Appendix E

PHS Biological Assessment

BIOLOGICAL ASSESSMENT

Assessing Impacts to Chinook Salmon, Cutthroat Trout and Steelhead Trout

Prepared for:

Multnomah County
Kim Peoples, Land Use Planning Division
1600 SE 190th Avenue
Portland, OR 97233

Prepared by:

Pacific Habitat Services, Inc.
9450 SW Commerce Circle, Suite 180
Wilsonville, OR 97070
Phone: 503-570-0800

John van Staveren
Gregg Lomnicky, Ph.D.
Patricia Farrell
Dan Averill

July 24, 2002

TABLE OF CONTENTS

1.0 INTRODUCTION

This Biological Assessment (BA) addresses the potential effects of expanding the existing Howard Canyon Quarry currently operating in rural east Multnomah County on species currently listed or candidates proposed for listing under the federal Endangered Species Act (ESA) and the State of Oregon's ESA. The quarry is within an approximately 33-acre property on the border of the watersheds of Howard Canyon Creek and Knieriem Creek/Ross. The property is south of Knieriem Road, east of Littlepage Road, and north of Louden Road and is illustrated on Figure 1.

Knieriem Creek and Howard Canyon Creek converge east of Littlepage Road to form Big Creek. Big Creek continues to flow to the west for approximately 4,000 feet where it plunges over an approximately 80-foot high water fall and joins the Sandy River. The drainage area of all of three creeks, which are designated by the Oregon Department of Fish and Wildlife (ODFW) as Class 1 streams, is approximately 4,134 acres.

A list of the species potentially affected by the quarry expansion is included in Table 1.

Table 1. Federal ESA Status of Species Found in the vicinity of the proposed Howard Canyon Expansion area

Species	Scientific Name	Evolutionarily Significant Unit (ESU)	Federal Status	Listing/ Proposal Date
Steelhead Trout	*Oncorhynchus mykiss*	Lower Columbia River	Threatened	March 13, 1998
Coastal Cutthroat Trout	*Oncorhynchus clarki clarki*	Southwest WA/Columbia River	None***	
Chinook Salmon	*Oncorhynchus tshawytscha*	Lower Columbia River	Threatened	March 16, 1999
Coho Salmon	*Oncorhynchus kisutch*	Lower Columbia River/Southwest WA	Candidate to Propose as Threatened	July, 1995

* Steelhead and coho salmon are under the jurisdiction of the NMFS. Coastal cutthroat trout are under the jurisdiction of the US Fish and Wildlife Service (USFWS).

** The state of Oregon has classified steelhead trout stocks, coastal cutthroat trout, and lower Columbia River coho salmon as Sensitive Species of Critical Concern under the Oregon ESA.

*** On June 26, 2002, the US Fish and Wildlife Service determined that the southwestern Washington/Columbia River population of coastal cutthroat trout does not need ESA protection. This determination was based on a review of population data that showed that in a large portion of the southwestern Washington/Columbia River area cutthroat trout populations are relatively robust and the offspring of freshwater populations are likely able to become anadromous. Consequently, the US Fish and Wildlife Service concluded that coastal cutthroat trout in this population segment are not likely to become endangered in the foreseeable future.

The 80-foot high waterfall in Big Creek precludes passage by Chinook salmon and steelhead trout from the Sandy River. As such, these species do not inhabit Big Creek, Howard Canyon Creek or Knieriem Creek. However, these creeks do provide habitat for resident cutthroat trout.

Although the waterfall restricts anadromous fish from entering the three creeks, the quality of water in the creeks still influences the quality of anadromous salmonid habitat in the Sandy River. For example, downstream of the confluence of the Sandy River and Big Creek are spawning gravels. These gravels could be negatively effected by changes in water quality stemming from riparian degradation or instream impacts to the three creeks. If the degradation of spawning gravels is directly associated with activities stemming from the operation of the quarry, the NMFS could view the action as a "take," as defined within the ESA. The impacts to the spawning gravels may be perceived as significantly modifying or impairing essential behavioral patterns (e.g. spawning). Section 9 of the ESA makes it unlawful to "take" a protected species.

