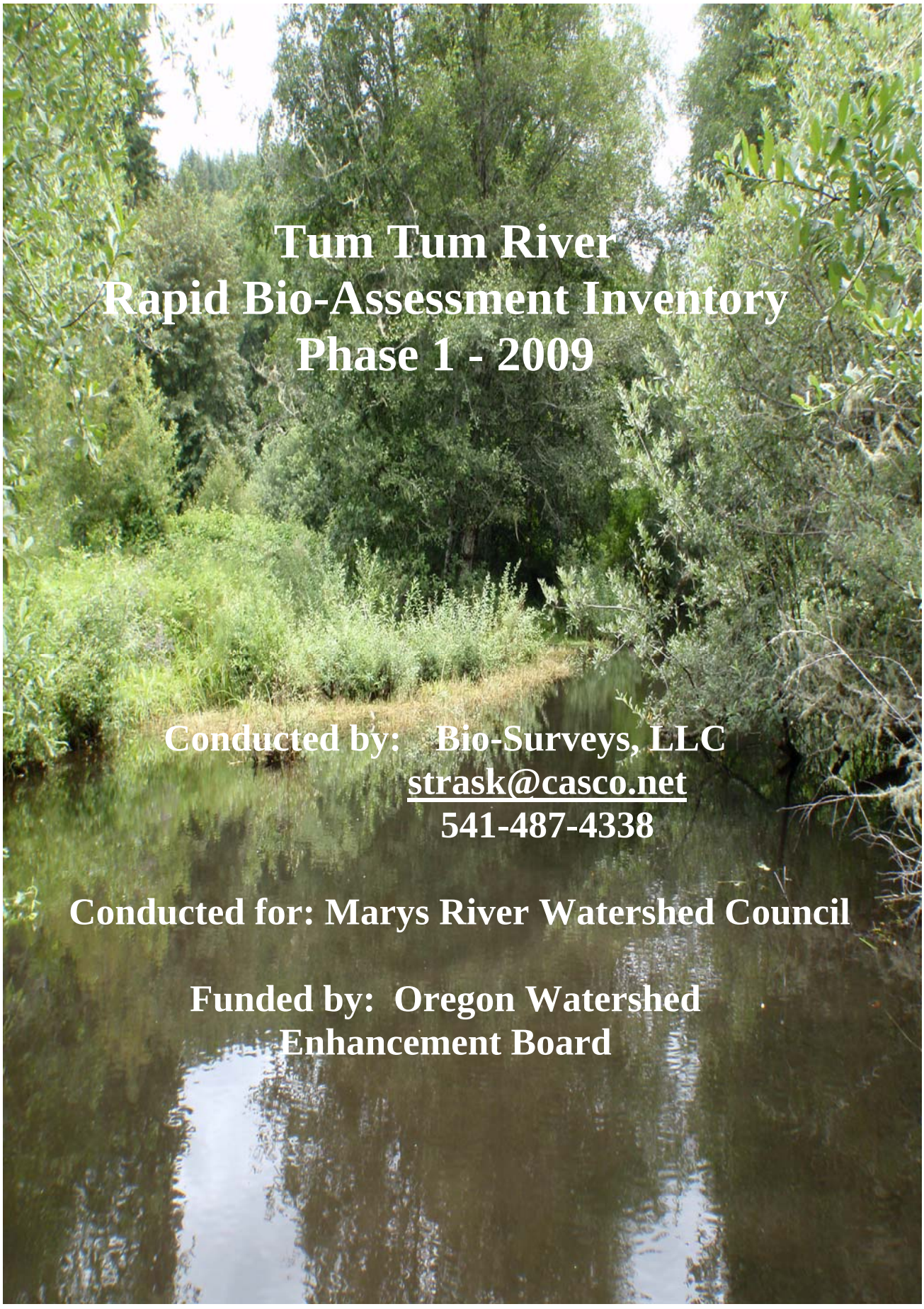

Tum Tum River
Rapid Bio-Assessment Inventory
Phase 1 - 2009

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Conducted for: Marys River Watershed Council

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Introduction

A Rapid Bio-Assessment snorkel inventory was conducted in the Tum Tum River subbasin, a tributary of the mainstem Marys River in the Marys River Basin, between 7-21-09 and 8-01-09. Inadequate funding was available to complete a full sub basin inspection of current fish distribution. Therefore, inventories of a few key reaches were identified that would begin to expand our understanding of how the target species (cutthroat trout) were distributed in relation to known temperature patterns (a potential limitation to summer rearing distribution). The key reaches selected for inventory were mainstem Tum Tum from the proposed project site on the Jensen property at RM 5.6 to an arbitrary end point at RM 7.8. A total of 2.2 miles were ground truthed for channel form, riparian condition and the potential for interactive floodplains as an indicator of potential winter habitat. Snorkel inventories of this mainstem reach were not appropriate due to the lack of suitable visibility. To address the issue of fish abundance within this mainstem reach we teamed up with ODFW district staff for a day of electrofish sampling to determine the presence or absence of cutthroat during summer flow conditions.

In addition, two primary headwater tributaries were snorkel inventoried using the RBA protocol described in the methods section. These tributaries were Shotpouch Cr and Bark Cr. Shotpouch was surveyed from its confluence with the mainstem of Tum Tum Cr to the private industrial forest property boundary at RM 7.2. A significant 4,150 ft section of mainstem Shotpouch was also not inventoried because of a lack of access to private industrial forest ownership. The Shotpouch inventory also included a 0.2 survey of Trib A, a western contributor of significance.

Bark Cr was surveyed from its confluence with the mainstem of Tum Tum Cr to the private industrial forest boundary at RM 2.6 (Access was denied for fish distribution inventories on this property). Cutthroat distribution continued beyond the end point of both of these two surveys and indications are that additional significant capacity exists above the end point in Shotpouch Cr. Diminishing habitat quality in the case of Bark Cr near the survey end point suggests that the primary habitats of concern for inclusion in a basin scale restoration strategy were included.

Several smaller Tum Tum tributaries (Scheele, Lasky, Hymes and 2 headwater forks of mainstem Tum Tum) were not inventoried and will become part of a future request for continued cutthroat abundance and distribution data collection.

