Stop Guide / Road Log

→ mostly Patty, Rainer, and Dan

There are many reasons why one might want to care about sediments and processes operating for the last couple of million years (hence, FOP)….one of them is the fact that such sediments can contain economic concentrations of dense, stable minerals. These are called placer deposits as distinguished from bedrock concentrations („lodes'). The concept of a placer deposit is simple: a dense mineral traveling in water will tend to sink faster, hence be concentrated at/near the bottom. In practice, however, there are LOTS of complications. In Interior Alaska those complications involve changes in climate, neotectonics, glacial and periglacial sedimentation, permafrost….the whole gamut. So, even if you don't care at all about mining, the topic of placers is interesting because there are so many components to it. In this trip we'll look at those various components and we'll also look at a little geophysics to help interpret the geology, Pleistocene fossils caught up in the „muck' , some gold compositional data, and (what the heck) an oddball geothermal system. We'll also be looking at the processes that are shaping this landscape today. These are things like thermokarsting, solifluction, and wildland fires. These modern processes all fall into the discipline of Geomorphology. An overall theme of this field trip is interactions between the surface and the subsurface geologic processes. Placer gold deposits provide a clear illustration of interactions between bedrock and surface processes. Gold moves from bedrock to valley fills and ends up alongside (usually under) extinct Pleistocene megafauna. During the field trip we will discuss placer gold deposition and other surficial and bedrock geologic relationships that are less clear.

On the way to our rendezvous in Livengood and between field trip stops, there are some great examples of some of the geologic process we will discuss. They don't require getting out and looking around (although you may wish to do so). We point them out to you so (a) you don't fall asleep driving out here and (b) they ARE interesting….again along the lines of relating surface and subsurface.

Much of the unedited text below is from-
GUIDEBOOK 4 GUIDEBOOK TO PERMAFROST AND RELATED FEATURESALONG THE ELLIOTT AND DALTON HIGHWAYS,FOX TO PRUDHOE BAY, ALASKA Edited by Jerry Brown and R.A. Kreig for the R.A. Kreig and Assoc, Inc. 4th Int'l Confr. on Permafrost

Unfortunately it is approaching midnight…so, No more editing…too bad.
I (Patty) have included the table that I put together with short notes that you can use for following along with the maps and odometer readings.

Incomplete road log up front   Stops behind that
Table for cross referencing with maps after that.

Guide to stop guide   Map symbols and text reference
RL0XX = Road Log point   STOPXX = FOP trip stop

Odometer Readings
EL = Elliott Hwy. to Livengood   LR = Livengood to Rendevous (RL033)
RA= Rendezevous to Amy Creek turnoff (RL035)

AC=Amy Creek turnoff to Stop 3 LB=Livengood Bench exposures from RL034 (gated)
EE = Elliott Hwy. toward Eureka Turnoff
ER= Eureka Road toward Rampart ET = Elliott Hwy from Eureka Road toward Tofty turnoff
TO= Tofty Rd CA= distance from RL062-RL069
TD=Tofty Rd. (RL062) to Dart AM TM=Tofty Rd (RL062). to Manley
EW= Elliott Hwy west From RL072 BR= Bean Ridge trail from RL07341

RL001 Junction of Elliott and Steese Highways
E-L 0.0 ZERO ODOMETER HERE

E-L 0.0-1.0 Here the distribution of typical interior vegetation types can be observed. Black spruce occurs on lower slopes that are underlain by permafrost close to the surface. Hardwoods, both birch and aspen, dominate the south facing slopes. They are particularly evident when one is traveling north. In the uplands southeast of Fox is a vegetation pattern controlled by substrate conditions that is typical of the Yukon-Tanana Upland. Upland loess has been nearly completely removed from the higher ridges, leaving bedrock with only a thin cover of loess, colluvium, and residual soils . The ellipsoidal and triangular ridges that point upslope are composed of 'flatiron'-shaped bodies of frozen-in-situ loess and retransported silt. Permafrost is shallow under black-spruce-covered ' flatirons' and is deeper under well-developed aspen and birch that typically grow on their upper margins (f ig .18). The sharp vegetation boundary between stunted black spruce on retransported silt and stands of large aspen, birch, and white spruce on unfrozen loess is useful for roughly separating permafrost and nonpermafrost terrain in this part of interior Alaska. However, large white spruce and birch trees can also grow on lower slopes where ice-rich permafrost occurs only 1.2 to 2.4 m below the surface (Kreig and Reger, 1982, pl. 11). Where the highway was constructed over sections of ice-rich permafrost, it caused thermal disturbance of the permafrost. This disturbance resulted in considerable thaw settlement, which has required continuing maintenance of the road. Several cuts have been made in the Birch Creek Schist along the west side of the road. [Note: BCS is an archaic term meaning: „metamorphic rocks of interior Alaska.' Ironically, „schist' *per se* is a minor component of the BCS.] Aspen is found on upper slopes and alder grows near the rock cuts. **A** spring located 0.6 ***km*** north of the road intersection flows year-round, and has been a source of fresh water for many Fairbanks and local residents for the last 30 yr. An old mining operation can be seen in the valley.

RL002 E-L This is the summit of the drainage divide. Davidson Ditch passes back to the west about 100 m beneath the present road through a tunnel constructed in the Birch Creek Schist. The old railroad also crossed the pass into the Chatanika River drainage at this location. Panoramas visible for the next few kilometers north of here give an impression of the percentage of the landscape that is frozen. Permafrost covers 50-60 percent of the area. Terrain vegetated with stunted black spruce is generally frozen, while slopes vegetated with deciduous forest (aspen, birch) are generally unfrozen except on north-facing and some lower east- and west-facing birch-covered slopes, which may be discontinuously frozen (R. Kreig, pers. commun.).

RL003 Haystack Mountain (780 m) can be seen ahead. The mountain marks the western boundary of the Poker-Caribou Creeks Research Watershed, which is operated under an interagency agreement to study the hydrology and climate of this interior region (Lotspeich and Slaughter, 1981; Haugen and others, 1982). The line of trees on the hill to the east marks the location of the Davidson Ditch. Between here and Livengood, the loess is generally thinner than 1.5 m on the hills. The highway section is located in bedrock, which results in noticeably better roadway conditions. Throughout this region, trees were burned and cut down during the peak of the gold-mining period. Black spruce and solifluction lobes are present on some north-f acing slopes.

RL004 In the valley below is the road to Dome City and the Eldorado Mining Camp. To the east are Pedro Dome and Dome Creek. Dome City is the site of an early mining camp. Placer gold mining, which used hydraulicking and large dredges as recently as the early 1960's, produced many excellent exposures of retransported organic-rich silt of late-Pleistocene age. The frozen, buried placers are 15.2 to 61 m deep (Mulligan, 1974). **A** pair of enormous (4 .l-m-long) mammoth tusks that weigh approximately 160 kg each came from these deposits; they are exhibited in the University of Alaska Museum. The tusks, which were found with a fairly cornplete skull, other bones, and considerable well-preserved mammoth hair, have been dated a t 32,700 ± 980 yr R.P. (ST-1632). Small streams crossing the slumped silt cliffs a t Dome Creek have exposed large ice masses that may still be observed. From the silt in these exposures, a partial carcass of Bison superbison crassicornis was recovered by miners and Otto W. Geist of UA in 1951. The carcass consisted of a head (complete with hide, horns, and one e a r) , four legs with hooves, and much torso hide about 3 nun thick. An initial date of more than 28,000 yr B.P. (L-127) was obtained on a piece of the carcass. In 1965, a date of 31,400 (+2,040 or -1,815) yr B.P. (ST-1721) was obtained by the radiocarbon laboratory of the Geological Survey of Sweden. **A** photograph of the carcass is on display at UA. Pieces of the fur and hide of a female superbison recovered from nearby Fairbanks Creek are dated at 11,950 ±135 yr B.P. (ST-1633)

RL005
Black spruce bogs are visible on a fan of retransported frozen silt from the Dome Ck drainage. The frozen silt covers an old terrace gravel of the Chatanika River. Placer gold was mined from underground shafts and drifts sunk to the base of the alluvium and into the upper meter of bedrock, and many tailing piles of gravel from the underground workings are present on the surface (Mulligan, 1974). Gravel was hauled to the surface in winter and washed in the summer.