Although no specific mining plan was reviewed for this BA, an assessment of the potential effects of mining within the watersheds was conducted. This report includes an assessment of the current quality and quantity of riparian habitat along the three creeks and an assessment of the in-stream habitat and fish presence within the three creeks. This information was used to determine the environmental baseline of the watershed. Potential impacts from expanding the proposed quarry were weighed against how the environmental baseline could be affected by the mining operation. Proposed conservation measures to ensure that the environmental baseline is not adversely affected are included.

2.0 PROJECT BACKGROUND

In 1996, Multnomah County completed the Howard Canyon Reconciliation Report (HCRR), which addressed natural resource, residential farm, and transportation impacts of a mining operation in the Howard Canyon Quarry. The HCRR assessed and evaluated the Economic, Social, Environmental and Energy consequences (ESEE analysis) of a small-scale aggregate rock mining operation in the quarry. Based on the best available information at the time, the County's ESEE analysis concluded that the impacts from such a mining operation were acceptable and that the quarry should be designated as a protected resource for extraction.

The HCRR assesses three natural streams that surround and drain the Howard Canyon Quarry site: Big Creek, Knieriem Creek and Howard Canyon Creek. Knieriem Creek and Howard Canyon are the closest streams to the mine and join to form Big Creek, which flows into the Sandy River. All three streams have been designated by Oregon Department of Fish and Wildlife as Class 1 "significant" streams. Multnomah County has designated these streams as significant Goal 5 resources. The final conclusion of the HCRR was that all three streams were or could be adequately protected from impacts from the proposed quarry operations.

In 1998, the National Marine Fisheries Service (NMFS) declared the Lower Columbia River Steelhead as a threatened species under the federal Endangered Species Act (ESA). The listing included populations inhabiting east Multnomah County living in the Sandy River.

In 1999, NMFS listed as threatened eight additional salmon populations under the ESA, including fall run Chinook Salmon, which inhabits east Multnomah County including the Sandy River. Soon thereafter, NMFS identified and officially designated the critical habitat that was required for the long-term survival for these species. In early 2002, the NMFS withdrew the critical habitat designation for 19 salmon and steelhead populations (including those in the Sandy River) pending a review of the economic impacts on affected businesses, communities, and individuals. However, salmon and steelhead trout habitat remains protected by the essential fish habitat provisions of the Magnusson-Stevens Act. The designation of the designation of fish stocks under the ESA and through the Magnusson-Stevens Act gives federal protection to these species and the habitat upon which they depend to live, feed and reproduce. The Sandy River basin, consisting of the Sandy River mainstem and its larger, fish-bearing tributaries, were included in this critical habitat designation for the endangered Steelhead and fall Chinook Salmon.

In response to changes in the assumption about the size and methods of the quarry operations and to the ESA listing for the Sandy River, Multnomah County is up-dating the HCRR. This update will result in an amendment to the County's Comprehensive Plan policies as they apply to this site.

3.0 EVALUATION METHODS

The information presented in this BA is based on site visits, a review of the proposed mining concept, discussions with the ODFW, the County, and a literature review.

Factors considered in the preparation of this BA include the species' dependence on specific habitat components that could possibly be removed or modified, the abundance and distribution of habitat and habitat components in the vicinity of the quarry, distribution and population levels of the species (if known), the degree of current impact to habitat, and the potential to mitigate or avoid any adverse effects of the mining operation.

The methods outlined in *Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Watershed Scale* (NMFS 1996) were used to analyze the potential for quarry expansion on water quality and instream and riparian habitat quality. The strategy outlined in this document is to determine the environmental baseline for the watershed, discuss how the proposed action (i.e. quarry expansion) would affect the environmental baseline, and then use that information to determine the potential effect of the expansion on listed species.

4.0 FISH PRESENCE WITHIN THE SANDY RIVER AND ITS TRIBUTARIES

The quarry falls within the boundaries of the Lower Columbia ESUs (Evolutionary Significant Units) for Chinook salmon (*Oncorhynchus tshawytscha)*, coho salmon, chum salmon and steelhead trout (*Oncorhynchus mykiss*) and the SW Washington/Columbia River ESU for coastal cutthroat trout (*Oncorhynchus clarki clarki*). Chinook salmon, coho salmon, chum salmon, and steelhead trout are under the jurisdiction of NMFS. Coastal cutthroat trout is under the jurisdiction of USFWS. Since chum habitat is not considered available in the Sandy River (NMFS, Federal Register), they will not be considered in this report. The state of Oregon has classified steelhead trout stocks, coastal cutthroat trout, and the lower Columbia River runs of Chinook and coho salmon as Sensitive Species of Critical Concern.

