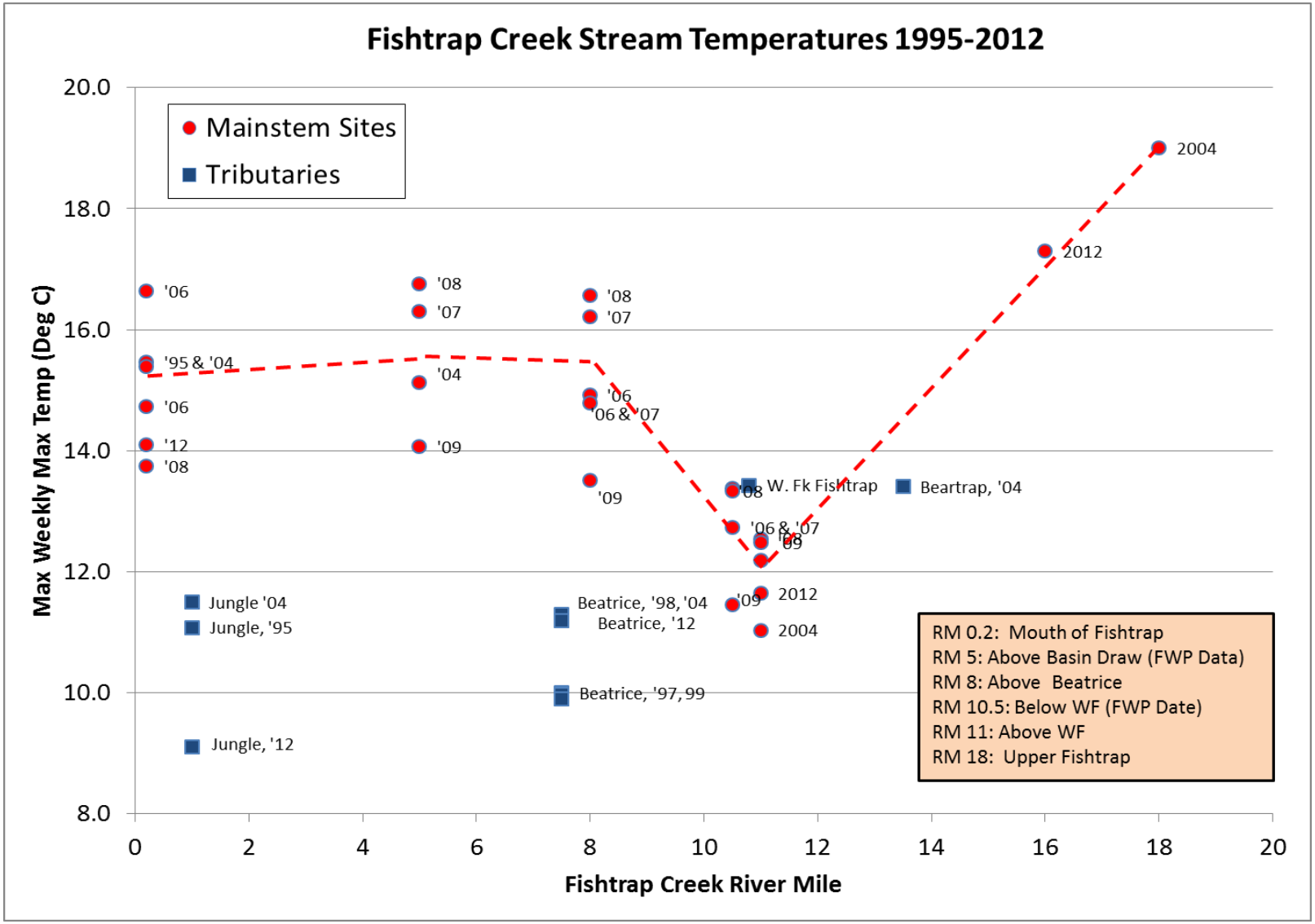
While there are some smaller tributaries and headwater areas within the watershed that are either too steep or too small to be suitable bull trout habitat, most of the 60,000 acre

watershed is suitable bull trout habitat in terms of summer water temperature, stream slope, and stream width (Figure 7-1).

Table 7-5: Mean MWMT in mainstem Fishtrap Creek. Information developed from data collected by Plum Creek (1994 to 2011).

Monitoring Location	RM	Years of Record	Mean MWMT °C
Fishtrap Creek at mouth	0.2	5	15.2
Fishtrap Creek above Basin Draw	5	4	15.6
Fishtrap Creek above Beatrice	8	5	15.2
Fishtrap Creek below West Fork Fishtrap Creek	10.5	5	12.7
Fishtrap Creek above West Fork Fishtrap Creek	11	5	11.9

Figure 7-4: Summer stream temperature data collected between 1995 and 2012 in the Fishtrap Creek watershed. (*Source:* USFS, unpublished data; MFWP unpublished data; PPL Montana unpublished data; Plum Creek, unpublished data)



7.4 Little Thompson River

PPL Montana deployed seven temperature monitors in the Little Thompson River drainage in 2012 (Table 7-6). This drainage was targeted for temperature monitoring because it is a relatively large watershed with relatively little available water temperature data.