RL006
Crossing the Chatanika River…which sits on top of a steeply-dipping fault. You'll be driving across several of the NE-trending faults on the way out. This one is significant for several reasons…behind you have been a series of placer gold deposits with heavy equipment. Past the CRF, you won't see any more for a long, long time. Lode gold deposits in Interior Alaska are mostly related to mid-Cretaceous plutonism (see Fig. RL1) and bedrock is exclusively metamorphic and sedimentary for the next 70 km or so.
A band of balsam poplar of various ages is conspicuous on the point bars. Although the Chatanika River is a small stream, in Wisconsin time it was large enough to carry away silt deposited in it by its tributaries. Rounded flood-plain gravel is close to the surface and overlies the Birch Creek Schist at a depth of about 55 m. The type section for a distinctive volcanic ash bed is located 2 h downstream from the Chatanika River bridge, where the river has exposed a cut in the frozen muck. The Chatanika Ash Bed occurs within and near the top of the Goldstream Formation.

RL007 Willow Creek
RL008 Road passes through 1971 burn area
Dan Mann's contribution to the guidebook (DM - Hillslopes, Forests, and Fires in Interior Alaska) provides some background on the role of fire on the interior Alaska landscape.
RL009 End 1971 burn area.

RL010 Wickersham Tors. Tors are big, monument-like outcrops that are more commonly seen in granite (e.g., „Granite Tors') but can form in any hard rock. In this case the hard rock is the „Wickersham grit', a latest Proterozoic/early Cambrian bimodal-sized, very well-cemented quartz sandstone. The formation of tors involves a powerful negative feedback. As soon as an area of bedrock emerges from the soil cover, weathering rates decline markedly. The higher the tor, the better the water drains off, and the less that physical weathering affects it. The contact with the Proterozoic (?) metamorphic rocks to the south is a mess, but Wickersham Dome, and the ridge coming west off the Dome is composed of this unit….and doesn't seem to go anywhere west of the Elliot Highway. Sigh. This part of the world is soooo broken up by low-angle and high-angle faults, it's hard to trace any unit very far along strike. Wickersham Dome is fairly high (3200 feet), but it lacks any evidence for past glaciations. Why was this region never extensively glaciated? Or was it? (See Guidebook Section GL, Known Pleistocene glacier extents in the 2010 Friends of the Pleistocene Field trip area)

RL011 – RL13 See table

RL014 Globe Creek (fault). Yet another steeply-dipping, NE-striking fault, separating the late Proterozoic rocks to the south from (mostly) Paleozoic rocks to the north. I'm always impressed at how sharply this topographic feature cuts across the landscape. We'll be seeing other faults with such expressions and (sigh) faults with very little topographic expression. The VERY DISTINCTIVE limestone we'll be driving by is one of the Paleozoic units. You can see a couple of bald knobs to the NE….and then they fade away. Another victim of complex faulting.

A dynamic mosaic of vegetation and soils covers the bedrock. This mosaic has been created by the combined influences of wildland fires on the one hand and interactions between permafrost and hydrology on the other. The north-facing slope on the far side of Globe Creek shows nice examples of little-studied features informally called "tree fingers." These are the strips of tall-canopy forest running downslope between areas of muskegs. The muskegs are underlain by several meters of frozen peat, while ground underneath the tree fingers thaws deeply in summer, which is probably why the big trees can grow there. See the field guide for more details about this slope feature. Why do north-facing slopes tend to be much steeper than the south-facing ones? Is this a result of bedrock structure or of permafrost and slope processes?

Figure SG-1

RL017 Pump Station 7 Fault….well, officially it's the Beaver Creek Fault, but it really does pass within 300 m of the Pump station and it really is active (Check out the EQ map). This is a major fault that lacks a major topographic expression…I'm guessing because the units on either side are pretty wimpy. We leave the Pz rocks behind and enter…magical…mysterious TURBIDITE LAND. The only exposures are roadcuts and they're pretty cool (if you like that sort of thing)…sandstone…shale…sandstone…shale…standstone…shale. The layers are millimeters to centimeters thick and there must be AT LEAST A GAZILLION. The unit is dominated by shale (i.e., deep water stuff) which is why it's so poorly exposed. We'll see it again between Livengood and Eureka and near Tofty and at Manley…

RL018 – RL23 See table

RL024 Cleary Creek (fault). Weirdly enough, the Tolovana River doesn't appear to be occupying a fault. Instead, the ENE-trending fault between TURBIDITE LAND and Paleozoic rocks of the Livengood area is somewhere in this lowland. It's marked on the resistivity map, RLx. The cool part is the ridge to the north: the bald spots are serpentinite. NOTHING grows on serpentinite. The veggies around the bald spots are growing on loess that partly covers the serpentinite. The entire ridge is part of an early Cambrian ophiolite (piece of oceanic crust) or which the serpentinite is the most distinctive part. This strip of mafic/ultramafic rocks shows up like gangbusters on aeromagnetic maps…and can be traced for > 50 km to the east and well past Tofty to the west.

RL026 The rocks on the north side of the road have been mafic/ultramafic under a cover of Devonian sedimentary rocks. The knob here is an extremely altered Cretaceous plutonic rock. There's also an altered dike with weathered-out pyrite. WE'RE ENTERING GOLD COUNTRY!!!. And, oh, yeah, there are fossils in a limestone-rich blob just east of the intrusion and up the hill a little.

RL030. Turnoff from the Elliot Hiway to Livengood. Don't miss it. The BIG valley you're in is part of the ~ N-S Myrtle Creek (AKA Minto) fault. It's marked on your resistivity and mag maps (RLx and y). More about that tomorrow. As you drive up the road notice the tiny dinky Livengood Creek (don't blink) which is clearly too small to be responsible for Livengood valley and the Livengood placers. You'll also get a sense of valley asymmetry: the SE side is quite steep and the NW side is quite gentle.

RL044 Turnout with view of Tolovana Dome and the drainage divide between Idaho and Brooks Creeks and Minto Flats.

Figure SG-2

x

Figure SG-3

RL045 Turnout with view of Moose Creek valley asymmetry and Sawtooth Mountains.