The intent of the inventory was to describe the current distribution and relative abundance of multiple age classes of Cutthroat within the selected Tum Tum reaches and

to compare this distribution with channel morphology and current land use. These overlapping layers of physical habitat condition and fish distribution were expected to reveal information about how Cutthroat are currently utilizing the available summer habitats of the Tum Tum Cr subbasin. The development of these relationships has resulted in a list of preliminary recommendations for enhancing or restoring the existing aquatic conditions and the development of a design for the Jensen and Gehling properties that attempts to address the current seasonal habitat limitations identified in the sub basin.

To collaborate with these descriptive layers of current condition, a complete temperature monitoring profile was created by deploying continuous temperature monitoring devices between the dates of June 27 and September 29, 2009. Mainstem Tum Tum and contributing tributaries were targeted for this effort.

Methodology

The Tum Tum River was not identified as a high priority subbasin of interest by an Assessment prepared for the Marys River Watershed Council by the EPA in 2003 (MRWC Action Plan, October 2003). This restoration screening process utilized a Habitat Suitability Index developed for Cutthroat to identify reaches exhibiting restoration potential for the species. Significant data gaps within this assessment led the MRWC to revisit the prioritizations in an effort to understand whether additional ground truthing would reveal a similar conclusion.

The Rapid Bio-Assessment (RBA) snorkel inventory methodology was selected as an appropriate tool for conducting this baseline inventory of the subbasin. The RBA method is designed to conduct a higher resolution inspection of the subbasin to describe actual fish abundance and distribution as well as tie those distributions to the morphological conditions on the ground. The survey was conducted by a single snorkeler to reduce the variability know to exist between surveyors. The survey was conducted in a narrow temporal range (7 days) in an attempt to get a snap shot of the pinch period (low flow) distribution of Cutthroat. Preliminary assumptions were made that the mainstem of Tum Tum Cr would be temperature limited during this low flow time period and that mainstem fish abundance would likely be low. The resultant Cutthroat distributions observed should be considered a snapshot of a very dynamic distribution pattern that has the potential of exhibiting extensive in-season variation driven by changes in flow and temperature. Land owner contacts were made for all of the small private and industrial ownerships prior to conducting the inventory.

The protocol was consistent for both tributary reaches but the lack of visibility in the mainstem Tum Tum demanded an alternate sampling strategy.

For the tributaries (Shotpouch and Bark), the first pool above the mainstem confluence was selected as sample unit number one. Every subsequent 5^{th} pool was inventoried after the initial pool selection to produce a 20% sample of the current distribution and abundance.

Individual survey segments exhibiting adequate visibility were sampled until the survey was terminated by denial of access on private industrial timber ownership.

Pools had to meet the minimum criteria of being at least as long as the average stream width. They also had to exhibit a scour element (this factor eliminates most glide habitats) and a hydraulic control at the downstream end. There were no minimum criteria established for depth. Only main channel pools were sampled. Side channel pools, back

waters and alcoves were not incorporated into the surveyed pool habitats. This suggests that expansions of the data to represent total population size would be inappropriate. In addition, no riffle or rapid habitats were sampled that also support a component of the summer rearing population of cutthroat trout.

The lineal distances represented in the database were estimated by pacing from the beginning of one sampled unit to the beginning of the next sampled unit. Total distances represented in the database are consistently greater than mapped distances using USGS 1:24,000 series maps. This is related to the level of sinuosity within the floodplain that is not incorporated in base map layers. If you are attempting to overlay this database on existing stream layer information there would be a need to justify lineal distances with known tributary junctions (these can be found in the comments column of the Access database).

Pool lengths and widths were generally estimated. Because pool widths vary significantly within a single unit, a visual estimate of the average width was considered adequate.

A cover/complexity rating was attributed to each pool sampled. This rating was an attempt to qualify the habitat complexity within the reach. The 1 - 5 rating is based on the abundance of multiple cover components within a sampled unit (wood, large substrate, undercut bank, overhanging vegetation). Excessive depth was not considered a significant cover component. The following criteria were utilized:

1	0 cover present
2	1-25 % of the pool surface area is associated with cover
3	26-50 % of the pool surface area is associated with cover
4	51-75 % of the pool surface area is associated with cover
5	> 75 % of the pool surface area is associated with cover

A numerical rating was given to each sampled unit for the surveyor's estimate of visibility. The following criteria were utilized:

Visibility	
1	excellent
2	moderate
3	poor

There was also commentary recorded within each of the surveyed reaches that included information on temperature, tributary junctions, the abundance of other species and adjacent land use. This information can be retrieved from the Access database provided as a deliverable of this project.

Mainstem Tum Tum River Results

Distribution and Abundance

Initial assumptions that the mainstem Tum Tum River was temperature limited and therefore would display a low abundance of summer rearing cutthroat appeared to be at least partially appropriate. Electrofish inventories conducted on August 7, 2009 observed cutthroat rearing in the mainstem from RM 1.1 to RM 10.1. Three different sites were electrofish sub sampled (RM 1.1, RM 6.1, RM 10.1). Cutthroat were observed at each sample location. The majority of the cutthroat observed were older age class (2+ and older). Thirteen cutthroat captured and measured exhibited an average length of 153 mm within a range of 101 – 248 mm. The estimated rearing density at all 3 mainstem sites was 0.01 cutthroat/Sqm of pool habitat. For comparison, the average rearing density for the primary headwater tributary Shotpouch Cr was 0.12 cutthroat/Sqm (a value 10 times greater than the average observed in the mainstem). Only one 0+ age individual was documented below the confluence of Scheele Cr.

Despite the low summer rearing densities observed, it was clear that some rearing was occurring in the mainstem for maintenance of at least an older age class component of the population during pinch period flows. This suggests that even minor improvements in mainstem water temperature profiles (duration) could succeed in providing immediate benefit to the mature spawning component of the population.

Migratory patterns

Upstream hoop and box traps were deployed and maintained continuously between June 2 and September 8 at RM 5.6 on the Jensen property. These traps passed a total of 36 cutthroat within the sample period and indicated that a continuous upstream migration pattern was present. All cutthroat captured were caudal clipped and only two marked fish were recaptured during the period of investigation (these individuals were recaptured directly after release and may have dropped back as a result of handling stress). Fish sampling paralleled the collection of continuous temperature data at the site. No peak in migration activity could be observed for the 21 day period when stream temperatures exceeded 64 deg and reached a daily maximum of 73.2 deg on July 29. No direct correlation can be made between upstream migration and increasing temperatures in the mainstem. All of the cutthroat captured at the site were 1+ and older age classes with an average length of 153 mm and a range between 91 – 310 mm. Electrofish sampling conducted below this location on August 7 indicated that low densities of cutthroat continued to summer rear within the mainstem.

