migratory bull trout prey on terrestrial and aquatic insects, macrozooplankton, mysids and small fish. Bull trout that are 4.3 inches long or longer commonly have fish in their diet (Shepard et al. 1984), and bull trout of all sizes have been found to eat fish half their length (Beauchamp and Van Tassell 2001).

Migration allows bull trout to move to or with a food source, access optimal foraging areas and exploit a wider variety of prey resources. Migratory bull trout begin growing rapidly once they move to waters with abundant forage that includes fish (Shepard et al. 1984). As these fish mature they become larger bodied predators and are able to travel greater distances in search of prey species of larger size and in greater abundance. In Lake Billy Chinook as bull trout became increasingly piscivorous with increasing size, the prey species changed from mainly smaller bull trout and rainbow trout for bull trout less than 17.7 inches in length to mainly kokanee for bull trout greater in size (Beauchamp and Van Tassell 2001).

Additional information about the bull trout's diet can be found in the final rule listing the bull trout as threatened published in the Federal Register (Fish and Wildlife Service 1999)

III. ENVIRONMENTAL BASELINE

Regulations implementing the Act (50 CFR §402.02) define the environmental baseline as the past and present impacts of all Federal, State, or private actions and other human activities in the action area. Also included in the environmental baseline are the anticipated impacts of all proposed Federal projects in the action area that have already undergone section 7 consultation, as well as the impacts of state and private actions which are contemporaneous with the consultations in progress.

A. Status of the Species in the Action Area

The Action Area for the Mine Project encompasses Bucktail Creek, Big Deer Creek, and Panther Creek, associated with the NPDES permit, as well as Williams, Moccasin, Deep, Panther, and Blackbird Creeks as related to the transportation of chemicals/reagents to and from the Mine Project (including road reconstruction work). The Mine Project is drained by Bucktail, Little Deer, and Big Flat Creeks. Bucktail Creek flows into South Fork Big Deer Creek, to Big Deer Creek, and on to Panther Creek. Big Flat and Little Deer creeks flow directly into Panther Creek. Figure 2 shows the locations of the above creeks in relation to the Mine Project.

Numbers of bull trout in the Panther Creek drainage are low and connectivity and interactions between resident populations in Napias and upper Deep creeks have been reduced or eliminated by migration barriers (Fish and Wildlife Service 1999). Connectivity among resident populations is unobstructed in other portions of the Panther Creek drainage (Fish and Wildlife Service 1999).

Big Deer Creek contains an impassable cascade/falls approximately 0.7 miles upstream from the confluence with Panther Creek that precludes fish migration. Fish population sampling in Big Deer Creek in 2001 (Kuzis 2004), 2003 (Stantec 2004), and 2005 (Ecometrix 2006,) and 2005 (Forest Service 2006) found only redband/ rainbow trout or cutthroat trout; no bull trout were

found. Additionally, researchers from Idaho State University conducted sampling in the Panther Creek watershed in 2004 and 2005; no bull trout were found in Big Deer Creek (E. Keeley, pers. comm. 2008). In general, there were very few fish downstream of the South Fork of Big Deer Creek. The lack of fish below the South Fork reflects the ongoing impacts of chemically contaminated water. The 2005 Forest Service survey crew sampled above and below the Big Deer cascade and found west slope cutthroat trout, above the falls, and rainbow trout in a presence /absence below the falls (Forest Service 2006). Big Deer Creek has the potential to be impacted by Mine Project operations.

The Big Deer Creek sub-watershed contains the South Fork Big Deer Creek and Bucktail Creek, both of which are located near the Mine Project site. This subwatershed has been impacted by historic mining activities. Waste Rock and tailings from the Blackbird mine site drain into Bucktail Creek which discharges chemically polluted water into the South Fork of Big Deer Creek; the copper and iron concentrations in Big Deer Creek below the South Fork have exceeded the lethal limits for most forms of aquatic life (Forest Service 1993). However, ongoing clean-up efforts and remediation activities including collection and storage of contaminated water from Bucktail Creek for treatment at the Blackbird Creek drainage collection pond have significantly improved water quality conditions. The IDEQ 303(d) list identifies Big Deer Creek from the confluence of South Fork Big Deer Creek to Panther Creek as water quality limited for sediment, pH, and metals. Bucktail Creek is on the 303(d) list from its source to its confluence with South Fork Big Deer Creek for metals contamination (IDEQ 2003). Bull trout have not been identified in S. Fork Big Deer Creek or Bucktail Creek.