Figure SG-4

Desc	Label	Odometer	x	y
Junction of Elliott and Steese Highways	RL001	EL-0		
Summit of drainage divide	RL002	EL-3.3	-147.633	65.00153
Haystack Mountian - Caribou/Poker Ck. watershed boundary	RL003	EL-4.5	-147.641	65.01633
Valley view - gold mining history and Pleistocene information	RL004	EL-5.5	-147.655	65.02957
Retransported silt covered terrace - Placer mining history	RL005	EL-8.9	-147.699	65.07935
Chatanika River crossing	RL006	EL-10.4		
Willow Creek	RL007	EL-11.8	-147.73	65.09227
1971 Burn area - south	RL008	EL-20.3		
1971 Burn area north	RL009	EL-22.1		
Wichersham Dome Wayside	RL010	EL1-26	-148.078	65.17776
Wichersham tors and terrace scarps (southeast)	RL011	EL1-28		
Aggie Ck. - Bedrock cuts in schist and argillite	RL012	EL1-29		
Wichersham Tors and terrace scarps (northwest)	RL013	EL-29.8	-148.125	65.21038
Globe Ck. Fault and "tree fingers"	RL014	EL1-34.6		
Grapefruit Rocks	RL015	EL1-36.3	-148.182	65.29113
Turnout - Sawtooth mountain view	RL016	EL1-37.9	-148.201	65.3006
Entrance to Pump Station 7	RL017	EL1-40.3	-148.265	65.31866
Tatlanika RIver bridge	RL018	EL1-42.4	-148.312	65.32826
Tatlanika Valley view - 1958 fire - turnout	RL019	EL-45	-148.263	65.35638
Joy Alaska	RL020	EL1-46.8		
White Mountain view - pullout	RL021	EL1-49.3	-148.224	65.40617
Colorado Creek tailhead (outhouse)- Tolovana RIver - campground	RL022	EL1-54.3	-148.269	65.47121
Turnout	RL023	EL1-56.7	-148.344	65.46501
Cleary Creek fault	RL024	EL1-57.5		
Sawtooth Mountains visible to the west	RL025	EL1-59.5	-148.417	65.4845
Entering gold country - fossils nearby	RL026	EL1-61.2		
Junction of old and new Elliott Hwys	RL027	EL1-61.4		
Money Knob visible to northwest - note drill pads	RL028	EL1-62	-148.499	65.49291
Livengood Creek	RL029	EL1-64.9	-148.584	65.50506
Junction with Livengood Road	RL030	EL-65.5 AND LR-0		
Junction betwee Livengood Road and Old Elliott Hwy.	RL031	LR-1.9	-148.546	65.52269
Old Elliott Hwy and "Lower Road" junction	RL032	LR-2	-148.546	65.52419
FOP Rendezevous turnoff - Hefflinger Mining	RL033	LR-2.4 & RA-0	-148.538	65.52754
Junction of "Upper"and "Lower"roads	RL034	RA-1.3 & LB-0	-148.51	65.54035
Junction between "Upper Road" and Amy Creek Road	RL035	RA-3.1	-148.455	65.55135

Livengood Creek - 2 wheel dirve vehicles park here	RL036	AC-0.4	-148.445	65.5475
Junction of Lillian Creek access and Old Elliott Hwy.	RL037	OE-0.67	-148.556	65.51486
Reclaimed placer mine and drill pad for hardrock exploration	RL038	NA	-148.566	65.51109
Old Hand workings	RL039	NA		
Junction Elliott and Dalton Highways	RL040	EE-0		
Applegate fire scar in view	RL041	EE-5.7	-148.887	65.42671
Cretaceous turbedite - west side of road - not hornfelsed	RL042	EE-13	-148.937	65.3734
Tolovana Hot Springs trailhead - parking	RL043	EE-19.8		
Pullout with view of Tolovana Dome, Minto Flats and the drainage divide between Brooks and Idaho Creeks	RL044	EE-29.9	-149.121	65.30312
Pull out with a view of valley assymetry and informational wayside	RL045	EE-33.2	-149.479	65.24684
Minto turnoff	RL046	EE-36.1	-149.561	65.22321
Turnout with nice views	RL047	EE-49.4	-149.962	65.1706
Hutlinana Creek	RL048	EE-55.4	-150.157	65.15829
Turnoff to Eureka, Minook Creek and "the road to Rampart"	RL049	EE-57.2 EU-0 & ET-0	-150.216	65.15975
Turnoff toward Thanksgiving Creek	RL050	EU-1.3 ER-0		
Pioneer Ck Rd. turnoff to east	RL051	ER-0.4		
View of Eureka Creek Valley Assymetry	RL052	ER-2	-150.214	65.20485
Good turnaround - Senic view	RL053	NA		
Minook Ck. fault valley - Good turnaround - Senic View	RL054	NA		
Hutlanana Hot Spring	RL055	NA		
Old Elliott Hwy. turnoff	RL056	ET-0.7	-150.224	65.15037
Baker Creek and Overland Bluff - Livengood Dome Chert- why the heck is this Ordovician Rock here?	RL057	ET-5.6	-150.288	65.09053
Landfill	RL058	ET-17.46	-150.579	65.00605
Tribal office	RL059	ET-18.71	-150.592	65.00622
Rock Quarry	RL060	ET-18	-150.598	65.00604
Water source - Potable	RL061	ET-18.3	-150.61	65.00795
Junction - Tofty Rd. and Elliott Hwy.	RL062	ET-18.6	-150.617	65.00669
Iditarod Kennels - Joe and Pam Redington	RL063	TO-0.5	-150.616	65.01319
Stay right on Tofty Rd.	RL064	TO-13.5	-150.846	65.0915
Stay Left on Tofty Road	RL065	TO-13.9	-150.855	65.09482
Trail to Carbonatite Dike	RL066	TO-14.3		
Doyon Sign	RL067	TO-15.8	-150.902	65.08619
Turn Left to go to Boy's pit (Stop 12) - Girls Pit (dangerous high walls - even though not very high) straight ahead.	RL068	TO-16.3	-150.917	65.08164
Carbonatite Parking	RL069	CA-1.2		

Carbonatite pit 3		NA	-150.873	65.1101
Carbonatite pit 2		NA	-150.873	65.11009
Carbonatite pit 1		NA	-150.873	65.11008
Possible injection well site at intesectin of Old Elliott and Dart-AM Farm	RL070	TD-0.3	-150.625	65.00693
Turnoff to historic school and BATH HOUSE	RL071	TM-0.5	-150.63	65.00363
Intersection- Bridge and Old Elliott Hwy. West	RL072	TM-0.6 & EW-0	-150.634	65.00293
Turn to Graveyard / Bean Ridge trail	RL073	EW-0.2		
Turbedite - No Hornfels	RL074	EW-0.4		
Gravel float in trail. Hornfelsed turbedite unit above unhornfelsed turbedite shale unit below	RL075	BR-0.6	-150.659	65.0037
Tanana River Landing	RL076	NA		
Hefflinger Property	STOP 1	NA		
Fractured faulted granite - Parking	STOP 10	TO-3.4		
Hornfelsed Turbedite	STOP 11	TO-4.38		
Idaho Gulch - Boy's Pit	STOP 12	TO-16.5	-150.914	65.07945
Dart AM - Farm	STOP 13	NA		
Manley Hot Springs Lodge / Camp Area	STOP 14	TM-0.7		
Mud Miners	STOP 2	NA		
Amy Creek Exposure	STOP 3	AC-0.8		
Fault	STOP 4	LB-0.7		
LVG Bench Section	STOP 5	LB-1.1		
Lillian Creek fault	STOP 6	OE-1.2		
Olive Creek fault	STOP 7	OE-3.2		
Eureka Rd. Parking	STOP 8	NA		
Terrace Gravels	STOP 9	EM-2.2	-150.208	65.2062
Manley Hot Springs Baths	STOP15	NA		

GUIDE TO FOP 2010 STOPS- Sort of

Arriving in Livengood

Figure 1 As you drive into Livengood, notice the Livengood Valley Assymetry. View up Livengood valley to the northeast from the Elliott Highway pull out on the west side of the highway. The turnout is immediately north of the Livengood road (visible on far right of image)

Day 1

Stop 1 – Livengood Valley - Larry's pit

Figure 2 Interbedded colluvium and peat on gold bearing gravels.

Figure 3 Larry is a wealth of knowledge regarding mining history in the Livengood area.

Stop 2 Upper Livengood Creek

Figure 4 Excavator feeding a trommel. Material then flows into a jig for separation into tailings and concentrates. There is approximately 50,000:1 reduction.