4.1 Documented fish within the Sandy River and its tributaries

The Sandy River mainstem and its fish-bearing tributaries are known to provide habitat for Lower Columbia River (LCR) Evolutionarily Significant Unit (ESU) of steelhead trout and Chinook salmon, both listed as threatened by the NMFS (FR 63(53):13347, FR 64(56):14308), the LCR/Southwest Washington (LCR/SW) ESU of coho salmon (candidate species since 1995, FR 60(142): 38011), and the Southwestern Washington/Columbia River (SWCR) ESU of the coastal cutthroat trout, which has been proposed for listing as threatened since March, 1999 (FR 64(64):16397).

The LCR steelhead and Chinook ESUs include the Sandy and Hood River basins and the Lower Willamette (to Willamette Falls). LCR/SW coho salmon range from the Deschutes basin and the Lower Willamette (to Willamette Falls) to Pt. Grenville on the Washington Coast. The SWCR coastal cutthroat trout ESU encompasses the Columbia River and its tributaries downstream from Fifteenmile Creek, and the Willamette River downstream of the Willamette River Falls.

Previous surveys for fish by the ODFW indicate that resident rainbow trout (*Oncorhynchus mykiss*) and mountain whitefish (*Prosopium williamsoni*) presently also occur in the Sandy River mainstem (Murtagh, 1997). Other fish found in the lower mainstem include the American shad (*Alosa sapidissima*), and Eulachon (*Thaleichths pacificus*).

4.2 Results of fish survey within the Howard Canyon Creek, Knieriem Creek and Big Creek

Where property access was granted, a backpack electroshocker (Permit No. OR2002-400 issued by the ODFW) was used to assess the presence of fish in Knieriem Creek, Howard Canyon Creek, and Big Creek. The survey was conducted in a downstream direction. The upper reaches of Knieriem Creek and Howard Canyon Creek were assessed first. Big Creek near Littlepage Road was surveyed last. The survey was conducted in February 2002, in cool weather (approximately 50°F) between the hours of approximately 9am to 3pm. The survey determined that only two fish taxa: cutthroat trout and a sculpin species tentatively identified as the reticulate sculpin (*Cottus perplexus*), reside in the three creeks. A Pacific Giant salamander (*Dicamptodon tenebrosus*) was also collected.

Multiage classes (based upon length relationships) of both cutthroat trout and sculpins were found in Howard Canyon Creek and Big Creek. Only sculpins were found in lower Knieriem Creek. The numbers of fish found through the survey were relatively low. All fish appeared in good health with no obvious anomalies including sores, fin rot, or parasites. Collected fish were revived in buckets, identified, enumerated, measured and returned to the streams.

5.0 SALMONID LIFE HISTORIES

5.1 Coho Salmon

Coho naturally exist along the Pacific Coast from Monterey Bay, California northward to Point Hope, Alaska. (Scott and Crossman, 1973). Historically, coho were probably found in most coastal streams. The species is also found in northeast Asia from the Anadyr River south to Hokkaido, Japan.

Coho salmon, like other Pacific salmon, spawn in freshwater, migrate to the ocean as juveniles, and feed until reaching sexual maturity. The fish then return to their natal stream to spawn and die. Adults typically initiate their freshwater spawning migration in late summer to early fall, and spawn by midwinter. Spawned out adults die soon afterward. Specific upriver migration and spawning times vary by river and stock (groups of fish that are genetically self-sustaining and reproductively isolated either geographically or temporarily). Incubation of the eggs in redds (nests made in gravel that consist of a depression dug by the spawning adult fish for egg deposition and then filled to take on a hummocky appearance) takes 1.5 to 4 months depending upon stream temperature. Hatched out alevins, with yolk sac still present, remain in the interstitial gravel space until the yolk sac is absorbed. These juveniles emerge from the gravel and begin to feed for the next 15 months. As juveniles begin the physiological transformation of smolting in preparation for existence in saltwater, they migrate downstream to the ocean. They spend two growing seasons in the ocean before returning as adults to spawn. A small number of early maturing males, (jacks), return after a single season (six months) at sea.