The presence of this migration pattern well into the low flow summer months (July and August) would strongly suggest that cutthroat rearing in the mainstem were conducting a temperature dependant upstream migration towards habitats with more suitable summer temperature profiles. This is a clear future monitoring objective that will assist in our understanding of how cutthroat trout are currently utilizing different stream reaches during different seasons. Currently, the hypothesis of a temperature dependant upstream migration is strengthened by the high concentration of cutthroat observed below an impassable beaver dam (5 ft vertical) at RM 5.9 on Shotpouch Cr. (Figure 1).

The stationary trapping at the Jensen property also collected Peamouth, Sandrollers, Red Side Shiners, multiple species of Sculpin and Dace, many Crayfish and a single adult Pacific Lamprey on August 24.

Physical habitat conditions

The Tum Tum River mainstem is characterized by deep channel entrenchment and isolation from its historical floodplain. There is a vast array of contributing factors that have collectively resulted in this condition. Probably most significant and wide spread is the loss of large riparian conifers within one site potential of the active channel. The loss of this key riparian component can be observed in the low wood densities currently functioning as hydraulic controls within the stream channel. The legacy of their existence however is still apparent from the conifer stumps within its floodplain and from buried wood slowly recruiting from lateral channel meander. Channel entrenchment at RM 5.6 (Jensen Property) currently ranges between 10 and 11 ft. In addition, historical agricultural pursuits within the floodplain have filled old channel meanders that used to function as key linkages to off channel floodplain and wetland habitats. Utilization of these historic floodplain terraces by rural residential landowners for livestock, forest plantations and residential infrastructure limits the potential for fully recovering natural process.

The current abundance of summer pool habitat is large (unquantified). However, the quality and quantity of headwater flows arriving to the mainstem is dramatically influenced by upstream land use impacts and water withdrawals from its primary headwater tributary Shotpouch Cr. The cumulative temperature impact on Tum Tum Cr from heavily degraded riparian canopies on agricultural lands within Shotpouch Cr have likely had a negative influence on the abundance and distribution of cutthroat during summer flow regimes in the mainstem.

Without complex wood accumulating in the mainstem, deep pool scour is sporadic. It is these deep lateral pool scours that currently support low densities of older age class cutthroat in the mainstem during low summer flow regimes. Full spanning debris jams become more abundant above RM 7.6 (0.2 miles below transmission line crossing).

The gradient in the mainstem is consistently less than 1 percent resulting in a low abundance of riffle habitat. Brief riffle transitions between pool units are common but insignificant habitat components (surface area). It is these transitional areas (head of pools) however that contained almost all of the observed summer rearing cutthroat.

Spawning and Incubation

The mainstem of Tum Tum was not populated by the 0+ age class during summer flow regimes. This indicates that very limited spawning and incubation is occurring in the surveyed mainstem. In addition, no appropriate sized gravels were observed for cutthroat spawning. The substrates were dominated by silts, organics and sands and in some cases scoured bedrock. This suggests that tributary and upper mainstem reaches are likely providing the bulk of this essential seasonal habitat.

Temperature

Temperatures were collected at 3 locations on the mainstem Tum Tum River during the summer of 2009. Continuous monitoring occurred at these sites between 6-21-09 and 9-29-09. The sites included the Lower Tum Tum at the railroad bridge crossing near RM 0, the Middle Tum Tum on the Jensen Property at RM 5.6 and the Upper Tum Tum just above the confluence of Shotpouch Cr at RM 10.6. The results of the Middle Tum Tum site are displayed in figure 5. In summary, the middle Tum Tum peaked at 73.2 deg on July 29 and reached daily maximum temperatures greater than 64 deg for 21 continuous days between July 16 and August 5. Interestingly, the lower Tum Tum site at RM 1.0 mirrored this response with a 73.2 deg peak and an identical 21 day continuous exceedance of the 64 deg DEQ benchmark for water quality. This comparison is different than the values documented for these same two sites in the 1998 report "Temperature Monitoring and Modeling of the Marys River Watershed". In this study there was a 3 deg temperature differential in the 7 day running average of maximum values. With a cooling trend observed downstream. The current data does not support the presence of this cooling trend.

The upper Tum Tum site at RM 10.6 peaked at 67.7 deg and maintained a continuous daily maximum greater than 64 deg for only 6 days. This suggests that the majority of the cumulative impacts to water temperature on the mainstem Tum Tum are not originating from the Tum Tum and its tributaries above the confluence of Shotpouch Creek.

Tributary Results

Shotpouch Creek

Distribution and Abundance

Snorkel inventories were conducted from RM 0 at the confluence with the mainstem Tum Tum to the private industrial forest property line at RM 7.2. Cutthroat distribution continued above the survey end point and rearing densities remained robust at the terminal extend of the inventory. This suggests that additional production capacity exists above the end point of the survey.

The abundance of cutthroat, as measured by pool density (fish/Sqm) was utilized as a metric for assessing the current utilization of available pool habitats. The observed peak density of 0.7 cutthroat / Sqm of pool surface area gleaned from multiple Oregon coastal basins were used to establish the potential range of abundance that represents a stable and productive deme (population segment). Adequate research has not been conducted to determine how this level of abundance relates to full seeding or the carrying capacity of the habitat.

For the 7.2 mile lineal distribution of cutthroat in Shotpouch Cr the average rearing density was 0.12 fish/Sqm. The range extended from 0 – 0.76 fish/ Sqm. This average density will be a valuable metric for comparing future survey results associated with restoration effectiveness monitoring.

The abundance of cutthroat improves dramatically above RM 3.4 where the historical pasture reach terminates near the confluence of Trib A. The average pool rearing density below the confluence of Trib A (reaches 1 and 2) was 0.04 cutthroat / Sqm, the average pool density above the confluence of Trib A (reach 3) was 0.19 cutthroat /Sqm. Two inter-related issues are present here that together are the likely drivers of this observed differential in rearing density. These are the lack of a significant riparian canopy in the pasture reach (reach 2) and the resultant solar exposure of aquatic habitats that elevates stream temperatures. Elevated summer stream temperatures are likely eliciting a migratory response from cutthroat rearing in the reach.

Migratory patterns

The highest recorded pool density (0.76 fish/Sqm) was documented in the pool below a 5ft vertical beaver dam that was functioning as a low flow summer barrier (passable during winter flow regimes). This abnormal concentration of fish (figure 1) indicates the likely presence of an upstream summer migration pattern. In addition, a single Oncorhynchus mykiss 1+ juvenile was observed below this barrier.