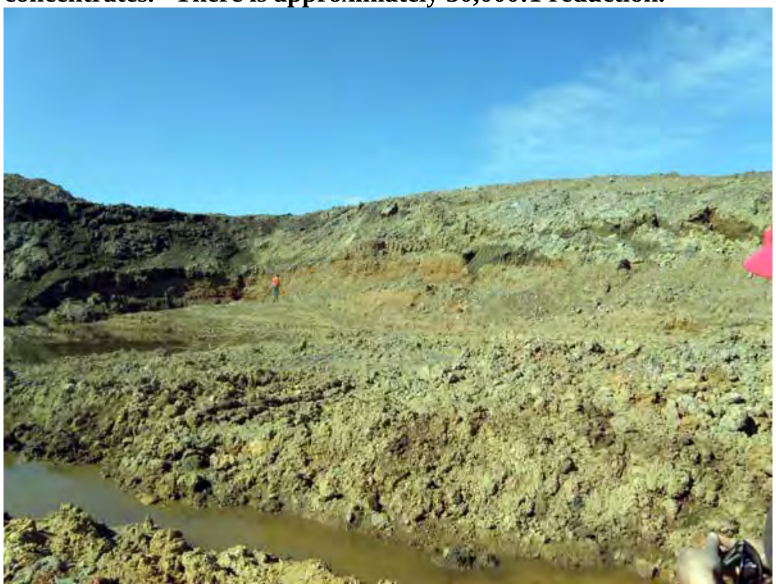


Figure 5 Baker pit.

Stop 3 (weather/time dependant) Amy Creek section

Figure 6 These gravels are X m above modern valley floor

Stop 4 – Quaternary (?) fault

Figure 7 Amy dolostone (right) faulted against Miocene and Quaternary or Tertiary (left). DGGS 2003 photo.

Stop 5 – Livengood Bench

Figure 8 Livengood bench Xm above current valley bottom. Gravels are overlain by finer material and wood. Near location where Tertiary pollen was collected by Karl and others

Stop 6 (Optional – time dependant) – Lillian Creek Fault

Figure 9 Zone of chewed-up rocks (fault) is 20 m wide.   Lillian Creek mostly occupies this near-vertical fault.

Stop 7 (Optional – time dependant) Olive Creek

Figure 10 edge of another vertical fault, this one ~ parallel to the Myrtle Crk fault. The 'rocks' are altered Devonian peralkaline volcanics. Olive Creek occupies the bulk of this fault zone.

Day 2
Stop 8 – Eureka

Pull in to material site on the East side of the Main Eureka road (AKA the road to Rampart) near the historic Eureka town site (no historic buildings visible). We will leave extra vehicle due to limited parking at Stop 9.

RL051 – Eureka valley view

Figure 11 Note Eureka Valley Asymmetry while driving to the site. Headwaters where Yeend (1989) suggested ancient Tanana flowed is visible in the distance

Figure 12 Exploration pits. BE EXTREMELY CAUTIOUS around these pits.

Figure 13 View in one exploration pit. Note lighter gravel near top of section. Darker gravel at the bottom is the gold bearing unit. We will discuss the possible source of these gravel units at the site.

Stop 10 – Tofty Road material pit

Pull in to material site on the west side of the road where we will consolidate into fewer vehicles for the drive to Stop 11.

Figure 14 Fractured Paleocene U-, Th-rich granite

Figure 15 Fractured and altered granite in fault zone. This fault is likely one of the conduits for hot water in the Manley Hot Springs thermal zone.

Stop 11 – Hornfelsed Turbidite unit

Figure 16 Note alternating layers of hornfelsed silt and sandstone.

Stop 11 – Idaho Gulch

Figure 17 Roughtop Mountain. View to the north-northeast from Boy's pit at Idaho Gulch. Monzonite tors result in a jagged profile. The presence of tors suggests that Roughtop Mountain was unglaciated during middle and late Pleistocene time but does not preclude Tertiary or early Quaternary glaciations. Mid-Cretaceous monzonite bodies are spatially associated with lode gold in the Tofty-Eureka-Livengood region.

Figure 18 Manley Hot Springs Dome and Bean Ridge. View to the south from the Boy's pit at Idaho Gulch. The Manley Hot Springs granite is the presumed source of placer tin at Tofty.

Figure 19 Active Mining at Boys pit, September 2009.

Figure 20 Using hydraulic nozzles to thaw permafrost, September 2009.

Figure 21 Hydraulically exposed Pleistocene section, August 2010. Note removed overburden from the top of the section (green area on left of photo).


Figure 22 Hydraulically exposed section, August 2010.


Figure 5 Ice wedge cast. August 2010.


Figure 23 Gravel and silt units below peat.


Figure 24 section on north wall. Silt with mixed organics underlain by gravel

Figure 25 Upper silt part of north wall section.


Figure 26 Bedrock. Permo-Triassic phyllitic metasedimentary rocks in pit bottom.

Stop 13 - Dart AM farm

Figure 27 Entrance to farm from the Old Elliott Hwy. Possible geothermal injection well site behind the sign.

Figure 28 Dart AM farm geothermal production well. John dart will be exposing a section for the Friends of the Pliestocene to check out at this location.

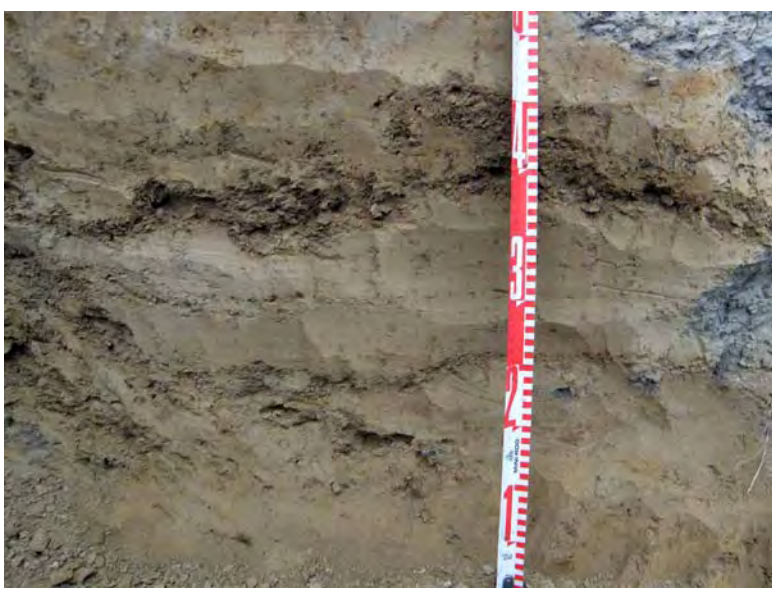


Figure 29 this is what material exposed at the base looked like on 8/11/2010. Silt with stringers of angular pebble gravel.

Figure 30 Dart AM hightunnel / greenhouse.   Note cutbank on right of photo.

Figure 31 This soil is exposed in the cutbank next to the greenhouse. Apparently the area was cultivated intermittently over the past 100 years. John Dart refers to this soil as the plow layer – which resulted from past potato farming.


Figure 32 Preparing fields for cultivation.