Coho stocks returning to the Sandy River and its tributaries form two runs in the basin. There is an early run hatchery stock and a wild run of coho salmon. Sandy River early run hatchery coho are developed from native Sandy River stock and are released into the river from the Sandy hatchery near river mile (RM) 22. The wild fish, a late returning stock, historically migrated into the Sandy River from October to February with spawning occurring from November to February. However, hatchery influences appear to have influenced run timing and fish now return primarily in September and October. After analysis of coho run size, migration timing at Marmot dam (RM 30), which is upstream of the project site, and spawning ground surveys and scale analysis, ODFW biologists determined that a stable but depressed wild coho population still exists that continues to reproduce naturally in the basin (Murtagh, 1997).

5.2 Chinook Salmon

Chinook salmon have much more diverse life histories than do coho salmon (Groot and Margolis, 1991). The fish are divided into two races, including spring and fall run races, also called runs or stocks, which are distinguished by river entry time. Stocks heading far upstream tend to arrive earlier than coastal run stocks. Within a race, further life history variation occurs, which spreads the risk of an environmental event threatening the existence of the species. For example, juveniles of a given year class may smolt immediately and go to the ocean, while other juveniles may spend 2 to 3 years living in freshwater before smolting.

In Oregon, fry generally spend a few weeks before heading to the ocean though a small percentage is known to overwinter before heading to the ocean. Sub-adults may spend 6 months to 5 years maturing in the ocean before returning to their natal river to spawn. If a catastrophic flood were to dislodge and destroy all eggs of a particular stock one year, the spreading of risk through life history variation would allow fish of that stock born in previous years to continue the existence of that stock.

Both spring and fall run Chinook salmon exist in the Sandy River. Spring run fish enter the river in the spring, while fall run Chinook enter the river during the late summer. Egg incubation typically occurs from November through February. During the spring, fry emerge from the gravel. Historically, between 8,000 to 10,000 wild spring Chinook may have once returned to the Sandy basin (Mattson 1955 in Murtagh 1997). Presently, management goals are to maintain an escapement of 2000 fish, including a minimum of 300 wild fish (Murtagh 1997), at Marmot dam which is upstream of the project site.

Indigenous fall Chinook can be divided into two groups (early maturing and later maturing Sandy stock). The later maturing stock, returns from December to early February, but in recent years the run has all but disappeared. The early-run fall Chinook return to the river from August until November.

Most fall Chinook juveniles emerge from the gravel in the spring and soon begin their gradual migration to the ocean, feeding in side channels and other food rich areas along the way. A very small percentage are thought to have a life history of overwintering like coho before heading to the ocean. Those that do overwinter utilize backwater habitats off the mainstem river during the winter to avoid the current of flood flows. Spring Chinook juveniles typically overwinter and migrate as 1+ (one year plus) individuals.

5.3 Cutthroat Trout

Coastal cutthroat trout (*O. clarki clarki*) are found within the entire Sandy River basin, and are the most common trout species in the basin (Murtagh, 1997). They have a generalized life history similar to other salmonids. Spawning occurs in the late winter to early spring. They are typically predacious, have long life spans (up to 10 years), and like cutthroat trout in general, are vulnerable to overexploitation by angling (Behnke, 1992). The species is also considered to be highly vulnerable to the consequences of logging activities (Behnke, 1992). Thus, increased sedimentation, reduced cover, and greater maximum water temperatures are all factors that may depress cutthroat trout populations. Both anadromous and resident forms exist in the Sandy River basin. Anadromous runs numbers are presently very low (Murtagh, 1997) just as they are for other lower Columbia River tributaries.

5.3.1 Coastal Cutthroat Trout

Coastal cutthroat trout (both migratory and resident forms) in the Big Creek/Howard Canyon watershed are part of the Southwest Washington/Lower Columbia River ESU. This ESU was proposed for listing as threatened under the Federal Endangered Species Act in April 1999 (64 FR 16397). A final listing decision was due in April 2000 but was postponed for 6 months to allow the USFWS time to obtain and review new scientific data to resolve disagreement about the status of the population (65 FR 20123). The USFWS planned to issue a decision on the proposed listing in October 2000; however, no ruling on the proposed listing has yet been made.