Little Deer Creek is a second order stream draining the Mine Project which flows to the northeast into Panther Creek. There are no 303(d) water quality limited stream segments listed for Little Deer Creek (IDEQ 2003). However, the entire upper portion of the Little Deer drainage was severely burned in the Clear Creek fire. As a result during a storm event in October 2000 the Little Deer Creek channel destabilized and unraveled. Though potential bull trout habitat is present, no bull trout have been found during survey efforts.

Big Flat Creek is a 3 mile long second order tributary to Panther Creek which is the primary drainage from the Mine Project site. There are no stream segments for Big Flat Creek listed on the IDEQ 303(d) list. Big Flat Creek is a steep first order drainage with only occasional surface flows. Much of the creek below the Mine Project flows under rocks or flows subsurface with no surface connection to Panther Creek. Thus the creek contains no fish habitat, and thus, no bull trout.

Blackbird Creek is a second order tributary to Panther Creek flowing southeast for about nine miles. Blackbird Creek is on the Idaho DEQ 303(d) list from Blackbird Reservoir to its confluence with Panther Creek for sediment, pH and, metals contamination (IDEQ 2001). The area is undergoing a remediation cleanup with the EPA as the lead agency that includes removal of mill facilities, expansion of a water treatment facility, capping of waste rock, and removal of tailings from along streambanks and impoundments have been undertaken in recent years. Cleanup activities are still occurring and agreements between the agencies and companies are ongoing to meet cleanup goals. The habitat conditions in Blackbird Creek have historically been poor, due to chemical pollution, stream bank degradation, low pools and woody debris, and high

temperatures (Forest Service 1993). However, surveys completed in 2003 found juvenile Chinook salmon and bull trout in the lower 100 yards of Blackbird Creek indicating that conditions have improved significantly (Stantec 2004). Blackbird Creek has the potential to be impacted by Mine Project operation, as well as the transportation route for the Mine Project.

Williams Creek is tributary to the Salmon River near Salmon, Idaho. During the irrigation season the lower reaches of the creek may be dewatered although in some years there may be sufficient flow for fish passage (IDEQ 2001). Bull trout have been surveyed/identified in Williams Creek. Williams Creek has the potential to be impacted by the transportation route of the Mine Project.

Moccasin Creek is a first order tributary to Napias Creek. Bull trout were the only fish species sampled in Moccasin Creek during 2001 electrofishing surveys (Kuzis 2004). Moccasin Creek is part of the Napias watershed (HUC 1706020313) that has been designated in whole or part as a priority watershed in PACFISH/INFISH for bull trout fisheries recovery during section 7 consultation for amending the Salmon and Challis Forest Plan. A falls in Napias Creek, located about 0.5 miles from the mouth, may limit stream connectivity between bull trout population in the Panther Creek drainage. Moccasin Creek has the potential to be impacted by the transportation route of the Mine Project.

Deep Creek is a major tributary stream of the Panther Creek drainage. Deep Creek is part of the Deep-Moyer watershed (HUC 1706020314) that has been designated in whole or part as a priority watershed in PACFISH/INFISH for bull trout fisheries recovery during section 7 consultation for amending the Salmon and Challis Forest Plan. Bull trout have been surveyed/identified in Deep Creek. The transportation route for the Mine Project parallels the lowest 4.2 miles of Deep Creek.

B. Factors Affecting Species in the Action Area

The Panther Creek watershed is being impacted by several factors including non-compliance with grazing standards to alterations of stream channels by agricultural practices, water withdrawls, and diking (Fish and Wildlife Service 2002). Roads are also encroaching on the floodplains of several creeks within the watershed, as well as Panther Creek itself. This causes increased peak flows, reduced off-channel habitat, and elevated sediment loads; resulting in degraded bull trout habitat (Fish and Wildlife Service 2002).