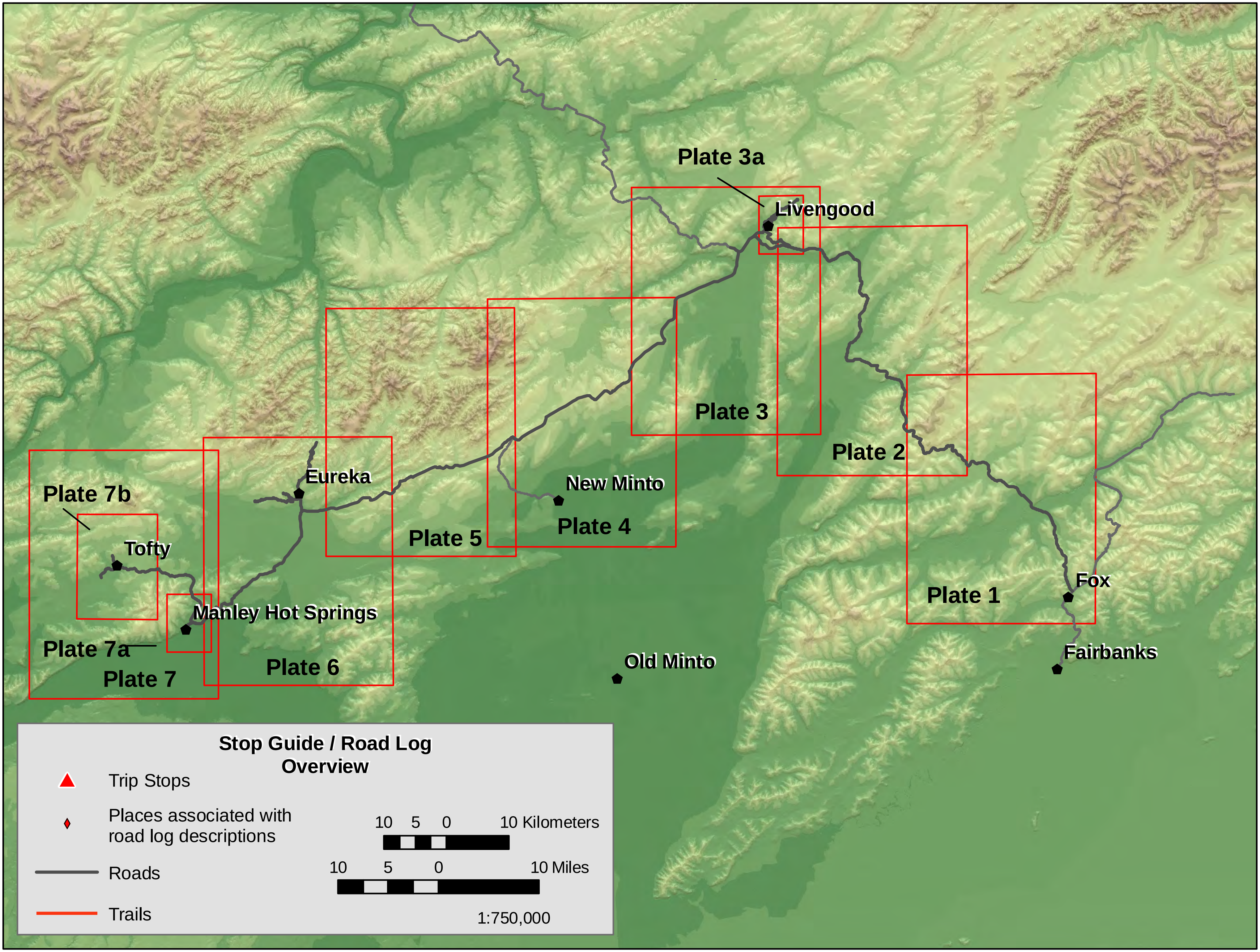
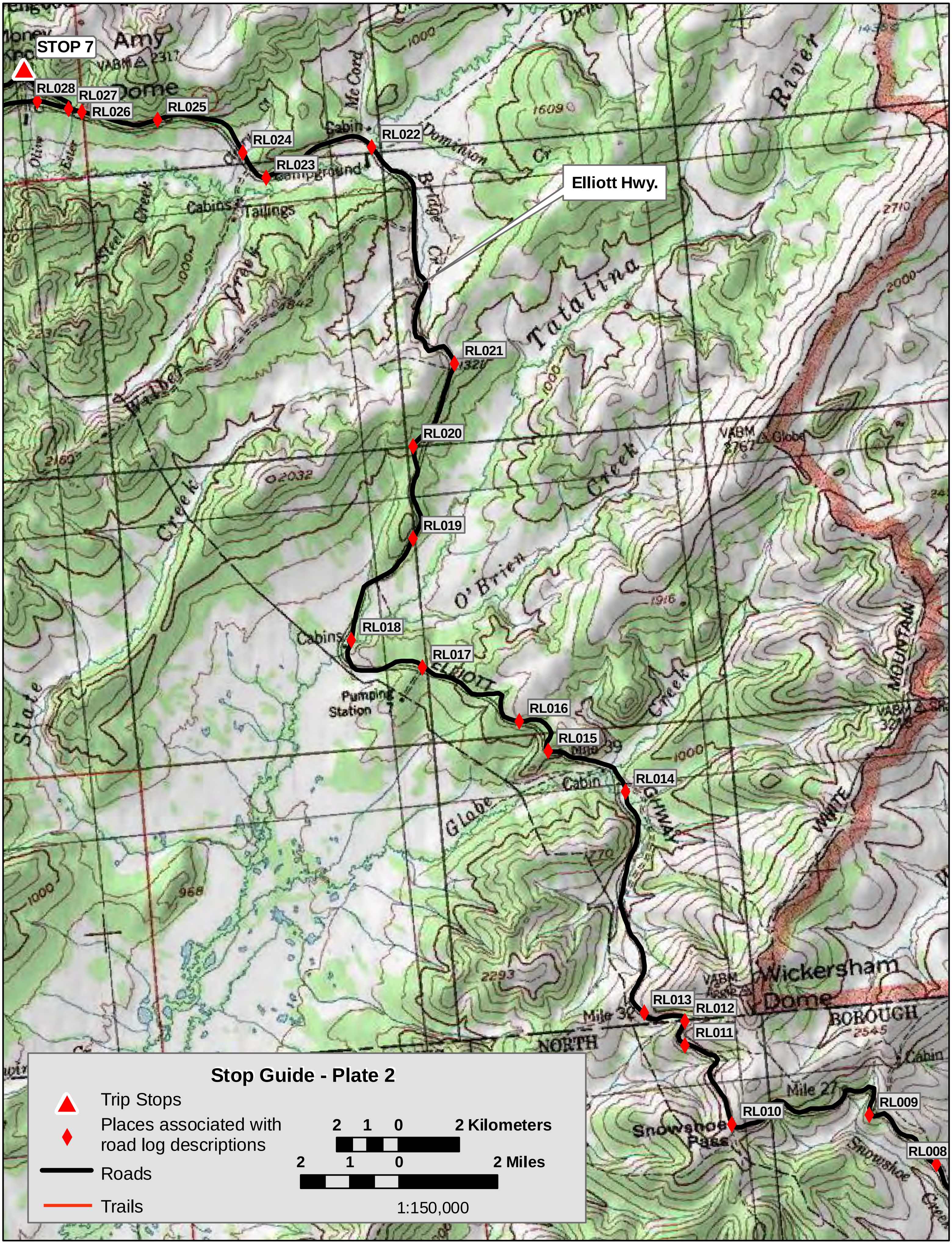
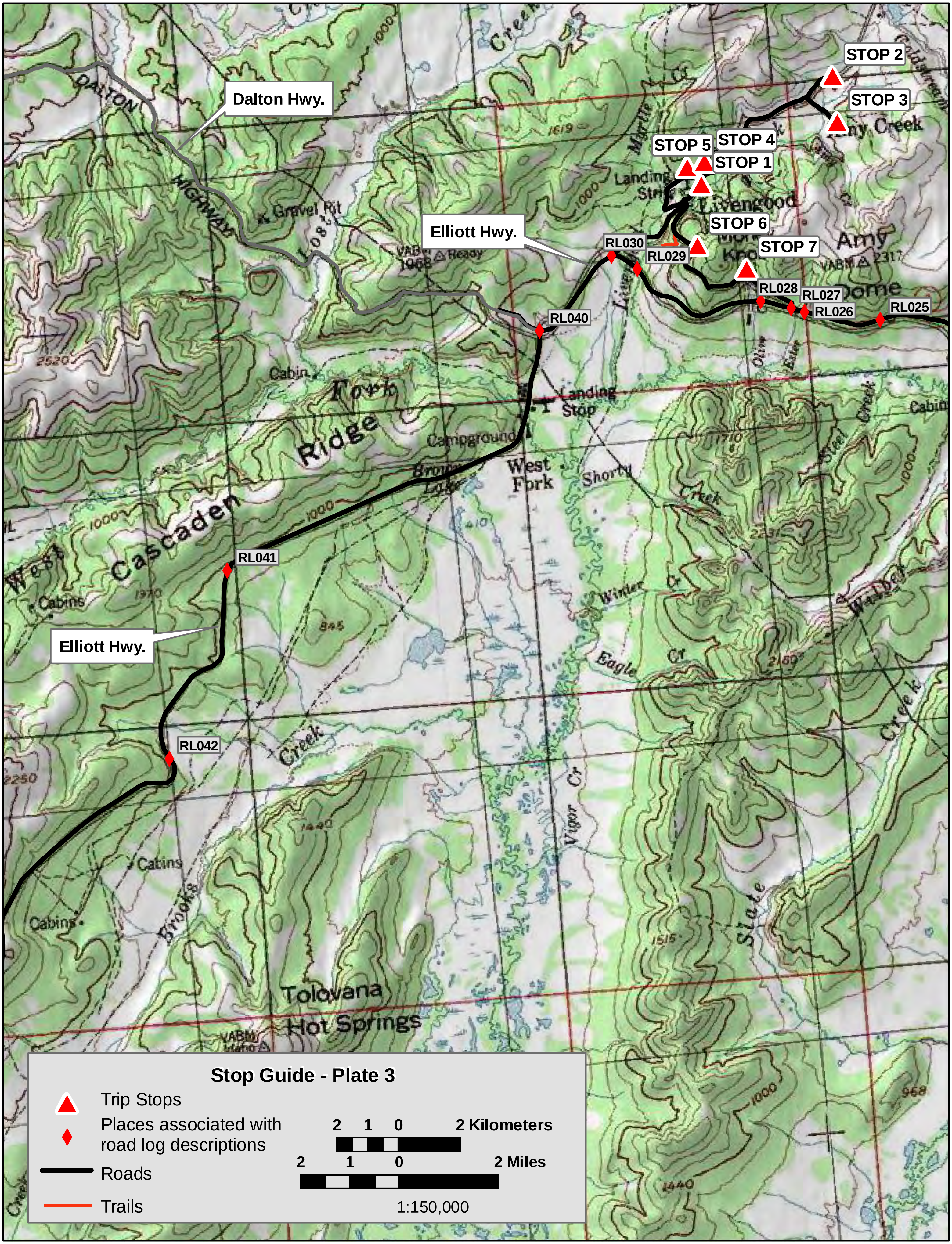