There is also a large culvert (70' x 8') at the Shotpouch Trail road crossing (RM 5.7) that currently exhibits a 6" perch at low summer flow regimes. The combination of perch height and velocity definitively terminates the upstream migration of adult brook lamprey (many adults observed stacked up below the pipe in spring 2009) and adult Pacific Lamprey (one adult carcass observed downstream of this crossing in summer 2009). The crossing is currently not a definitive barrier to upstream migrant cutthroat (resident or fluvial). However, an increasing abundance pattern can be observed from figure 1 as the culvert is approached during the snorkel inventory indicating the possibility that the perched crossing may be influencing (delaying) the upstream temperature dependant migrations of cutthroat also.

Physical habitat conditions

The current land use in Shotpouch is key to understanding how cutthroat may be responding to habitat conditions. To simplify, Shotpouch could be visualized as exhibiting three fairly distinct reaches defined by variations in land use.

1) The first reach from the Tum Tum confluence to the first bridge crossing at RM 1.2 can be classified as recovering from early agricultural use. There is a historical legacy of beaver here but no significant current use. There is an intact riparian that consists of a low stocking density of older age class alder and a dense inner riparian canopy of almost exclusively Pacific Nine bark. The upper half of this reach is completely enshrouded by a dense over story of this species. Reed Canary Grass and Willow are present in much lower densities (having been out competed by the nine bark). Pools are simple, shallow, wood densities are low and riffle habitats are nearly non existent except as hydraulic transitions between large slow pools. Spawning gravels are nearly non existent.

2) The second reach from RM 1.2 to RM 3.4 (confluence of Trib A) currently exhibits the impacts of livestock grazing and a very extensive contiguous history of this use. The

riparian canopy is sparse and composed of a few senescing alder and tenacious willow clusters emanating from within the active channel. The current condition results in extensive solar exposure during summer flow regimes which probably has a negative impact on water quality locally and results in cumulative temperatures impacts downstream. The channel exhibits a high level of sinuosity here with accelerated channel meander underway because of the lack of root mat complexity within the inner riparian belt. This active meander pattern has resulted in the recruitment of a significant gravel resource stored in historical floodplain terraces. Large deposition plains of migratory substrates are abundant within this reach and an indicator that the combination of optimum gradient and high sinuosity are providing for gravel storage and sorting (these are excellent indicators of an effective location for LWD placements for the provision of winter habitat and summer cover). Many excellent opportunities exist within this reach for developing a highly interactive floodplain during winter flow regimes that would provide high quality, low velocity off channel winter habitats. An increase in riffle habitats within the reach (driven by an increase in gradient from reach 1) also provides substantial habitat diversity that favors the production of macroinvertebrates.

3) The third reach from RM 3.4 to RM 7.2 can be described as exhibiting a more functional riparian canopy. This is likely the result of a major morphological shift above the confluence of Trib A that transitions the stream channel from the broad interactive floodplain observed in the first 3.4 miles to a much narrower valley form exhibiting alternating hillslope confinement. This major underlying morphological feature suggests that historical land use probably also shifted away from agricultural (livestock) use which has resulted in a higher level of riparian function. Wood densities increase within this reach because of the close proximity of hillslope sources of large wood (wood densities remain sub optimum and the conifer component is limited). Localized broad low terraces colonized by beaver are storing large quantities of cool ground water that are currently mitigating for the elevated stream temperatures observed downstream in reach 2. There are currently 8 functioning beaver ponds within this reach. One of these ponds contained 234 older age class cutthroat and represented 7% of the total pool rearing component of the Shotpouch population. In addition, the wetland complexes that surround these active beaver flats provide extensive ecosystem services and enhance the species diversity of a forest dominated community.

Spawning and Incubation

0+ age trout were first observed at RM 2.2 (this is a point 1 mile into reach 2, the pasture reach). Observations continued to the end point of the survey at RM 7.2. In general, their densities continued to increase after the confluence of Trib A in a steady climb toward the end point of the survey. Indications are that no cutthroat spawning is occurring in reach 1 and that only limited spawning may be occurring in reach 2 (probably driven by the juxtaposition of an unnamed eastern Tributary at approximately RM 1.5 and Trib A at RM 3.4, both significant spawning destinations). Unobstructed passage to headwater tributaries would likely be critical for complete utilization of the subbasins seasonal spawning and incubation habitats.

Temperature

Continuous temperature data was collected between 6/21/09 and 9/29/09. The data logger was located just above the confluence with the mainstem of the Tum Tum River. The results of the Shotpouch Cr site are displayed in figure 6. In summary, Shotpouch Cr peaked at 72.4 deg on July 29 and reached daily maximum temperatures greater than 64 deg for 19 of the 21 days between July 16 and August 5.

The stark similarities in duration of exceedance and general temperature profiles between the values observed for Shotpouch Cr and the Middle Tum Tum Sites (figures 5 and 6) indicate that Shotpouch Cr has a strong influence on the conditions observed on the lower 10.6 miles of the mainstem Tum Tum River.

Fortunately there were two temperature logger sites in Shotpouch Cr in the Temperature study conducted by the Marys River Watershed Council in 1998 and 1999 (Temperature Monitoring and Modeling of the Marys River Watershed, 1999). The lower site was at RM 1.2 at the beginning of the pasture reach, the upper site was at RM 5.7 at the Shotpouch Trail culvert crossing. This survey documented a value of 68.1 deg for the greatest 7 day average at the lower Shotpouch site and 61.9 deg for the greatest 7 day average at the upper Shotpouch site. There was a radical 6.2 deg increase in average stream temperature in this 4.2 mile stream segment that includes 2.2 miles of degraded riparian corridor.

Bark Creek

Distribution and Abundance

Snorkel inventories in Bark Cr were conducted from RM 0 at its confluence with mainstem Tum Tum to the private industrial forest property boundary at RM 2.6. The abundance of 1+ and older cutthroat was extremely low throughout the survey with the average density at 0.01 cutthroat / Sqm of pool surface area throughout their range of distribution. This is an unusually low abundance and a definitive indicator of systemic dysfunction.

Unique circumstances exist in Bark Cr that likely influence the current level of fish abundance. The primary issue is the existence of a private lake at RM 3.2 (0.6 miles above the end point of this survey). This 30 acre man made lake probably functions as ideal cutthroat habitat with access to high quality headwater spawning reaches. However it probably also functions as a sink for out migrant age classes that would normally populate downstream stream segments.