The Blackbird Mine continues to release contaminants into Blackbird, Big Deer, the South Fork of Big Deer Creek, and Panther Creek; chemicals include copper, arsenic, cobalt, and iron. Downstream of the Blackbird Mine discharge in Blackbird Creek there is an absence of aquatic life, including bull trout. The Blackbird Mine Site Group is currently working on remediation activities at the site in response to a Comprehensive Environmental Response Compensation and Liability Act (CERCLA) action at the site. Clean-up goals are being met in some areas, and are working towards attainment in others. Fish, including bull trout, are beginning to reoccupy portions of the Blackbird Mine impact area where they once avoided (Fish and Wildlife Service 2002).

Migration barriers also impact bull trout within the Panther Creek watershed, as does seasonal dewatering. Williams Creek (along the transportation route for the Mine Project) is separated from the mainstem Salmon River by season dewatering (Curet, *in litt.* 2001).

IV. EFFECTS OF THE PROPOSED ACTION

Effects of the action are defined as "the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with the actions, that will be added to the environmental baseline" (50 CFR §402.02).

A. Direct and Indirect Effects

1. Direct Effects

Direct effects are defined as the direct or immediate effects of the action on the species or its habitat. Direct effects result from the agency action, including the effects of interrelated and interdependent actions.

Direct effects to bull trout from the Mine Project would occur from water quantity changes in Bucktail Creek from mine dewatering; hazardous material spills from transportation of chemicals to/from the Mine Project; water quality impacts from the NPDES outfall on Big Deer Creek; riparian disturbance for discharge pipeline construction and cable car crossing construction; and, changes in sedimentation to streams from ground disturbance, road construction and increased traffic, including decreased long term sediment delivered to streams due to road improvements.

Water Quantity

The mine dewatering process would alter groundwater flow and is expected to reduce the groundwater inputs into Big Flat and Bucktail Creeks causing reduction of flow into the South Fork of Big Deer and Big Deer Creeks. Data indicates that bull trout are not present in Big Flat, Bucktail, or S. Fork Big Deer creeks (see Status of the Species section of the Opinion for more details); therefore, reductions in baseflows to those creeks would not impact bull trout. Predicted changes in baseflow of Big Deer Creek and Panther Creek due to the Mine Project are a 1% flow reduction during operation and 0% flow reduction post closure for Big Deer Creek, and 0% flow reduction both during operation and post-closure for Panther Creek. Based on the multiple surveys conducted for bull trout in Big Deer Creek, as outlined in the Status of the Species section of this Opinion, and that no bull trout have been found, and the fact that there is an impassable cascade near the mouth of Big Deer Creek, the Service considers Big Deer Creek to be unoccupied by bull trout. Therefore, it is the Service's position that impacts due to water quantity are not likely to adversely affect bull trout. Likewise, as there are no predicted changes in baseflow expected for Panther Creek, there would be no impacts to bull trout from water quantity in Panther Creek.

Chemical Transportation

The direct and indirect effects of a hazardous materials spill on bull trout are determined by characteristics of the material, life stage of bull trout, time of year, and the environment. Material characteristics which influence the effects of a spill include the toxicity of the substance that could be spilled, the chemical form (i.e., gas, solid, liquid), the environmental fate if spilled (e.g., persistence, bioaccumulation, etc.), the quantity of the material spilled, and the physical and chemical properties of the material such as solubility and volatility. Some of the environmental characteristics that influence the effects of a spill include stream temperature, pH, stream velocity, volume, gradient, and the proximity of the spill to surface water. The soil absorption and neutralization rates at the spill site also influence the effects of a hazardous materials spill. The effects of a spill can be reduced if the response time to the spill site is rapid, the response team is well trained, and effective mitigation measures are used to contain and treat the spill.