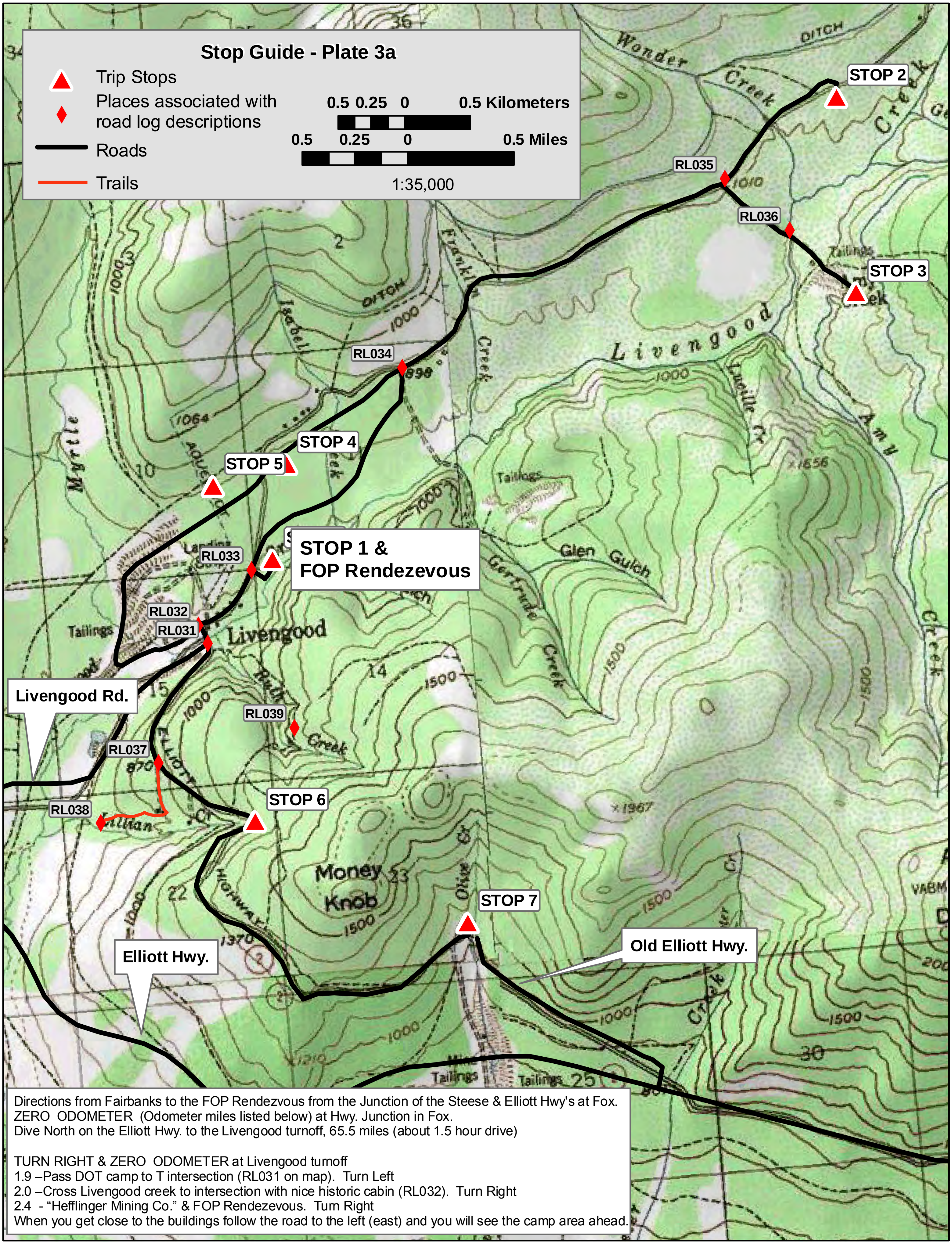
Plate 3a
Livengood
Plate 3
Plate 2
New Minto
Plate 4
Eureka
Plate 5
Plate 7b
Tofty
Manley Hot Springs
Plate 7a
Plate 7
Plate 6
Plate 1
Fox
Fairbanks
Old Minto
Stop Guide / Road Log
Overview
Trip Stops
Places associated with
road log descriptions
Roads
Trails
10 5 0 10 Kilometers
10 5 0 10 Miles
1:750,000


Stop Guide - Plate 1
Trip Stops
Places associated with road log descriptions
Roads
Trails
2 1 0 2 Kilometers
2 1 0 2 Miles
1:150,000
RL001
RL002
RL003
RL004
RL005
RL006
RL007
RL008
RL009
RL010
RL011
RL012
RL013
Elliott Hwy.
Fox
Wickersham Dome
BOROUGH
BOUNDARY
Haystack Mtn
Olnes
Chatanika
Snowshoe Pass
Mile 27
Mile 20
TRANS ALASKA PIPELINE
Vault
Gilmore
Gold Stream