The abundance of 0+ cutthroat was also very low in Bark Cr and their distribution sporadic. The oscillating distribution is likely linked to the location of tributary confluences that have the potential of contributing downstream emergent fry to the mainstem. Note that their abundance diminishes toward the end point of the survey (figure 4) after the confluence of the western tributary at RM 2.4. Clearly, limited early age class recruitment is occurring in the stream segment from RM 2.4 to the lake at RM 3.2.

Migratory patterns

There are often indications in a snorkel inventory that upstream temperature dependant migrations from lower mainstem habitats (Tum Tum) are occurring. This is usually observed in abundance peaks in the first ½ mile above the mainstem confluence. In Bark Cr, none of these patterns were observed suggesting that Bark Cr does not provide functional summer refugia from elevated mainstem temperatures.

Physical habitat conditions

The channel condition and structure in Bark Cr remained homogeneous throughout the surveyed reach. Channel entrenchment near the confluence with mainstem Tum Tum was 6 ft. This level of incision quickly transitioned to 4 ft and remained constant throughout the remainder of the survey. Unlike conditions observed in Shotpouch, there were no historical beaver terraces observed with evidence of an interactive floodplain.

The stream does appear to have two distinct riparian conditions. The first mile of stream exhibits limited late seral woody species within the riparian. The result of historical agricultural activities long since abandoned. At approximately RM 1 the riparian transitions to a completely forested canopy with excellent LWD recruitment potential.

An ODFW aquatic habitat Inventory of Bark Cr identified 4 distinct morphological reaches in their 2.6 mile inventory. Most importantly was their summary of substrate composition. Reach 1 consisted of 100% silts and organics. Reaches 2 -4 were composed of 83% silts and organics with the balance of the substrate course sand and low quality gravels.

Spawning and Incubation

The 30 acre private lake in the headwaters of Bark Cr would not play a significant role in influencing fish distribution if there were adequate spawning gravels in the lower mainstem or in the tributaries that contribute to the lower mainstem. However, in the case of Bark Cr, heavy silt loading appears to render any available gravel as low quality with an associated low egg/fry survival rate. The declining abundance of cutthroat near the end point of the survey that were associated with increases in sediment loading (especially visible in the 0+ age class, figure 4) also suggest that spawning and rearing habitats become less suitable in a progression toward the lake.

There are two tributaries near the end point of the survey. The tributary at RM 2.4 entering from the west provides 30 percent of the mainstem flow at its confluence and contains high quality (low sediment load) well sorted gravels appropriate for cutthroat spawning. The tributary at RM 2.6 entering from the east is a minor contributor of summer flow but also appears to provide some cutthroat spawning potential. Long term protection of the riparian associated with the tributary at RM 2.4 is likely a significant conservation goal for maintaining current levels of function for the lower mainstem.

Temperature

Continuous temperature data was collected between 7/06/09 and 10/29/09. The data logger was located just above the confluence with the mainstem of the Tum Tum River. The results of the Bark Cr site are displayed in figure 7. In summary, Bark Cr peaked at 70.3 deg on July 29 and reached daily maximum temperatures greater than 64 deg for 15 of the 19 days between July 16 and August 3.

The resultant pattern of diurnal heating and cooling at this site was suspiciously similar to the temperature profile documented for the lower Shotpouch Cr site (2.2 miles upstream). When the data logger was retrieved it appeared that a back water influence from the mainstem Tum Tum was present. Based on this observation no viable conclusions can be extracted from the data set that could shed light on Barks contribution to the systems summer temperature budget.

The field inventory conducted by Bio-Surveys of Bark Cr on August 14 recorded a calibrated max daily temperature of 60 deg at 1450 hours at RM 1.7. The value documented at the Bark Cr data logger station at RM 0 for the same date and time was 58.9 deg with the site recording a daily maximum of 60.5 deg at 2100 hours. It is possible that the temperature logger is an accurate reflection of current conditions at the mouth of Bark Cr but the uncertainty surrounding the deployment site renders this data inconclusive.

The intent of rigorous temperature monitoring was to begin the process of understanding how the contribution of tributaries may be influencing what appears to be a summer temperature limitation in the mainstem of the Tum Tum River. Any impacts to the mainstem Tum Tum likely also influence its potential to contribute cool summer flows to the Marys River mainstem. An obvious unaddressed question for Bark Cr would concern the potential influence of elevated surface temperatures spilling from the private lake in the upper drainage. Elevated surface spills could also play a role in the declining abundance of cutthroat observed (figures 3 and 4) as the inventory progressed upstream toward the Lake. Temperature data is not available to verify this assumption.

Recommendations

Tum Tum

- Broad scale riparian planting is a fundamental must for the recovery of ecosystem function along the mainstem of Tum Tum Cr. The development of a riparian planting plan on the Jensen property for the provision of large conifer recruitment to the active channel directly addresses the current state of severe channel dysfunction (entrenchment).
- Development of additional mainstem riparian planting plans to accomplish the two tiered objective of providing the long term recruitment potential of conifer to the active channel and the development of a functional buffer for the provision of shade. Prioritize planting projects that establish a full site potential riparian buffer width (180 ft).
- Because of the 10 – 11 ft channel incision that currently exists in many segments of the mainstem Tum Tum, the lack of significant riparian wood resources to key and secure log placements, the confined condition as a result of deep channel entrenchment and the risk of significant flood impacts to rural residential infrastructure, LWD placements exhibit an increased level of risk. However, boulder placements (graded riffles) in the mainstem are easier to control final elevations for and appear to be a suitable strategy for beginning the process of rebuilding floodplain interaction at specific sites exhibiting the potential for floodplain interaction.
- The Jensen property contains 3 of the 4 high quality sites for restoring floodplain connectivity within the surveyed segment of the mainstem Tum Tum River. The construction of graded riffles on the Jensen property would result in boosting the bedload retention of migratory sands and fine gravels and enhance floodplain interaction during winter flows.
- The construction of graded riffles on the Gehling property in association with off channel habitat expansion would result in boosting the bedload retention of migratory sands and fine gravels, enhance floodplain interaction during winter flows and simultaneously provide low velocity off channel rearing habitat for cutthroat.
- Identify historical channel meander patterns and target outreach toward the recovery of additional off channel habitat linkages (unsurveyed portion of mainstem). These sites will likely require a parallel treatment of the mainstem to restore higher frequency connectivity during winter flows due to the severe state of mainstem channel incision.
- Develop a long term strategy for monitoring the seasonal migration patterns of the resident and fluvial cutthroat in the mainstem. The current lack of knowledge in this arena suggests that the development of a restoration strategy to restore natural process is lacking a fundamental requirement for success.
- The current lack of a complete subbasin scale inventory for the Tum Tum River and all of its tributaries leaves us unable to make definitive conclusions on the primary seasonal limitation for cold water species. It is clear from the surveys conducted to date that, with the deep channel entrenchment in the mainstem and

its current lack of complex woody debris, abundance of off channel winter habitat may be a significant seasonal limitation. To address this fundamental data gap, continued high resolution RBA inventories integrated with a physical habitat assessment would be valuable in prioritizing a restoration strategy.