When looking at effects to bull trout from a spill, the Service is assuming a worst-case scenario based on the highest probability for a spill to occur (based on frequency and quantity of shipments) and the toxicity of chemicals being transported. If a spill occurred, it could impact bull trout directly through lethal or sub-lethal effects, or indirectly by reducing prey base and/or degrading habitat. All of the streams located along the transportation route for the Mine Project are occupied by bull trout (Williams, Moccasin, Deep, Panther, and the lower portion of Blackbird Creek); additionally, they all contain suitable habitat for bull trout spawning and/or rearing.

A hazardous material spill that reaches toxic levels in Williams Creek (tributary to the Salmon River) may or may not reach the Salmon River. Whether or not the Salmon River is affected would be influenced by the time of year of the spill, the amount of spilled material, and the amount of surface water in the lower portion of the stream. On low water years, lower Williams Creek may be completely de-watered for irrigation during the growing season. If a spill were to occur during this time, the toxic materials are unlikely to be transported to the Salmon River. The Salmon River is occupied by bull trout.

Accident probabilities were calculated based on Forest data of accidents per vehicle mile (Forest Service 1997) and is described fully in Section 7.2.3.2.1 and Table 7-2 of the Assessment. Basically, calculations indicate that four of the 19 chemicals to be transported to/from the Mine Project have an accident probability of once in less than 200 years (with the greatest probability being once every 9 years). All others have an accident probability of once every 300 years or greater (all the way up to once every 6,220 years). The materials with the highest accident probability are bulk concentrate (once every 9 years), diesel/gasoline/oils/lubricants (typically shipped on the same truck; 41 years), cement (54 years), and ammonium nitrate (156 years). That being said, there is a lower probability than those provided above of an accident *that involves a spill* into an occupied bull trout stream (based on the shipping container, form of the material, etc), and that is discussed more fully in the following paragraphs.

Based on several factors (amount of material transported, form of material, and durability of the shipping container) the Assessment indicated diesel, gasoline, and antiscalant fell into the category of high risk of release during a spill event.

Toxicity hazard ratings provided in the Assessment were derived using information from the literature (EPA Ecotox database, MSDS sheets, and independent refereed literature), and using the 96-hour LC_{50} (lethal concentration where by 50% of the test subjects died following a 96-hour exposure) for salmonids and/or freshwater aquatic species. Results of the calculations indicate sodium sulfide and Super FLOC^{tm} are highly toxic (copper sulfate also fell into the highly toxic category, although a modification to the Mine Project Plan of Operations removed copper sulfate from the ore processing step and therefore will not be used).

Based upon the volume of materials and frequency of transportation to the Mine Project, as provided in the Assessment, the materials with the probability of an accident near a stream of less than once in 100 years are bulk concentrate and cement. Based upon the spill analysis, the materials with the highest probability of a release in the event of an accident are diesel and gasoline, and antiscalant. Additionally, the most toxic materials identified that would be transported are sodium sulfide and Super FLOC^{tm}. Generally the spill analysis indicated that the materials with the highest probability of accidents are generally less toxic, and the more toxic materials have much lower accident probabilities (Table 2).

Table 2: Materials selected for toxic effect analysis (taken from the Assessment).

	Years between Accidents near Streams	Spill Risk	Toxicity
Gasoline	40	High	moderatly toxic
Diesel	40	High	slightly toxic
Anitscalant	1244	High	not acutely toxic
Bulk Concentrate	9	Low	insoluable – not toxic
Cement	54	Low	slightly toxic (pH)
Sodium Sulfide	1244	Low	highly or moderately toxic depending on source
Super Floc	2073	Low	highly toxic

As specified in the Assessment, the potential effects of a spill were evaluated based on the toxic thresholds for each material and the streamflows in the adjacent and downstream receiving waters, to determine the quantity of material necessary to reach the predicted toxic concentration in a one minute spill. Streamflows used in the calculation were based on average minimum low flows in order to take the most conservative approach. Table 3 describes toxicity thresholds for those materials with a high spill risk and/or are of high toxicity.

Quantities of gasoline displayed in Table 3 that would be required to reach toxic concentrations range from less than 1/100th of a gallon in Williams, Moccasin, Blackbird and Deep Creeks to two gallons in the Salmon River, depending on the chemistry of the gasoline and which reach of the river is impacted.