Coastal cutthroat populations exhibit four life history types. These various types represent the most complex life histories of any salmonid in Oregon. Resident (non-migratory) cutthroat trout occur in small headwater streams and exhibit little instream movement. Fluvial populations undergo in-river migrations between small spawning tributaries and mainstem rivers sections downstream, similar to ocean migrations of sea-run cutthroat trout. Adfluvial populations migrate between spawning tributaries and lakes. Anadromous or sea-run populations generally migrate to the ocean (or estuary) for less than a year before returning to freshwater. The migratory form does not typically over-winter in the ocean, and forays to the sea appear only rarely to include traversing long distances. Most cutthroat remain within 10 kilometers (6 miles) of the coast. A few have been found up to 80 kilometers (50 miles) offshore (64 FR 16397). Anadromous cutthroat trout either spawn during the first winter or spring after their return, or they undergo a second migration before maturing and spawning in freshwater.

ODFW and Washington Department of Fish and Wildlife have presented evidence that non-migratory forms of this species can produce migratory offspring (64 FR 16397). However, while the occurrence of this recruitment may buffer declines in migratory populations, it has not demonstrated the ability to offset them. Reductions in migratory populations threaten to isolate genetic stocks and increase the extinction potential of the species.

5.4 Steelhead Trout

Steelhead (*Oncorhynchus mykiss*) in the Sandy River watershed are part of the Lower Columbia River ESU that was listed as threatened in March (63 FR 13347). Adult winter steelhead in this ESU typically enter the river systems starting in November through the end of March; peak entry is January and February. The adults spawn soon after entering. The fry emerge from April through July, and then rear in fresh water for one to three years (Busby et al. 1996). The fish smolt in the spring and emigrate downstream from March through June during high spring flows.

Steelhead trout, *Oncorhynchus mykiss,* have two distinct life histories, anadromous (steelhead) and freshwater resident (rainbow or redband trout). Anadromous juveniles rear in freshwater and then migrate to marine waters for a period of growth after which they return to freshwater to spawn. Resident life history types spend their entire lives in freshwater. The following life history description focuses on the anadromous life history form. Freshwater habitat requirements are similar for both anadromous and resident life history types.

Anadromous steelhead can be divided into two reproductive ecotypes, based on the adults' levels of sexual maturity at the time of freshwater entry and duration of their spawning migration. These two ecotypes are termed "stream maturing" or "summer" steelhead and "ocean maturing" or "winter" steelhead. Summer steelhead enter freshwater as sexual immatures during the summer months and require several months of maturation prior to spawning. Winter steelhead enter freshwater ready to spawn in late winter or early spring (NMFS 1996). In the Sandy, winter fish are native and summer steelhead have been introduced from Skamania River stock (Murtagh 1997). It is debated that there may have been a small native summer run present.

Winter steelhead begin migrating to the Columbia River and their natal tributary streams in December and January. Summer steelhead begin their migration and entry into freshwater during June or July, overwintering in freshwater until they spawn in late winter to early spring. In the lower Columbia River ESU, most steelhead spawning occurs from March through May (WDF *et al.* 1993).

Unlike most species of *Oncorhynchus*, steelhead are capable of spawning multiple times (NMFS 1996). Preferable spawning habitat includes streams with cool, clear, and well oxygenated water. Water depths typically range from 10 to 137 cm (4 to 54 in); with water velocities ranging from 5 to 13 cm/s (2 to 5 ft) per second. Optimal gravel sizes range from 0.6 to 23 cm (0.25 to 5 in) in diameter (Barnhart 1991). After spawning, spent steelhead (kelts) that have survived the process outmigrate back to ocean waters. For steelhead populations north of Oregon, repeat spawning is relatively uncommon, and more than two spawning migrations are rare. In Oregon and California, the frequency of two spawning migrations is higher (up to 10%), but more than two spawning migrations is unusual (NMFS 1996).