Shotpouch

- Remove and replace the Shotpouch Trail culvert (currently 8' diameter with 6" perch). The wetted channel averages 13.2 ft wide above and below the crossing (bankfull widths are greater). This is a high priority restoration prescription.
- Restore ecosystem function and address the downstream impact of elevated summer temperatures by prioritizing the recovery of the riparian canopy in reach 2 (the pasture reach). This will likely require significant outreach to landowners and some creative approaches to collaboration. Consider fencing and planting, CREP rental programs and the potential purchase of conservation easements.
- Develop an enhancement strategy for the historical beaver flat that exists in Reach 1. There is tremendous potential here for encouraging off channel habitat development with structure placement. The development of complex channel braiding and the recovery of the riparian canopy with forage species specific for beaver are also realistic objectives.
- Develop an interim strategy to bridge the gap between current condition and the recovery of natural function. Large wood placements to encourage floodplain interaction and develop deep pool scour would be appropriate.
- Emulate the type of function that can be observed in and around RM 6. (Localized broad terraces colonized by beaver). This may require the planting of forage species preferred by beaver (willow, vine maple, cottonwood). Consider a localized plan for the expansion of beaver coupled with a long term strategy for damage control and culvert maintenance.
- Design and construct instream LWD structures in strategic locations that would trap mobile spawning gravels and develop complex habitats for both summer and winter refugia.
- Develop a long term monitoring strategy that delivers the data required to be effective at adaptive management.

Bark

- Attempt to verify the out flow temperature profile of the lake in the upper drainage as a potential high priority site for mitigating for elevated downstream temperatures that may have a cumulative impact on mainstem Tum Tum.
- Identify the western Trib at RM 2.4 as a key conservation component for maintaining cool mainstem temperatures and for maintaining intact spawning refugia. This may be important in the development of future upslope forest management plans.