Table 3 shows that a spill of less than 20 gallons of diesel would likely cause toxicity to aquatic organisms in Williams, Moccasin, Blackbird, Deep, and Panther Creeks. In the Salmon River

below Panther Creek the Assessment estimates as little as 75 gallons would be toxic. Effects from petroleum spills on fish include disruption of oxygen uptake at the gill interface (suffocation), physical coating, and ingestion of product. In addition, if the chemical is absorbed into the sediments, there is also potential for continued release to the water column and subsequent impacts to aquatic organisms over time.

As with all chemicals to be transported to the Mine Project, the Assessment projects that toxic concentrations would be reached with the smallest volume of spilled materials in Moccasin Creek, due to the low baseflows in this stream. For the antiscalant, this would amount to a volume of only 1 gallon released into Moccasin Creek. In contrast, a release of 726 to 1349 gallons would be required to yield toxic concentrations of antiscalant in the Salmon River below the confluence of Williams and Panther creeks, respectively. Table 2 outlines the quantity of material spilled into or transported to a stream that would reach the toxic threshold.

Table 3. Toxic thresholds for key materials at risk of release in the event of a one minute spill (taken from the Assessment).

			Moccasin Creek	Blackbird Creek	Williams Creek	Deep Creek	Panther Creek below Blackbird Creek	Salmon River below Williams Creek	Salmon River Below Panther Creek
Low Flow cfs			*1*	*2.5*	*3*	*4.1*	*20*	*700*	*1300*
Material	**Toxicity (mg\l)**								
LIQUIDS									
Gasoline	2.7	gallons	0.002	0.004	0.005	0.006	0.031	1.102	2.046
Diesel	18		0.01	0.02	0.03	0.04	0.20	6.98	12.97
Diesel	25		0.01	0.03	0.04	0.06	0.28	9.70	18.01
Antiscalant	2660		1.04	2.60	3.11	4.26	20.76	726.76	1349.70
SOLIDS									
Cement	92	lbs	0.34	0.86	1.03	1.41	6.89	241.22	447.98
Ammonium Nitrate	8.01		0.03	0.08	0.09	0.12	0.60	21.00	39.00
Sodium Sulfide, Hydrated	0.55		0.000005	0.0052	0.0062	0.0084	0.041	1.44	2.68
Superfloc	0.22		0.0008	0.0021	0.0025	0.0034	0.0165	0.58	1.07

The bulk concentrate will be the most transported material from the Mine Project; however, steel roll off containers with locking lids will be used to ship the concentrate. This material has a low spill risk because it is a solid and with the low solubility is unlikely to be toxic unless left exposed to air for an extended time period.

According to the analysis provided in the Assessment, aquatic spill hazards of cement would be more likely associated with effects on physical habitat if not quickly removed, rather than acute toxicity, as the acute toxicity hazard rating is 'slightly toxic'. Spills of cement could increase the

pH significantly, which could result in high levels of mortality to aquatic organisms and physical habitat alteration from hardening of the activated cement in the streambed.

Ammonium nitrate (ANFO) would be mixed on site at the mine with diesel fuel to produce a commercial grade explosive used for blasting rock in the mine pits. It would be hauled to the mine approximately four times per month as a dry bulk product. Given this low frequency of transport and the fact that it will be shipped as a dry bulk product, there is less probability an accident would occur, as well as a low risk of a spill based on the transport method (container type). The toxicity level for ANFO was derived from studies conducted with rainbow trout and solutions of ammonium and nitrite, the intermediate product of ammonia oxidation. As stated in the Assessment, the quantities of ANFO that could cause toxic concentrations are in the range of 0.1 pounds in Moccasin Creek, and in the range of 1 to 39 pounds for the Salmon River, depending on the duration of the release and which reach of the river is impacted.