Table 7-6: Temperature monitoring in Little Thompson River drainage, 2012.

Location	Latitude	Longitude	Date Start	Date End	MWMT ^{o}C
Little Thompson River at mouth	N.47.72918	W.115.02811	7/2/2012	9/19/2012	20.8
North Fork Little Thompson River	N.47.68618	W.114.94092	7/2/2012	9/18/2012	15.7
Little Rock Creek at mouth	N.47.71753	W.115.00907	7/2/2012	9/18/2012	18.5
Mudd Creek at mouth	N.47.67851	W.114.98856	7/2/2012	9/18/2012	14.8
Little Thompson River After Snider Creek Before Cabin Creek	N.47.68353	W.114.82702	7/2/2012	9/18/2012	20.7
Nancy Creek at mouth	N.47.70826	W.114.76998	7/2/2012	9/18/2012	19.6
Little Thompson River after North Fork Little Thompson River before Snider Creek	N.47.68106	W.114.91926	7/2/2012	9/18/2012	17.1

All sites monitored had an MWMT in excess of 15 ^{o}C except for Mudd Creek. The North Fork Little Thompson River had an MWMT of 15.7 ^{o}C, which is marginal for bull trout.

In 2008, MFWP recorded single readings of water temperature in the North Fork of Little Thompson River, Alder Creek, McGinnis Creek, and Tepee Creek, all below 15 ^{o}C. However, these were single readings, and not an estimate of the MWMT.

Summer water temperature in the mainstem Little Thompson River is in the unsuitable range for bull trout, but there may be some tributary areas of the Little Thompson River that are cold enough to support bull trout rearing.

7.5 Tributaries Upstream of the Little Thompson River

7.5.1 Bear Creek

No bull trout have been found in Bear Creek. Summer water temperature was monitored by Plum Creek in 2009, and the MWMT was found to be 15 ^{o}C. Much of Bear Creek has a slope in excess of 15 percent. No fish were found in Bear Creek upstream of the mouth of the stream, as noted in a 2008 BA prepared by the Smith et al. (2008). There is a large cascade canyon reach upstream of the mouth (about ½ mile upstream of the confluence) and sampling of three to four sections upstream of that found no fish (J. Mickelson, USFS, personal communication, December 2012).

A large forest fire burned nearly 100,000 acres in the Bear Creek, Chippy Creek, Big Rock Creek watersheds, as well as other watersheds in the Little Bitterroot River drainage in 2007. Fish habitat in these watersheds is currently affected in the burned areas.

7.5.2 Chippy Creek

PPL Montana water temperature monitoring found the MWMT in Chippy Creek in 2012 was 16.6 ^{o}C. Plum Creek has found MWMT in Chippy Creek to range from 13.5 to 17 ^{o}C, and the USFS found an MWMT of 14.8 ^{o}C in 2004 in Chippy Creek (Copenhaver, et al., 2005). Overall, the summer water temperature in Chippy Creek is marginal, with cooler years being suitable for bull trout, but in warm years the MWMT is in excess of 15 ^{o}C (Figure 7-2). Plum Creek found juvenile bull trout in Chippy Creek in 1995 (B. Sugden, Plum Creek, personal communication, December 2012).

7.5.3 Semem Creek

PPL Montana water temperature monitoring found the MWMT in Semem Creek in 2012 was 16.5 ^{o}C. No other habitat data have been collected in Semem Creek. Plum Creek collected fish data in this stream, but did not detect bull trout presence (B. Sugden, Plum Creek, personal communication, December 2012). Given the stream's location in the watershed, the thermal regime, and the size of the drainage, this stream has a low probability of supporting migratory bull trout.

7.5.4 Meadow Creek

PPL Montana water temperature monitoring found the MWMT in Meadow Creek in 2012 was 16.7 ^{o}C. No habitat data are available for Meadow Creek. Plum Creek sampled fish in Meadow Creek and found cutthroat trout, but no bull trout (B. Sugden, Plum Creek, personal communication, December 2012).

7.5.5 Big Rock Creek

PPL Montana water temperature monitoring found the MWMT in 2012 in Big Rock Creek was 15.5 ^{o}C at the mouth and 14.1 ^{o}C upstream of Boulder Gulch. In 2004 the USFS found an MWMT at the mouth of Big Rock Creek of 15.3 ^{o}C (Copenhaver, et. al., 2005). Plum Creek has found MWMT in Big Rock Creek to range from 13.2 to 16 ^{o}C. The MFWP made single day temperature readings in late August 2010, and found water temperatures consistently less than 15 ^{o}C in all areas of Big Rock Creek tested, upstream of the mouth.

While some of the tributaries to Big Rock Creek are too steep or small to support bull trout, the stream as a whole appears to have generally suitable conditions to support bull trout.