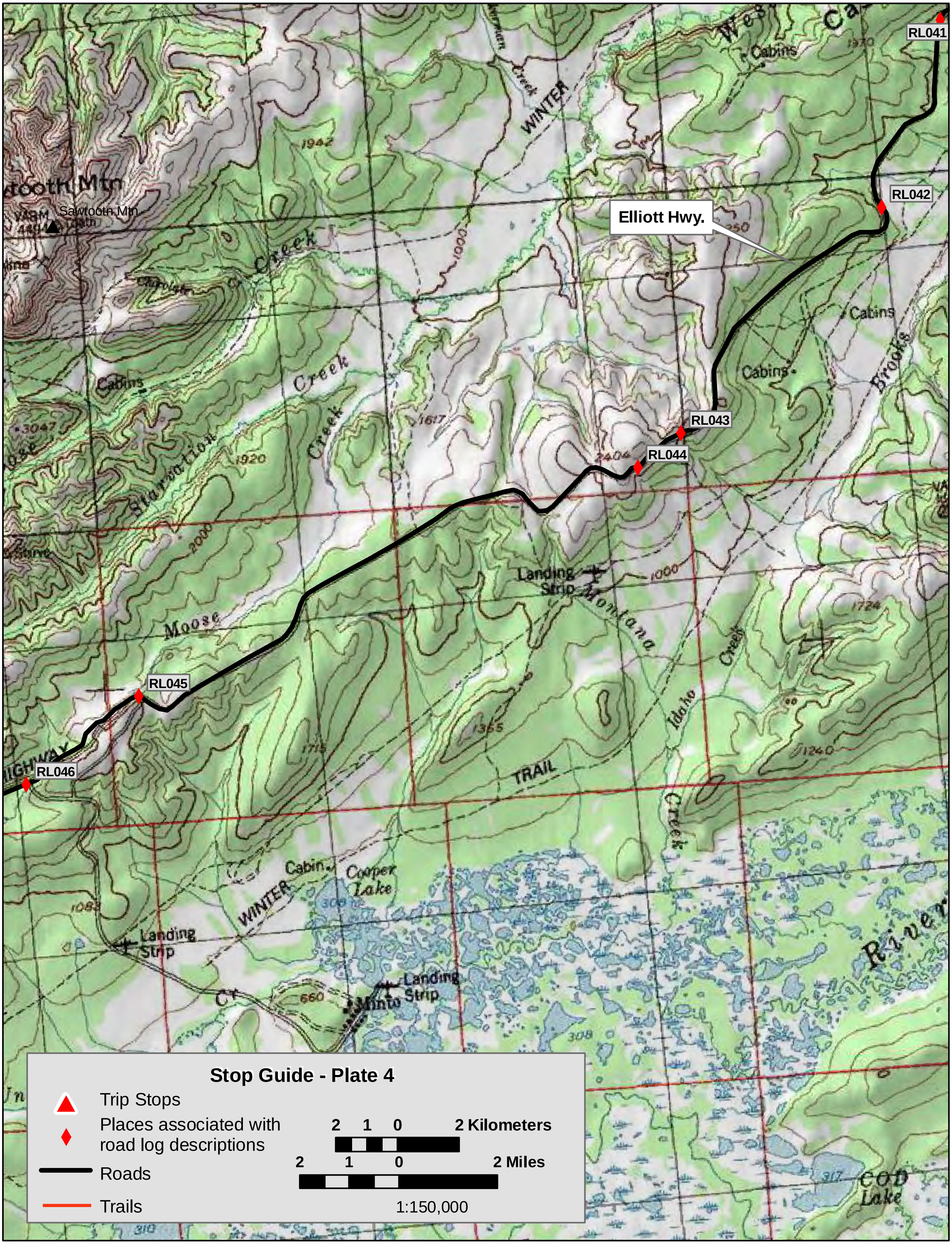
STOP 7
RL028
RL027
RL026
RL025
RL024
RL023
RL022
Elliott Hwy.
RL021
RL020
RL019
RL018
RL017
RL016
RL015
RL014
RL013
RL012
RL011
RL010
RL009
RL008
Amy Dome
Campground
Cabins
Tailings
Tatalina
O' Brien
Creek
Globe
Pumping Station
Wickersham Dome
NORTH
BOROUGH
WHITE
MOUNTAIN
River
Snowshoe Pass
Mile 32
Mile 27
Stop Guide - Plate 2
Trip Stops
Places associated with road log descriptions
Roads
Trails
2 1 0 2 Kilometers
2 1 0 2 Miles
1:150,000


Dalton Hwy.
Elliott Hwy.
Elliott Hwy.
STOP 1
STOP 2
STOP 3
STOP 4
STOP 5
STOP 6
STOP 7
RL025
RL026
RL027
RL028
RL029
RL030
RL040
RL041
RL042
DALTON HIGHWAY
Livengood
Amy Dome
Landing Strip
Gravel Pit
Cascaden Ridge
Fork
West Fork
Campground
Brown Lake
Landing Strip
Shorty Creek
Winter Cr
Eagle Cr
Vigor Cr
Brooks Creek
Tolovana Hot Springs
State
Walker Creek
Steel Creek
Cabin
Cabins
Stop Guide - Plate 3
Trip Stops
Places associated with road log descriptions
Roads
Trails
2 1 0 2 Kilometers
2 1 0 2 Miles
1:150,000



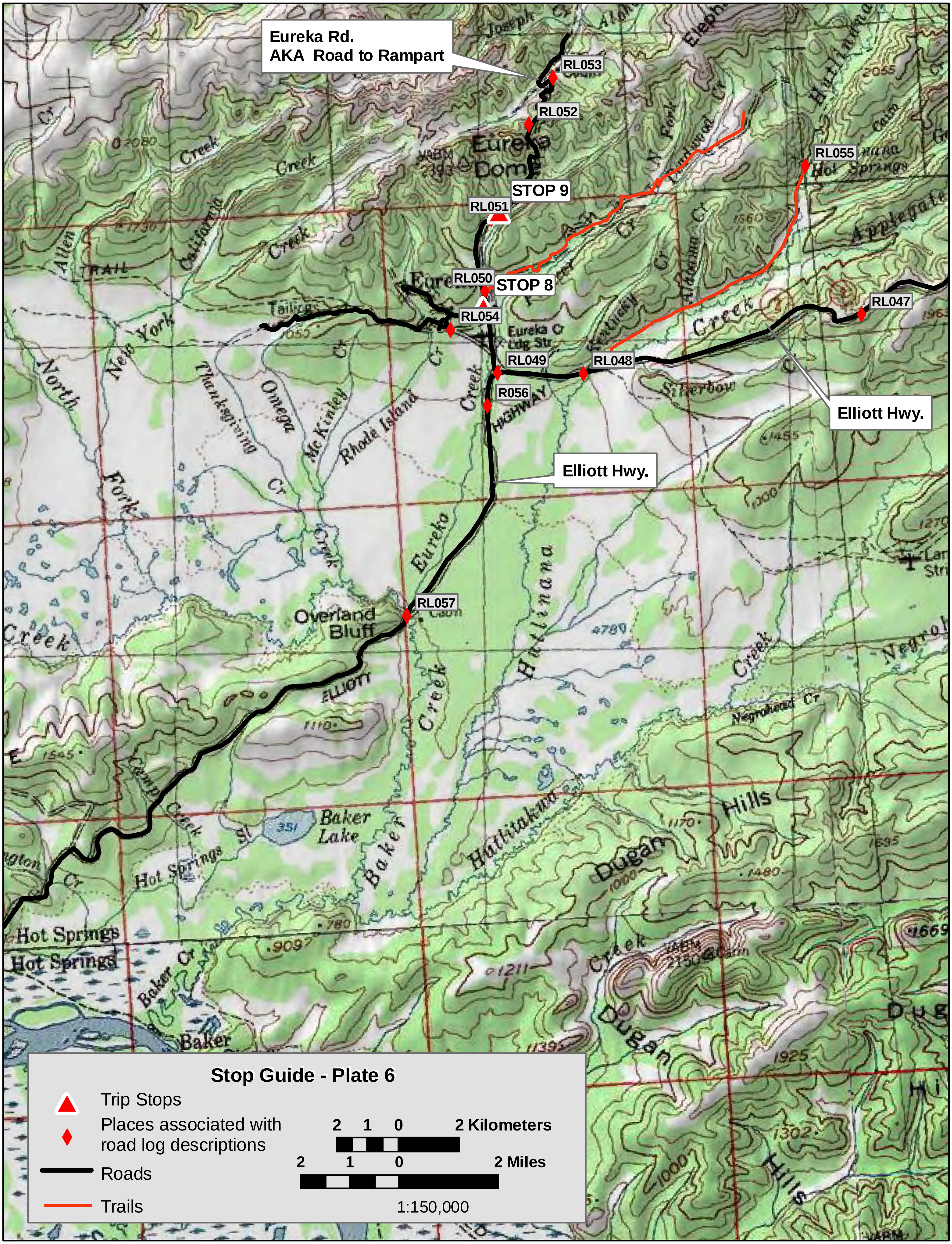
Directions from Fairbanks to the FOP Rendezvous from the Junction of the Steese & Elliott Hwy's at Fox.
ZERO ODOMETER (Odometer miles listed below) at Hwy. Junction in Fox.
Dive North on the Elliott Hwy. to the Livengood turnoff, 65.5 miles (about 1.5 hour drive)

TURN RIGHT & ZERO ODOMETER at Livengood turnoff
1.9 –Pass DOT camp to T intersection (RL031 on map). Turn Left
2.0 –Cross Livengood creek to intersection with nice historic cabin (RL032). Turn Right
2.4 - "Hefflinger Mining Co." & FOP Rendezevous. Turn Right
When you get close to the buildings follow the road to the left (east) and you will see the camp area ahead.