Sodium sulfide has a low accident probability near streams (2,073) and will be shipped dry in 50 lb sacks giving it a low spill risk if there is an accident near a stream. The toxicity ranged from highly to moderately toxic depending on which toxicity source is used. The manufacturer's MSDS data sheet listed a toxicity of 0.55mg/l for *Brachydanio reri.* (zebra fish). At this level it would require less than one pound of material to create toxic conditions in the small creeks and 1 to 2 ½ pounds to create toxic conditions in the Salmon River.

The flocculent that is used at mill in the processing would be a dry cationic polyamide, hauled as a dry bulk product in 50 pound sacks and therefore would have a low risk of release into streams in the event of an accident. Because of its infrequent delivery it has a very low accident probability of once every 2,073 years for locations along the haul route that could result in a spill reaching a stream. According to the material safety data sheet provided by the supplier (CYTEC) the 96 hour static acute LC_{50} for rainbow trout is 0.22 mg/l. Quantities of flocculent that could cause toxicity are low; less than $1/1000^{th}$ of a pound in the small creeks to about 1 pound for the Salmon River below Panther Creek, depending on the duration of the spill and which reach of the river is impacted.

As part of the Plan of Operations, FCC has developed and will implement a Spill Prevention and Response Plan. The Plan outlines transportation requirements that must be adhered to while transporting all fuel, reagents, and concentrates and should include, but are not limited to:

- All shipments of fuel, reagents, and concentrates shall be accompanied by a pilot vehicle that will be in radio communication with the truck and the mine site at all times.
- All transport vehicles transporting fuel, reagents, and concentrates shall carry a copy of the Spill Prevention and Response Plan in the vehicle, as well as the necessary equipment for 'first response' actions to control a spill.
- Transportation of fuels and reagents is allowed only during daylight hours.
- Maximum speed on Forest roads is 30 miles per hour, unless otherwise posted, and would be adhered to.

Full details on the transportation of fuels and chemicals and on-site handling and storage of fuels and chemicals can be found in FCC's Spill Prevention and Response Plan (FCC 2002).

Affects of Chemical Transportation

Based on accident probability data collected for the Forest, the chance of an accident with a spill into a stream occupied by bull trout is expected to occur once within 40 years (based on the most likely scenario of a spill), all the way out to once within 2073 years (based on the least likely scenario). The life of the Mine Project is expected to be 16 years (including construction, operation, and reclamation). As such, an accident with a spill into an occupied bull trout stream is not expected within the life of the Mine Project. Thus adverse affects to bull trout are not anticipated based on the implementation of the Mine Project as outlined in the Assessment.

NPDES Permit

The draft NPDES permit contains discharge limitations for 16 potential pollutants: eight metallic elements, arsenic (a metalloid), ammonia, sulfate, sulfide, total suspended solids (TSS), pH, dissolved oxygen, and temperature (Table 4). The discharge point (Outfall 001) is proposed for Big Deer creek, approximately 1,500 feet downstream from Southfork Big Deer Creek. Panther Creek lies approximately 3.0 miles downstream from the outfall, with an impassable cascade located in Big Deer Creek approximately 0.7 miles from the confluence of Big Deer and Panther Creeks (i.e., 2.3 miles downstream from the outfall). A mixing zone is not being requested as part of this permit, with the exception of sulfate. For all other constituents, water quality criteria will need to be met at the discharge point (i.e., end of pipe).

Arsenic

Arsenic occurs naturally in the environment. It is bioaccumulated by organisms but is not biomagnified through the food chain (Eisler 1988). Toxic effects of arsenic to aquatic life are significantly modified by numerous biological and abiotic factors such as water temperature and hardness, pH, organic content, phosphate concentration, suspended solids, etc. (Eisler 1988). This is particularly important in the Panther Creek watershed if land management activities (e.g. grazing) decrease riparian shading of streams resulting in increasing water temperatures. Sublethal effects including anemia, gallbladder inflammation, and liver degeneration were observed in salmonids at dietary concentrations of 43.1 - 60 µg/g (Eisler 1988). These changes may in turn result in altered feeding behavior, reduced body weight and reproductive success, and survival. Additionally, concentrations of 40 - 42 µg/l were associated with onset of mortality of rainbow trout embryos after 30 days post-hatching exposure (Birge *et al.* 1979, 1981).