As described in Section 5, bull trout are present in Big Rock Creek. It is not known if these fish are strictly resident, or if there is migratory bull trout use of the watershed. The Big Rock Creek bull trout population is the most upstream bull trout population known to occur in the

Thompson River drainage. (A single bull trout was found in Murr Creek, but that stream is not known to have a bull trout population.)

7.5.6 Lazier Creek and Adjacent Watersheds

PPL Montana monitored water temperature in the Lazier Creek drainage in two locations in 2012, including Whitney Creek above Lazier Creek, and Lazier Creek at the mouth. PPL Montana also monitored the adjacent drainages, Indian Creek and Twin Lakes Creek. Only Whitney Creek above Lazier Creek had an MWMT slightly above 15 ^{o}C, the other sites were colder than 15 ^{o}C (Table 7-7).

Table 7-7: Temperature monitoring in Lazier Creek, Indian Creek and Twin Lakes Creek drainages, 2012.

Location	Latitude	Longitude	Date Start	Date End	MWMT ^{o}C
Lazier Creek at mouth	N.47.91040	W.115.05257	7/6/2012	9/18/2012	10.4
Whitney Creek above Lazier Creek	N.47.91485	W.115.08924	7/6/2012	9/18/2012	15.2
Indian Creek at mouth	N.47.91122	W.115.05181	7/6/2012	9/18/2012	9.9
Twin Lakes Creek at mouth	N.47.91238	W.115.04996	7/6/2012	9/18/2012	9.3

These results are consistent with findings of Plum Creek, who monitored Lazier Creek and Indian Creek and found that MWMT was less than 10 ^{o}C (Figure 7-2).

Although these watersheds are generally suitable for bull trout with respect to summer water temperature, slope, and stream size, they are not known to contain bull trout.

7.5.7 Murr Creek

PPL Montana monitored water temperature in the Murr Creek drainage in two locations in 2012, at the mouth and midway up the drainage. The site at the mouth had an MWMT just slightly in excess of 15 ^{o}C, the site further upstream was colder than 15 ^{o}C (Table 7-8).

Table 7-8: Temperature monitoring in Murr Creek drainage, 2012.

Location	Latitude	Longitude	Date Start	Date End	MWMT ^{o}C
Murr Creek at mouth	N.47.94028	W.114.97455	7/3/2012	9/17/2012	15.7
Murr Creek at middle	N.47.94230	W.114.92738	7/5/2012	9/17/2012	12.5

Water temperature monitoring done by Plum Creek in 1995 and 1999 found an MWMT less than 15 ^{o}C (Figure 7-2). Overall, the Murr Creek drainage appears to have water temperatures cold enough to support bull trout.

The drainage is, generally, of sufficient size and gradient to support bull trout (Figure 7-1). However there is a fish passage barrier reported to be present in Section 9 and Section 11

(Plum Creek, 1998b). Although a single bull trout was reported in Murr Creek in 1998, there is no known bull trout subpopulation present in Murr Creek (Plum Creek, 1998b).

7.5.8 Watersheds Upstream of Murr Creek

PPL Montana water temperature monitoring found the MWMT in McGregor Creek in 2012 was 15.8 ^{o}C. In 1995 Plum Creek monitored water temperature in McGregor Creek and found an MWMT less than 15 ^{o}C (Figure 7-2). Overall, summer water temperature in McGregor Creek appears to be in the suitable to marginal range.

The only other watershed with water temperature data in the headwaters of the Thompson River is Boiling Springs Creek, which has an MWMT generally in excess of 17.5 ^{o}C.

No bull trout have been detected in the headwaters area of the Thompson River drainage.

8.0 Discussion

The goal of this Project is to develop projects to restore migratory bull trout in the Thompson River drainage. The water temperature pattern in the mainstem Thompson River may be a major barrier to migratory bull trout.

It is clear from the bull trout radio telemetry data that migratory bull trout use the mainstem Thompson River as a migratory corridor to access the West Fork of the Thompson River and Fishtrap Creek. These two watersheds have been confirmed to be spawning areas for migratory bull trout. Bull trout do not appear to use the mainstem Thompson River as a spawning tributary, and it is unlikely that the mainstem is used as juvenile rearing habitat, although juvenile use of the Thompson River is not well understood at this time. However, adult bull trout may use the mainstem as winter habitat.

There is little evidence that bull trout migrate further upstream in the mainstem Thompson River than Fishtrap Creek. As described in Section 6.1.2, the available radio telemetry data are limited; however, the bull trout tracked in the watershed to date have generally stayed downstream of the confluence with Fishtrap Creek.

Although none of the mainstem Thompson River is in the optimal range for summer water temperature, the portion of the mainstem downstream of Fishtrap Creek is cooler than areas upstream of Fishtrap Creek. Water temperature may be a barrier to the migration of bull trout into tributary areas upstream of Fishtrap Creek.

Warm water temperature in the Thompson River is, to a large extent, of natural causes. Water flowing out of Little Thompson Lake at the headwaters of the drainage is in excess of the thermal range for bull trout. Therefore, any plan to enhance migratory populations of bull trout must take into consideration the summer thermal barrier posed by the mainstem Thompson River upstream of Fishtrap Creek.