Steelhead eggs hatch in about four to seven weeks depending on the water temperature (Scott and Crossman 1973). The young alevins remain in the gravel until their yolk sac is depleted (usually from two to five weeks). Upon emergence from the gravel, steelhead fry form schools and inhabit the margins of the stream until they become stronger swimmers (Barnhart 1991). Natural rearing of steelhead typically lasts two years prior to ocean migration, although some juveniles smolt after only one year or as much as seven years (Busby et al. 1996). Summer rearing is typically spent within riffle habitat, whereas pools are preferred during winter months. (Wydoski and Whitney 1979).

Steelhead smolts begin their outmigration in late April through June, typically with spring "runoff". In the Sandy river, smolt outmigration occurs from April through June with a peak in May (Murtagh et al. 1997) Outmigrants typically measure between 120-180 mm in length and can take as long as two to three months to move downstream to the estuary (Wydoski and Whitney 1979).

Not much is known about the saltwater phase of steelhead development. Due to their extensive freshwater residence, steelhead smolts do not spend an appreciable amount of time in the estuarine areas, but rather move directly into deeper, open water. In the ocean, steelhead feed heavily on a variety of organisms, especially juvenile greening, squids, and amphipods. They are in turn preyed upon by other fish and marine mammals (Barnhart 1991). Steelhead predominantly spend 2 years at sea before returning to spawn in fresh water but may spend anywhere from 1-5 years at sea before returning to spawn (Emmett et al. 1991, Behnke 1992, Busby et al. 1996.) During surveys for salmon, Washington and Oregon steelhead have been scattered westward as far north as 160° W to the Gulf of Alaska, and westward along the Aleutians to 175° W (Wydoski and Whitney 1979).

6.0 ENVIRONMENTAL BASELINE

6.1 Geologic Setting

The quarry is located on a Boring high-alumina olivine basalt flow underlain by sediments of the Troutdale Formation. The facies of Troutdale in this area is a vitric sandstone consisting largely of yellowish variously hydrated basaltic glass grains (Tolan and Beeson 1984). The principal bedload for Howard Canyon Creek, in addition to colluvial cobbles of the Boring basalt, are reworked sediments of the Troutdale Formation. Stream morphology is determined in large part by the structural properties of these sedimentary deposits underlain by older tholeitic basalt flows. Structural properties of these older basalts probably determine the morphology of the stream channels. Uplift through the last several million years has undoubtedly caused some fracturing of the Troutdale sediments which determines the drainage patterns.

The headwaters of Howard Canyon Creek and Knieriem Creek lie in the Troutdale Formation and form a series of small steep tributaries draining south from the quarry area. The northern slope from the quarry area into Knieriem Creek is relatively undissected by drainages; suggesting that most of the surface and ground water from the quarry area goes south to Howard Canyon Creek. Howard Canyon Creek, which lies approximately 1300 feet south of the quarry area, has a gradient of approximately 2%. Tributary drainages to the creek from the quarry area have a variable spacing and strike with an average spacing of 370 feet. The gradient of these small tributary channels varies from 15% to 25% (6.66:1 to 4:1).

The moderately well drained haplumbrept soils mapped for the slope south of the quarry by the Natural Resources Conservation Service are developed on loess and old alluvium. Mershon silt loam (fine-silty, mixed, superactive, mesic Aquic Humic Dystrudept) typically has a very hard and very firm 2C horizon at 40 to 60 inches depth. This horizon may keep a significant portion of the surface water above this depth. The runoff curve number class C for this soil is the result of moderately easy infiltration into the surface horizons of the soil. The permeability is 0.6 – 2.0 inches/hour above 15 inches and 0.2 – 0.6 inches/hour below 15 inches. The top 3 feet of these soils typically contain 2% pebbles and deeper parts of the soil profile contain 15% gravel and cobbles.

6.2 Instream Habitat

A common feature of the creeks within the vicinity of the quarry is the general lack of complex instream habitat, which primarily stems from the lack of large woody debris (LWD) within the streams. Logging, agricultural activities, and other local land use practices have reduced LWD recruitment in the watersheds. It also appears that several landowners within the area keep their streams and banks "clean". One landowner offered that he thought he was helping the stream and fish by removing LWD.