Figure 1

1+ and 2+ age class

Shot Pouch Total Cutthroat Density Summer 2009

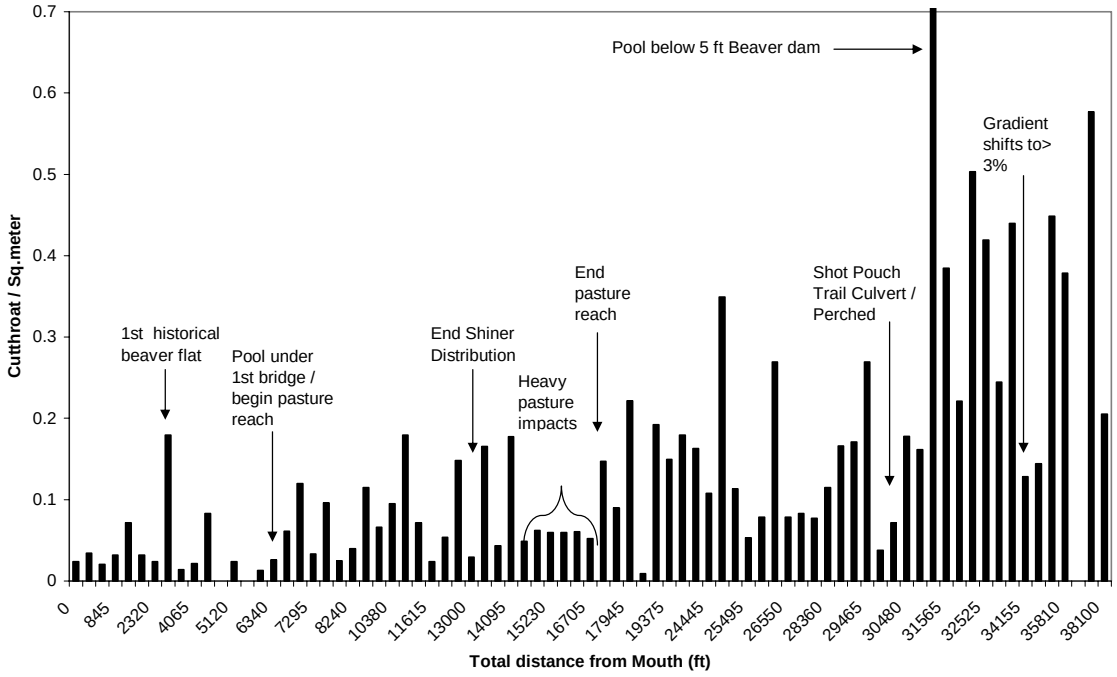

Figure 2

Shot Pouch 0+ Cut Densities Summer 2009

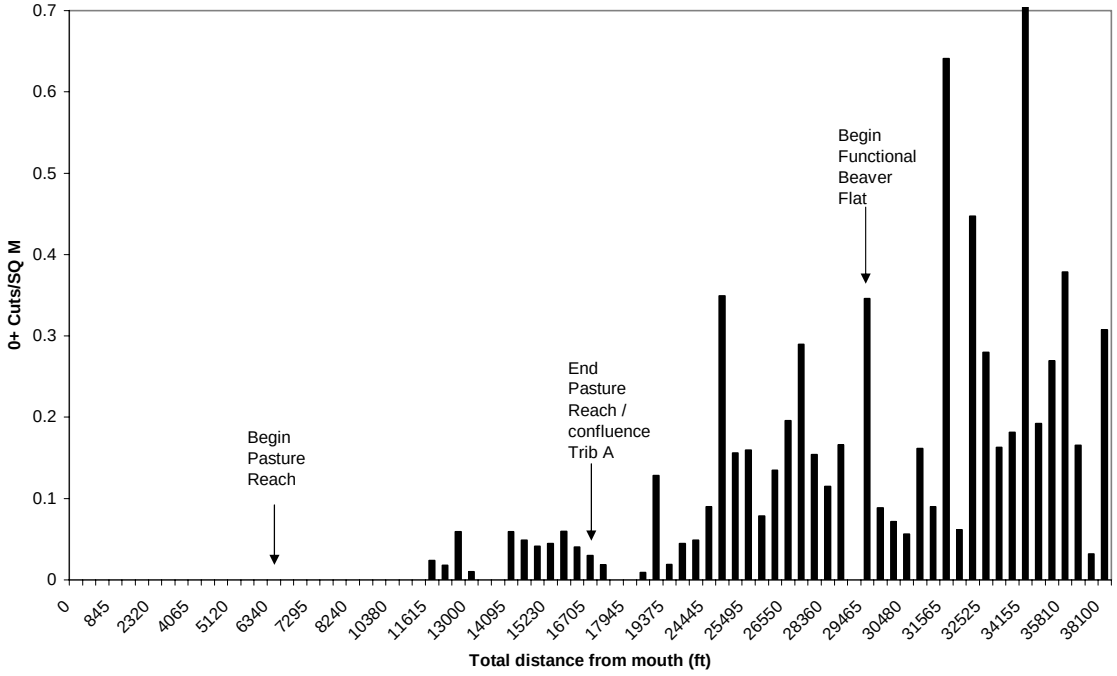

Figure 3

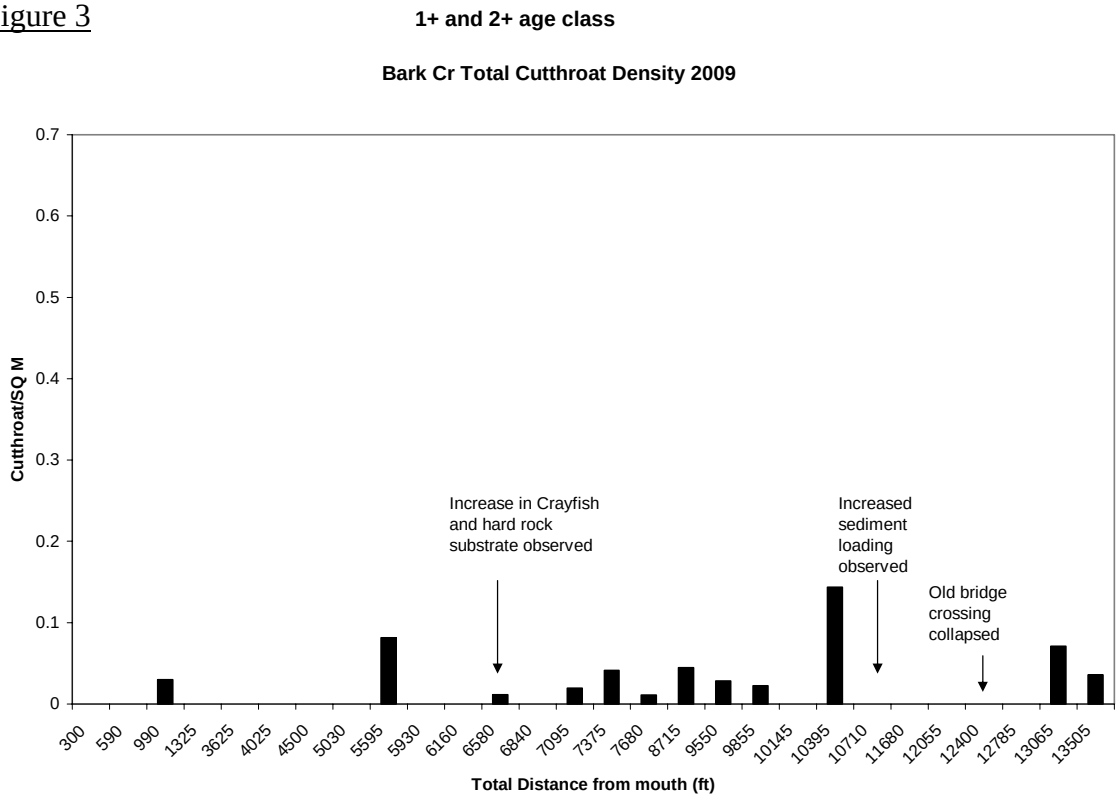

Figure 4

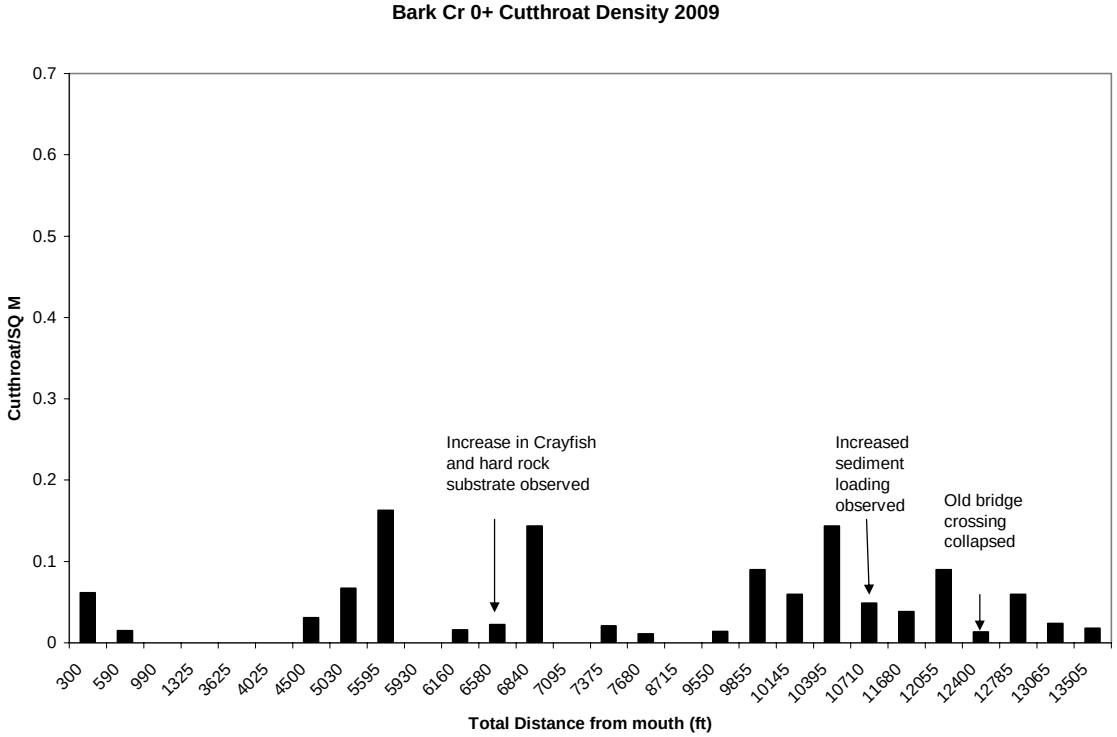

Figure 5

Middle Tum Tum River (Jensen Property RM 5.6)