Other researchers have made observations about the limiting factors for bull trout in the Thompson River drainage, and made recommendations about potential restoration and enhancement projects. A review was completed of available documents/literature to identify potential bull trout habitat enhancement/restoration measures and projects within the Thompson River watershed. The following sections describe the habitat enhancement measures and projects by drainage within the watershed, and Table 8-1 provides a summary of the results.

Table 8-1: Summary of documented limiting factors and potential projects in the Thompson River drainage to enhance bull trout habitat.

Subwatershed	Stream Name	Bull Trout Present	Limiting Factors/Comments	Potential Projects to Enhance Bull Trout Habitat	Source (Author, Year)
Thompson River		Y	Channel confinement due to roads paralleling river; elevated stream temperatures; and lack of large woody debris (LWD); non-native fish species	Road removal; LWD placement efforts	USFS, 2012
Goat Creek			High Gradient Stream. Plum Creek found Goat Creek to be fishless		USFS, 2012; B. Sugden, Plum Creek, personal communication Dec. 2012
West Fork Thompson River	West Fork Thompson River	Y	Sediment; barriers; temperature; and lack of LWD	LWD placement efforts, riparian planting; road reduction in tributaries	USFS, 2012
	Honeymoon Creek				
	Big Spruce Creek	Y	Culvert barrier	Replace barrier	USFS, 2012
	Four Lakes Creek	Y	Culvert barrier	Replace barrier	USFS, 2012
	Anne Creek	Y	Sediment due to road	Remove road	USFS, 2012
Bay State Creek					
Big Hole Creek			Steep cascade in lower mile of stream may prevent upstream movement		B. Sugden, Plum Creek, personal communication, December 2012.
Barktable Creek					
Calico Creek			Stream disappears before reaching the Thompson River	Stream is fishless	B. Sugden, Plum Creek, personal communication, December 2012.
Deerhorn Creek		Y	USFS replaced a fish passage barrier in the lower end of the drainage. Plum Creek detected bull trout in surveys in the 1990's, but no juvenile bull trout.		Watson and Hillman, 1997; B. Sugden, Plum Creek, personal communication, December 2012.
Fishtrap Creek	Fishtrap Creek	Y	Instream habitat; temperature, lack of LWD; non-native fish species; and sediment	LWD placement efforts, riparian planting; road reduction in	Horn, 2011; Land & Water, 2000;

Subwatershed	Stream Name	Bull Trout Present	Limiting Factors/Comments	Potential Projects to Enhance Bull Trout Habitat	Source (Author, Year)
				tributaries	USFS, 2012
	Jungle Creek	Y	Sediment	Road reduction	USFS, 2012
	Cliff Creek				
	Beatrice Creek	Y	Road sediment; natural barrier	Road reduction	Land & Water, 2005; USFS, 2012
	Young Creek				
	Daily Creek				
	Basin Draw	N	Plum Creek records indicate bull trout not present in this stream		B. Sugden, Plum Creek, personal communication, December 2012.
	West Fork Fishtrap Creek	Y	Temperature, Fish barrier (culvert); and sediment	Road decommissioning; LWD placement efforts	Land & Water, 2005; USFS, 2012
	Stony Lake Creek				
	Slide Creek				
	Whiteface Creek				
	Little Creek				
	Beartrap Creek	Y	Fish barrier (culvert); instream fine sediment; and temperature	Remove barrier; riparian planting; LWD placement; road decommissioning	Land & Water, 2005; USFS, 2012
	Radio Creek				
	Cool Creek		Too Small		
	Mantrap Fork				
Little Thompson River	Little Thompson River	Y	Temperature; sediment; barriers; private land (grazing); non-native fish species	Reduce non-native fish species populations in drainage; road reduction; work with landowners to reduce grazing impacts on private land; LWD placement	USFS, 2012
	Marten Creek		Westslope cutthroat trout (pure strain) found in Marten Creek, but no bull trout		
	Little Rock Creek				

Subwatershed	Stream Name	Bull Trout Present	Limiting Factors/Comments	Potential Projects to Enhance Bull Trout Habitat	Source (Author, Year)
	North Fork Little Thompson River				
	Snider Creek				
	Cabin Creek				
	Tepee Creek				
	Alder Creek		Instream habitat	LWD placement	USFS, 1991; USFS, 2008
	Nancy Creek				
	McGinnis Creek				
	Corona Creek				
	Mudd Creek				
Bear Creek				Reported to be fishless upstream of the mouth	Smith et al., 2008.
Chippy Creek		Y	Juvenile bull trout detected in this stream in the 1990's		Plum Creek, 1997
Semem Creek					
Meadow Creek				Cutthroat only in this stream	B. Sugden, personal communication, Plum Creek, December 2012
	Big Rock Creek	Y	Spawning habitat due to poorly sorted gravels with substrate tending towards small cobble; temperature; sediment; and pools	Road reduction; suppress non-native fish species; LWD placement efforts	USFS, 1996; USFS, 2012
Lazier Creek	Lazier Creek				
	Whitney Creek		Upper Whitney Creek is fishless		B. Sugden, personal communication, Plum Creek, December 2012
Indian Creek	Indian Creek				
	Twin Lakes Creek				
Shroder Creek		Y	Plum Creek detected bull trout, but have not recently verified this species presence in this		Plum Creek, 1997; B. Sugden,