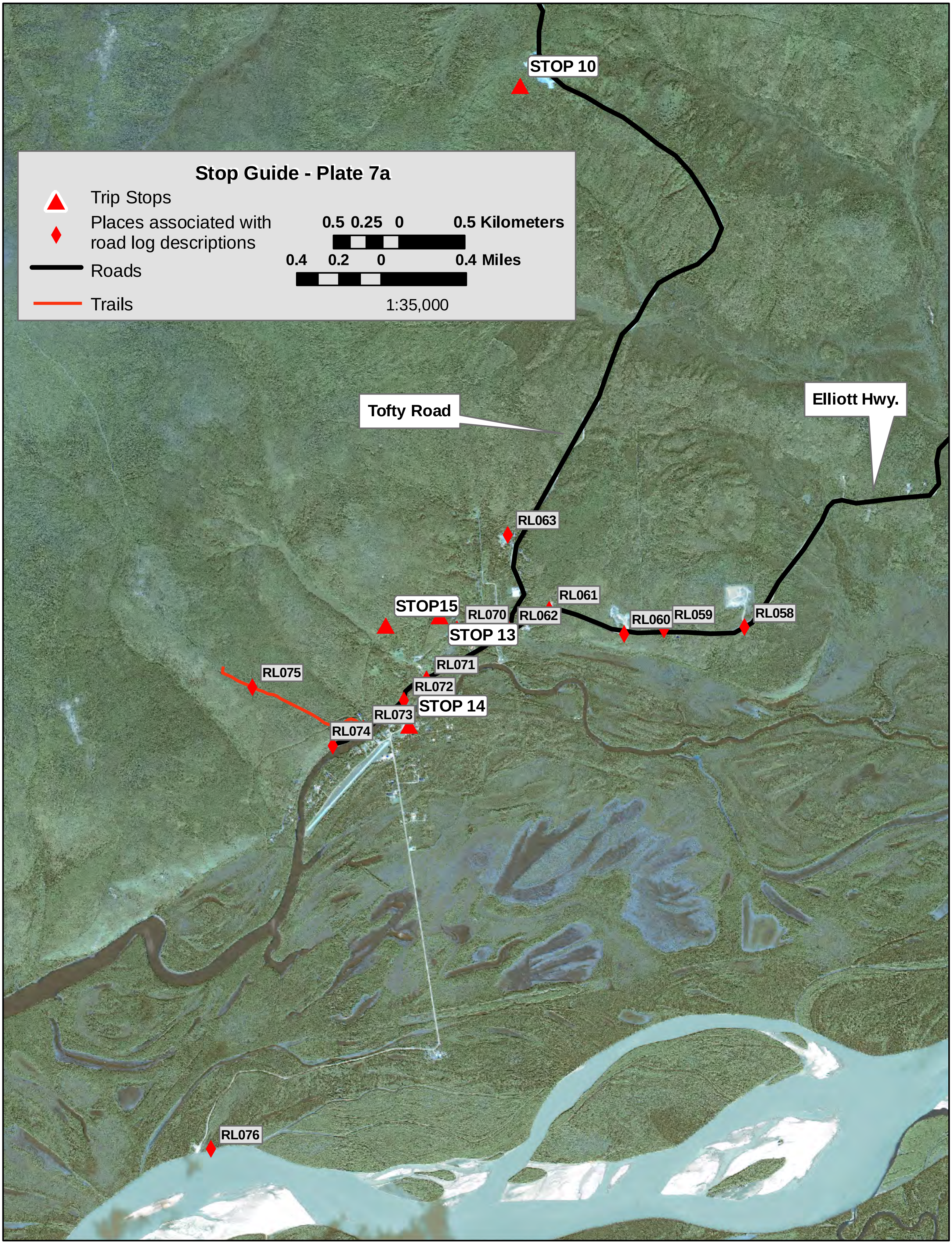


RL041
RL042
Elliott Hwy.
RL043
RL044
RL045
RL046
Sawtooth Mtn
Cabins
Creek
WINTER
Starvation
Moose
Landing Strip
Montana
Idaho
Creek
TRAIL
Cabin
Cooper Lake
Minto
Brooks
River
Stop Guide - Plate 4
Trip Stops
Places associated with road log descriptions
Roads
Trails
2 1 0 2 Kilometers
2 1 0 2 Miles
1:150,000

Stop Guide - Plate 5
Trip Stops
Places associated with road log descriptions
Roads
Trails
2 1 0 2 Kilometers
2 1 0 2 Miles
1:150,000
RL045
RL046
RL047
RL055
Elliott Hwy.
ELLIOTT
HIGHWAY
Sawtooth Mtn
Wolverine Mtn
Elephant Mtn
Landing Strip
Cabins
Applegate
Creek
Chapman Cr
Texas
TRAIL
Uncle
Hot Springs


Eureka Rd.
AKA Road to Rampart
RL053
RL052
RL055
STOP 9
RL051
RL050
STOP 8
RL054
RL047
RL049
RL048
R056
Elliott Hwy.
Elliott Hwy.
RL057
Overland Bluff
Eureka Dome
Eureka Cr
Hutlinana
Baker Lake
Hot Springs
Dugan Hills
HIGHWAY
ELLIOTT
Stop Guide - Plate 6
Trip Stops
Places associated with road log descriptions
Roads
Trails
2 1 0 2 Kilometers
2 1 0 2 Miles
1:150,000


Stop Guide - Plate 7
Trip Stops
Places associated with road log descriptions
Roads
Trails
2 1 0 2 Kilometers
2 1 0 2 Miles
1:150,000
Tofty Road
Elliott Hwy.
STOP 10
STOP 11
STOP 12
STOP 13
STOP15
STOP 14
Roughtop Mountain
Manley Hot Springs Dome
SERPENTINE RIDGE
Tofty
Woodchopper
Hot Springs Landing
RIVER
Manley Hot Springs



Stop Guide - Plate 7a
Trip Stops
Places associated with road log descriptions
Roads
Trails
0.5 0.25 0 0.5 Kilometers
0.4 0.2 0 0.4 Miles
1:35,000
STOP 10
Tofty Road
Elliott Hwy.
RL063
RL061
RL062
RL070
STOP15
STOP 13
RL060
RL059
RL058
RL071
RL072
STOP 14
RL073
RL074
RL075
RL076


Stop Guide - Plate 7b
Trip Stops
Places associated with road log descriptions
Roads
Trails
0.9 0.45 0 0.9 Kilometers
0.8 0.4 0 0.8 Miles
1:63,360
STOP 12
RL064
RL065
RL066
RL067
RL068
RL069
Tofty Road
RIDGE
Cabin
Quartz Cr
Sullivan Cr
Tofty
Cabins
Miller Cr
Cache Cr
Little Denver Cr
Gold Basin Cr
Killarney
Irish Cr
1455
1836
VABM 2649