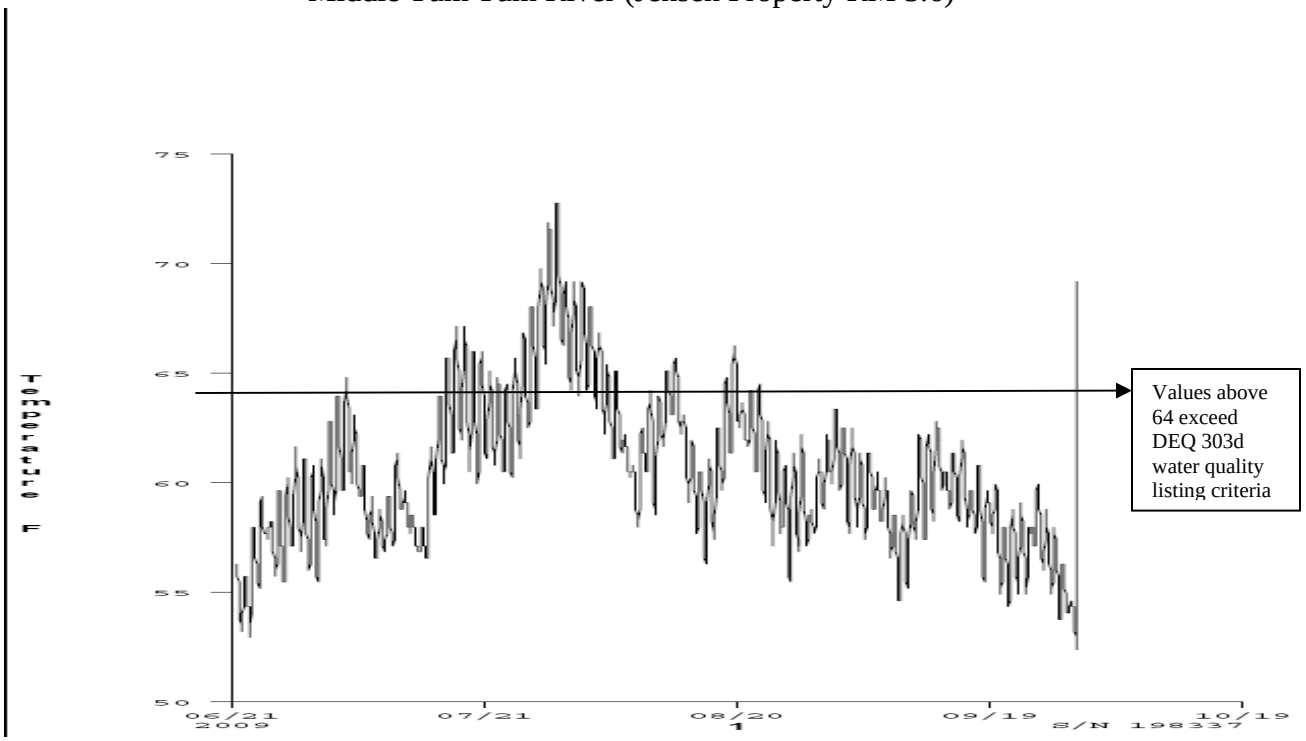

Figure 6

Lower Shotpouch Cr (Just above confluence w/ mainstem Tum Tum River)

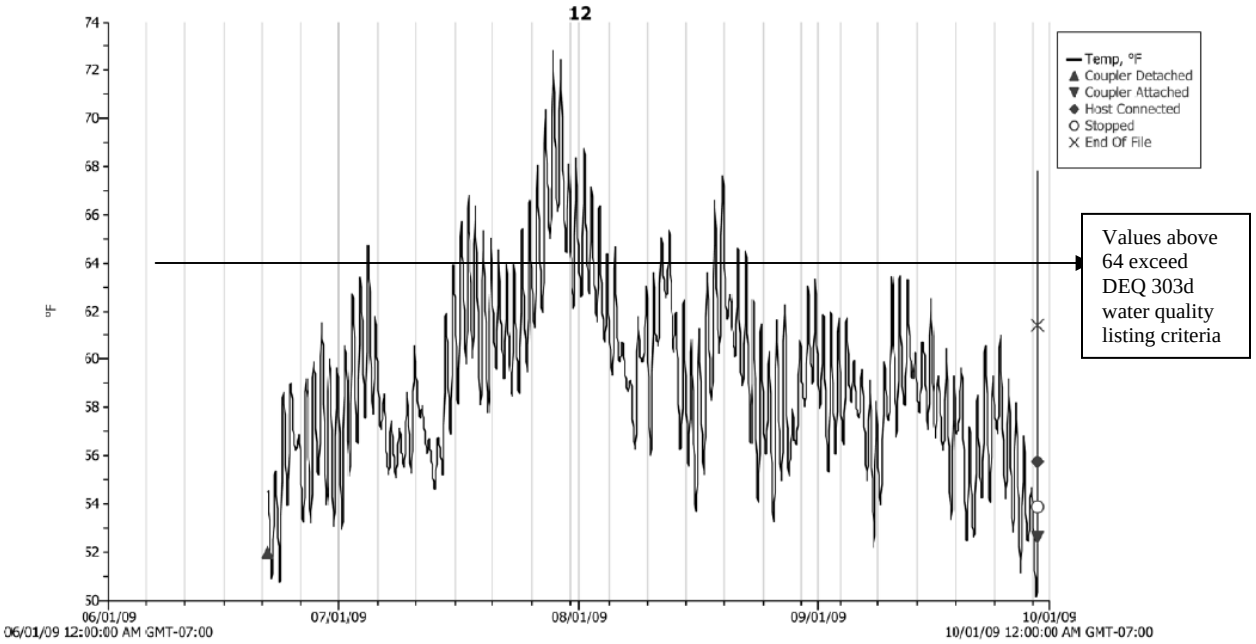

Figure 7

Bark Cr (Just above confluence of mainstem Tum Tum River)