Subwatershed	Stream Name	Bull Trout Present	Limiting Factors/Comments	Potential Projects to Enhance Bull Trout Habitat	Source (Author, Year)
			stream		personal communication, Plum Creek, December 2012
Murr Creek	Murr Creek		Natural Barrier in lower section of Murr Creek. A single bull trout found in this stream near the mouth, but the stream is not anticipated to be a bull trout stream.		Plum Creek, 1998b
	North Fork Murr Creek		Natural Barrier Prevents Upstream Passage		Plum Creek, 1998b
McGregor Creek					
Boiling Springs Creek			Stream temperatures too warm		

8.1 West Fork Thompson River

The West Fork Thompson River is one of the most important bull trout subwatersheds in the Thompson River drainage, and it is documented to support the migratory life history form. Any projects which can enhance bull trout habitat in this watershed have a high probability of benefitting the migratory life history form.

Limiting factors for bull trout habitat that were identified within the West Fork Thompson River include (USFS, 2012):

- Sediment levels due to the main riparian road and extensive road system in the upper drainage
- Fish barriers on Honeymoon Creek and Four Lakes Creek
- Lack of large woody debris (LWD) creating pool habitats
- Barriers in tributaries (Big Spruce Creek, Four Lakes Creek)
- Sediment levels in tributaries (Anne Creek) due to roads

Although the USFS 2012 report also identifies elevated water temperatures as a limiting factor for bull trout in the West Fork Thompson River, the analysis presented here does not support that conclusion.

The habitat enhancement/restoration measures that were identified to increase the quality of bull trout habitat within the West Fork Thompson River included (USFS, 2012):

- LWD placement efforts
- Riparian plantings (trees and shrubs)
- Road reduction and/or decommissioning in Anne Creek
- Fish barrier removal/culvert replacement projects in Big Spruce Creek and Four Lakes Creek

The most important projects that were identified to improve bull trout habitat in the West Fork Thompson River watershed included (USFS, 2012):

- Implement extensive travel planning and road reduction in the Four Lakes Creek, Anne Creek and upper headwaters of the West Fork Thompson River (especially in riparian areas) to reduce sediment and improve temperatures
- Assess the main West Fork Thompson River Road (which parallels the West Fork Thompson River for approximately 6 miles) and the feasibility to obliterate the road to reduce sediment and improve temperatures
- Replace culvert barriers on Honeymoon Creek, Big Spruce Creek, and Four Lakes Creek
- Assess the potential to construct large woody debris jams to create quality pools in the mainstem of West Fork Thompson River

8.2 Fishtrap Creek

The Fishtrap Creek drainage is the largest sub-watershed in the Thompson River drainage, and may be the most important bull trout habitat in the Thompson River drainage. It has documented spawning and rearing use by migratory bull trout. Any projects to restore or enhance bull trout habitat in this watershed have a high probability of benefitting the migratory life history form.

Land and Water Consulting (2005) completed an analysis of limiting factors influencing native fish populations in Fishtrap Creek. The document includes a summary of the factors that could potentially limit fish in the watershed. The analysis was focused on specific environmental factors that may influence fish life history requirements (e.g., migration, juvenile rearing, overwintering, propagation, etc.). They cited limiting factors to native fisheries (not specific to only bull trout) in the watershed as culvert barriers, stream temperatures, low amounts of LWD in lower Fishtrap Creek, and mass wasting in lower Fishtrap Creek (Land and Water, 2005). Other factors such as angling pressure and dewatering of lower Fishtrap Creek were also identified as potential limiting factors, but data were insufficient. Mass wasting and dewatering issues in the lower Fishtrap Creek appear to be natural conditions of the watershed. Culverts, limited LWD in the stream, and angler pressure are directly related to land use practices and resource management.

Land and Water (2005) suggested that afternoon shade averaged only about 30 percent in lower Fishtrap Creek. The low shade levels are attributed to active channel migration and a wide stream. Riparian harvesting and streamside roads have generally affected the east/north side of Fishtrap Creek, which would have a negligible effect on afternoon shade levels (Schult and McGreer, 2004). Shade levels can be controlled in the future with maintenance of effective stream buffers (Land and Water, 2005).