A general pattern for the creeks is the change from canopied streams, with better quality riparian habitat, stable banks and better LWD recruitment, to less complex, increasingly channelized and exposed streams lower in the watershed. This was demonstrated when the width to depth (W/D) ratio of the streams was estimated. Streams are generally considered properly functioning if the W/D ratio is 10 or less.

Upstream of the pastures and the existing quarry on Howard Canyon Creek, the W/D ratio at two survey locations was 10.67 and 7.69, indicating the stream was close to properly functioning for this condition. Downstream near the confluence with Big Creek, the ratio had increased to an average of 20, indicating the decrease in quality of the stream lower in the watershed. In this area, stream structure was poor, banks were eroding, woody debris was absent, substrate was mostly embedded and not diverse, riparian vegetation was virtually nonexistent and the stream was almost entirely glide/run versus defined pools and riffles.

The range of W/D ratios were similar on Knieriem Creek. Upstream, where the riparian areas are more intact, the W/D ratio was 7. In this portion of the channel, the creek flows primarily with minimal human influence. This was apparent in the quality of the substrate and instream habitat. Large woody debris was present in and over the channel and large riparian trees, such as western red cedar, are stabilizing banks and creating overhanging banks and pools. This section of the stream was significantly different than the downstream sections of stream influenced by yards and pastures. In this downstream area, the W/D ratio was 37.

The W/D ratios for Big Creek ranged from 6.5 to 11.9. However, these results were not representative of stream conditions and were skewed by property access. Observations made from adjacent roads and properties appeared to indicate that W/D ratios were averaged higher than those measured.

6.3 Water Quality

Water quality was not directly measured during field visits. Therefore, the environmental baseline for water quality can only be indirectly addressed. Water temperature averaged 42.5°F in the streams during the February field visits.

Upstream of the quarry where human influence is minimal, the water quality of Howard Canyon Creek, Knieriem Creek and its small tributary Ross Creek appeared very good. Canopy cover is good which maintains lower temperatures during the summer. Chemical influences and sedimentation are likely not a problem. Though it was raining during one site visit, all streams ran clear. Downstream, where the streams run through yards and pastures, it is likely that nutrients and fecal coliform from livestock and septic tanks enter the streams. Chemicals leaching into the stream systems likely occurs where there are insufficient buffers from roads (hydrocarbons) and when the creeks flow through pastures or yards (herbicides, fertilizers). Additionally, the streams probably become slightly more turbid due to the unstable and failing banks.

Although the quality of the water degrades in all of the streams lower in the watershed, the quality does not appear to be sufficiently poor to inhibit populations of cutthroat trout and sculpin from persisting along the entire stream network even during the summer. Indirect evidence for this stems from the presence of multi-age class fish populations.

6.4 Riparian Habitat

Existing riparian conditions were assessed within the Howard Canyon, Knieriem Creek and Big Creek watersheds. The assessment included determining actual and potential riparian area widths and assessing the existing functions of riparian reaches within the watersheds in order to establish a baseline condition.

6.4.1 Riparian Assessment Methodology

Riparian Width

The Urban Riparian Inventory and Assessment Guide (Riparian Guide) (Pacific Habitat Services 1996) was used for establishing the baseline riparian conditions. The Riparian Guide depends on a combination of best available knowledge, field observations, and best professional judgment. The first step in the riparian inventory is to divide the study area into watersheds and then into riparian reaches. Land use and/or vegetation communities typically distinguish reaches. A Riparian Characterization Form and riparian assessment is then completed for each reach. The forms provide information on the physical and biological characteristics of the riparian area, such as vegetation, slope, adjacent land uses, and degree of disturbance. The dominant riparian tree species within 100 feet of the water resource is determined, which establishes the potential riparian width, based on potential tree height (PTH). PTH is used as the potential riparian width because it represents a distance in which a tree can still affect the water resource (e.g. shade, organic material).

The riparian width is measured from the edge of the water resource, typically either the top of a streambank or the outer edge of an adjacent wetland, lake, or pond. Riparian areas on both sides of a stream channel are assigned separate widths. Right and left widths are not combined and do not include the channel.

Where riparian area trees have been eliminated by land-use activities or natural causes, such as development, land slides, or logging, it may be necessary to extrapolate tree heights from a reference site. The reference site should be similar in character and landscape position and should be located as close as possible to the riparian reach. If a reference site is used, it is noted on the Width Determination Form. If a reference site cannot be located, field observations and reference materials must be used to establish PTH.