USFS (2005) identified seven culverts in the upper Fishtrap Creek watershed as probable fish passage barriers. These include individual crossings of Stony Lake Creek, Cool Creek, Beartrap Creek, West Fork Beartrap Creek, Radio Creek, West Fork Fishtrap Creek, and Mantrap Fork. Since 2004, four of the seven culverts have been removed. Stony Lake Creek log culvert collapsed and was replaced with a larger culvert around 2006/07. This new culvert meets the minimum Q100 (100-year flood flow) fish passage requirements. The Stony Lake Creek project was a quick fix and USFS would like to install a larger culvert, but since fish passage is not impeded, the project is a low priority. In 2010, three culverts were replaced to accommodate fish passage. These fish passage projects included 1) the installation of a large pipe arch culvert in Radio Creek; 2) installation of a bridge at West Fork Fishtrap Creek; and 3) installation of a large pipe arch culvert in Mantrap Fork. Currently fish passage barriers identified in Cool Creek, Beartrap Creek, and West Fork Beartrap Creek remain. The Beartrap and West Fork Beartrap culverts were proposed for removal under the Fishtrap Environmental Impact Study. These projects have not been completed, as of this report, and USFS anticipates these culverts will likely be removed in

2 to 3 years when the road system in the Beartrap drainage is decommissioned (J. Mickelson, USFS, personal communication, June 2012).

The following text was taken from Land and Water (2005) and summarizing the limiting factors, as identified in the Fishtrap Creek watershed, in more detail.

Woody Debris in lower Fishtrap Creek

Lower Fishtrap Creek contains very little LWD. This likely contributes to the low frequency and quality of pools observed in some channel types in lower Fishtrap Creek, and likely impacts juvenile rearing and overwintering habitat. In 1933, prior to any timber harvest or road construction in the watershed, 50% of the lower 6.7 miles had a "high" LWD recruitment potential. Today, as a result of channel migration, timber harvest, and streamside road construction, about 34% of the riparian length is considered to have a "high" LWD recruitment potential (Schult and McGreer 2004). This decline in LWD recruitment potential may have contributed to the currently low instream LWD loads. Another factor might be large floods that occurred in 1996 and 1997, which might have exported a significant amount of instream wood.

LWD levels in streams may naturally recover over time if adequate riparian management practices are implemented. Active placement of wood in some reaches of lower Fishtrap Creek may also be feasible.

Mass Wasting of lower Fishtrap Creek Terrace

Erosion of the high terrace bordering lower Fishtrap Creek generates a very large amount of coarse and fine sediment that is delivered to the stream. The coarse sediment fraction is not efficiently transported by the stream, so channel aggredation is occurring, leading to stream braiding and high width-to-depth ratios in some reaches. This is also likely contributing factor to the low pool frequency observed. Locations of current terrace erosion are visible on 1933 aerial photographs which pre-date watershed development (Schult and McGreer 2004). Erosion of the high glacial terrace bordering lower Fishtrap Creek generates a very large amount of coarse and fine sediment that is delivered to the stream. The coarse sediment fraction is not efficiently transported by the stream, so channel aggradation is occurring, leading to stream braiding and high width-to-depth ratios in some reaches.

Dewatering of Mainstem Fishtrap Creek

During low flow periods in drought years, portions of lower Fishtrap Creek go dry. Depending on the exact timing of dewatering, bull trout may not be able to move upstream to access spawning areas. This is considered a natural condition associated with coarse substrate and low flows during

drought years. The floods of 1996 and 1997 may have increased the occurrence of this limiting factor with increased coarse sediment deposition. While this is suspected to be a significant limiting factor in some years, the spatial and temporal extent of the dewatering and overall importance of this to native fish populations is unknown.

Angling Pressure
While the data are not conclusive, angler pressure appears to have increased significantly in recent years. Resident angler fishing days for Fishtrap Creek were 66 in 1995, 194 in 1997, and 754 in 1999. Should this increasing trend continue, harvest may become a limiting factor.

Although Land and Water (2005) mentioned angler harvest as a possible limiting factor, it should be noted that it is illegal to fish for bull trout in the Thompson River watershed. Therefore, any angler harvest of bull trout in Fishtrap Creek is illegal.

Other limiting factors for bull trout habitat that were identified within Fishtrap Creek include (USFS, 2012; Horn, 2011; Land and Water, 2005):

- Sediment levels due to the main riparian road and extensive road system in the upper drainage (Beatrice Creek)
- Lack of LWD creating pool habitat
- Non-native fish species
- Fish barriers in tributaries (Beatrice Creek, West Fork Fishtrap Creek, and Beartrap Creek)
- Sediment in tributaries (Beatrice Creek, West Fork Fishtrap Creek, and Beartrap Creek)

Although the USFS 2012 report also identifies elevated water temperatures as a limiting factor for bull trout in Fishtrap Creek, the analysis presented here does not support that conclusion.

The habitat enhancement/restoration measures that were identified to increase the quality of bull trout habitat within Fishtrap Creek included (Land and Water, 2005; USFS, 2012):

- LWD placement efforts in lower Fishtrap Creek, West Fork Fishtrap Creek, and Beartrap Creek
- Riparian plantings (trees and shrubs) in Fishtrap Creek and Beartrap Creek to increase shading in stream
- Road reduction and/or decommissioning in tributaries (Mantrap Creek, Jungle Creek, Beatrice Creek, Beartrap Creek, and West Fork Fishtrap Creek)
- Fish barrier removal/culvert replacement project on Beartrap Creek

The most important projects identified to improve bull trout by USFS (2012) included:

- Implementation of road decommissioning, as proposed under the Fishtrap Pproject, to reduce sediment levels in Mantrap Creek
- Implement extensive travel planning and road reduction in the Daisy Creek and Shale Creek areas along Fishtrap Creek to reduce sedimentation
- Identify areas for large woody debris placement where feasible on Fishtrap Creek to create quality pools and reduce stream temperatures
- Assess feasibility to plant large conifers along mainstem Fishtrap Creek in certain areas to provide additional shading to the stream
- Suppress non-native fish populations in Fishtrap Creek and Thompson River mainstem

8.3 Little Thompson River

As described in Section 5, there does not appear to be a bull trout population currently in the Little Thompson River. In addition, radio telemetry data have not indicated migratory bull trout movements into the Little Thompson River. The mouth of the Little Thompson River appears to be the approximate current upstream limit of adult bull trout migration in the mainstem Thompson River. Therefore, there is a high risk that habitat improvement or enhancement in this watershed will not benefit bull trout.

Summer water temperature appears to be a potential limiting factor for bull trout potential in the Little Thompson River drainage, although some subwatersheds such as Mudd Creek may be cool enough to support bull trout. Even if summer water temperature can be decreased in the Little Thompson River, there is no certainty that bull trout will re-colonize this watershed.

Other potentially limiting factors for bull trout habitat that were identified within Little Thompson River include (USFS, 1991; USFS, 2012):

- Sediment due to roads and grazing
- Lack of pool habitat due to grazing
- Instream habitat in tributaries (Alder Creek)
- Non-native fish populations

The habitat enhancement/restoration measures and projects that were identified to increase the quality of bull trout habitat within the Little Thompson River included (USFS, 2012):

- LWD placement efforts
- Road reduction and/or decommissioning
- Non-native species reduction projects
- Working with landowners to reduce grazing impacts on private land within the drainage

8.4 Big Rock Creek

Big Rock Creek flows into the Thompson River approximately 27 miles above the confluence with the Clark Fork River. It contains the most-upstream bull trout population known in the Thompson River drainage. It is not known if the Big Rock Creek bull trout population contains a migratory component.

The lower portion of Big Rock Creek is paralleled by a county road. Issues with excessive erosion and road impingement at this site have been ongoing for years and finally culminated in a road washout in 2008. After consultation with the MFWP, Sanders County decided that instead of repairing the washout, a portion of the road should be moved out of the floodplain. The road was moved in 2009. In addition, a bridge was installed directly upstream of the problem site, replacing two undersized culverts.

With the road moved and the new bridge installed, the washout area presented an opportunity to improve fish habitat and create stability in the lower portion of the creek. In 2009 the MFWP and the USFS proposed a reclamation project along approximately 100 m of stream at the washout site. The project consisted of three different treatments within the washout site. All treatments focused on stream bank stability and floodplain function. No in-stream hardened structures were built. The project was completed in fall 2010. Effectiveness of project has not yet been evaluated or reported on since the completion of the enhancement efforts.

Other potential limiting factors for bull trout habitat that were identified within Big Rock Creek include (USFS, 1996; USFS, 2012):

- Spawning habitat due to poorly sorted gravels with substrate tending towards small cobble
- Sediment due to the extensive road system in the drainage
- Lack of pool habitat

The USFS reports also identified summer water temperature as a potential limiting factor; however that conclusion is not supported by the results of the data reported here.

Other habitat enhancement/restoration measures and projects that were identified to increase the quality of bull trout habitat within Big Rock Creek included (USFS, 2012):

- LWD placement efforts
- Road reduction and/or decommissioning
- Non-native species reduction projects

If additional habitat improvement or enhancement projects are identified in this watershed, they can benefit the resident population of bull trout, but it is unknown if this population contains a migratory component.

9.0 Recommendations

Migratory bull trout are known to utilize two subwatersheds in the Thompson River drainage, the West Fork Thompson River and Fishtrap Creek. To the extent that there are habitat problems in these two watersheds which can be repaired, or habitat functions that can be enhanced, then those efforts will potentially benefit the migratory life history. For this reason, we recommend that these two watersheds have the top priority for any habitat improvement project.

The mainstem Thompson River downstream of Fishtrap Creek is the migratory corridor for bull trout. There is also evidence to indicate that this river is used for overwintering by migratory bull trout. Habitat improvement projects which would enhance overwintering habitat, and security for adult bull trout at all times of the year, would be an additional top priority.

Big Rock Creek contains bull trout, but the presence of the migratory component is unknown. As a second priority, we recommend additional research be conducted to determine if the Big Rock Creek bull trout population is migratory. If yes, then additional projects to restore and enhance the bull trout habitat in Big Rock Creek could be planned. In addition, it would mean that the mainstem Thompson River is still being used as a migratory corridor upstream of Fishtrap Creek. In that case, the mainstem Thompson River between Fishtrap Creek and Big Rock Creek would also be added to the priority list for habitat improvement and enhancement.

There are other subwatersheds in the Thompson River drainage which may have the potential to support bull trout. These are Mudd Creek, Alder Creek, Murr Creek, Lazier Creek, Twin Lakes Creek, and Indian Creek. Some of these watersheds have very little fish population data available. We recommend that some additional fish surveys be conducted to assess the current status of fish populations in these watersheds, as time and budget allows.

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Appendix A – Results of 2012 Water Temperature Monitoring

Complete results of PPL Montana and MFWP 2012 water temperature monitoring.

Stream	GPS Location		Date Deployed	Date Retrieved	MDM	MWAT	MWMT
Beartrap Creek at Fishtrap Creek	N.47.84534	W.115.17197	7/2/2012	9/19/2012	12.7	11.0	12.5
Beatrice Creek at Fishtrap Creek	N.47.79300	W.115.10578	7/2/2012	9/19/2012	10.3	8.4	9.9
Big Hole Creek at Thompson River	N.47.66357	W.115.11273	7/2/2012	9/19/2012	10.1	9.1	9.9
Big Rock Creek after Boulder Gulch	N.47.86076	W.114.85543	7/5/2012	9/17/2012	15.2	12.0	14.2
Big Rock Creek at Thompson River	N.47.87224	W.114.99779	7/3/2012	9/18/2012	16.1	14.4	15.5
Calico Creek at Thompson River	N.47.69085	W.115.08985	7/2/2012	9/19/2012	8.0	7.6	7.6
Chippy Creek at Thompson River	N.47.78461	W.115.00073	7/3/2012	9/18/2012	17.1	15.2	16.6
Deerhorn Creek at Thompson River	N.47.70539	W.115.09010	7/3/2012	9/19/2012	10.0	8.2	9.7
Four Lakes Creek at West Fork Thompson River	N.47.70798	W.115.20919	7/3/2012	9/19/2012	12.0	10.0	11.4
Indian River at Thompson River	N.47.91122	W.115.05181	7/6/2012	9/18/2012	10.1	7.9	9.9
Jungle Creek at Fishtrap Creek	N.47.73085	W.115.07045	7/3/2012	9/19/2012	10.4	9.1	10.1
Little Thompson River after North Fork Little Thompson River before Snider Creek	N.47.68106	W.114.91926	7/2/2012	9/18/2012	17.8	15.4	17.1
Little Thompson River after Snider Creek Before Cabin Creek	N.47.68353	W.114.82702	7/2/2012	9/18/2012	21.7	17.8	20.7
Lazier Creek at Thompson River	N.47.91040	W.115.05257	7/6/2012	9/18/2012	10.8	9.3	10.4
Little Rock Creek at Little Thompson River	N.47.71753	W.115.00907	7/2/2012	9/18/2012	19.2	16.4	18.5
Little Thompson River at Thompson River	N.47.72918	W.115.02811	7/2/2012	9/19/2012	21.7	17.4	20.8
Mcgregor Creek at Thompson River	N.48.02176	W.114.99042	7/3/2012	9/17/2012	16.5	14.3	15.8
Meadow Creek at Thompson River	N.47.84204	W.115.03573	7/6/2012	9/18/2012	17.6	14.1	16.7
Mudd Creek at Little Thompson River	N.47.67851	W.114.98856	7/2/2012	9/18/2012	15.4	13.2	14.8
Murr at Middle	N.47.94230	W.114.92738	7/5/2012	9/17/2012	12.8	12.0	12.5
Murr at Thompson River	N.47.94028	W.114.97455	7/3/2012	9/17/2012	16.2	13.8	15.7
Nancy Creek at Little Thompson River	N.47.70826	W.114.76998	7/2/2012	9/18/2012	20.7	17.5	19.6
North Fork Little Thompson River	N.47.68618	W.114.94092	7/2/2012	9/18/2012	16.3	13.5	15.7
Semem at Thompson River	N.47.78981	W.115.00553	7/3/2012	9/18/2012	17.2	15.4	16.5
Thompson River above Chippy Creek	N.47.78369	W.115.00819	7/6/2012	9/25/2012	20.0	16.9	19.0
Thompson River above Fishtrap Creek	N.47.71478	W.115.04034	7/6/2012	9/25/2012	20.7	17.4	19.8

Stream	GPS Location		Date Deployed	Date Retrieved	MDM	MWAT	MWMT
Thompson River above West Fork Thompson River	N.47.65531	W.115.16588	7/6/2012	9/25/2012	18.8	15.3	17.7
Thompson River at Gaging Station	N.47.58759	W.115.23302	7/6/2012	9/25/2012	17.7	14.7	16.7
Twin Lakes Creek at Thompson River	N.47.91238	W.115.04996	7/6/2012	9/18/2012	9.7	8.3	9.3
Whitney Creek at Lazier Creek	N.47.91485	W.115.08924	7/6/2012	9/18/2012	16.2	12.5	15.3