Although the riparian width will never exceed the PTH, it may be less than the PTH if impervious surfaces or permanent structures (e.g. buildings or roads) are inventoried within the riparian area. Therefore, on the Riparian Width Determination form, the first width represents the PTH and the second width represents the actual width as determined in the field and during review of aerial photographs.

Riparian Functional Assessment

Riparian areas provide numerous and complex functions that affect both aquatic and terrestrial systems. Many ecological functions of riparian areas are also provided by wetlands, floodplains, and vegetated upland areas.

The Riparian Function Assessment evaluates the ability of the riparian area to provide water quality, flood management, thermal regulation, and wildlife habitat functions. The results indicate whether the functions of each reach are intact, degraded, or severely impacted. The assessment is completed by answering a series of questions. Most of the questions are intended to be answered using data from the Riparian Characterization Form.

Because certain elements or characteristics of a riparian area are more critical to its function, the answers are "weighted." The points are then totaled for each side and for each function. Based on the score, the riparian function will be assessed as high, medium or low.

The results of the Riparian Function Assessment for all of the riparian areas within the inventory study area are then transferred to a Riparian Function Assessment Summary Table.

Riparian Functions

Water Quality

Riparian areas can enhance water quality in many ways. Undisturbed densely vegetated riparian areas trap sediments, inhibit erosion and filter runoff originating from impervious surfaces, lawns, golf courses, etc. Sedimentation and erosion, although natural processes, are accelerated in urban areas by increased impervious surfaces. Impervious surfaces also inhibit infiltration. Sediment within a riparian area can be from erosion of poorly vegetated uplands, runoff from impervious surfaces, or floods from an adjacent water resource. Sediments often carry nutrients (e.g. phosphates and nitrates) and pollutants (e.g. heavy metals, hydrocarbons) to water resources, altering water chemistry, burying spawning gravels and impacting fish and wildlife habitat. Excessive concentration of nutrients in the water can trigger algal blooms, depleting the water of oxygen required by fish and other aquatic organisms.

The ability of a riparian area to resist erosion is related to slope, soil type, type of vegetation, vegetation cover, landscape position, and degree of human disturbance.

Flood Management

Riparian areas and associated wetlands and floodplains provide a valuable flood management function by reducing the force and volume of floodwaters. Floodwaters flowing into a vegetated flood prone riparian area can be slowed or temporarily stored, reducing peak flows and flooding downstream. Woody vegetation, in particular, resists floodwaters and reduces its velocity. Topographic features, such as swales and depressions, can enhance a riparian area's ability to manage flood flows. Reducing the velocity of floodwaters in the riparian area allows infiltration of water into the soil. Water entering the soil is slowly released into the main channel, delaying its movement downstream.

Thermal Regulation

Water temperature affects the ability of a stream to support viable populations of certain aquatic organisms. Riparian shade, especially forest canopy, moderates temperature within and adjacent to a water resource. Although stream temperatures are important throughout the year, summer temperature is generally more critical for fish species such as salmonids. High water temperatures and sunlight are factors that can promote algal blooms, reducing dissolved oxygen required by anadromous fish and other cold-water dependent organisms.

The aspect or orientation of the water resource and the height of the adjacent riparian vegetation play important roles in how effective riparian vegetation is in providing shade.

Wildlife Habitat

Riparian areas provide valuable habitat for wildlife and influence fish habitat. The highest quality wildlife habitat in urban areas has a variety of plant species and layers, a perennial water source, and some degree of protection or buffering from disturbance.

Riparian areas are particularly important migration corridors between upland and aquatic systems for a wide variety of species. It has been reported that the majority of Oregon's major wildlife species, including amphibians and reptiles, use wetlands or riparian areas during some portion of their life cycle.

6.4.2 Riparian Area and Distribution

Seven (7) riparian reaches were assessed as representative of the existing riparian conditions in the watersheds. Each riparian area was assigned a code and a modifier for right or left side, and a watershed code (e.g. R-HC-2L, R-HC-2R). A data sheet was compiled which documents the existing riparian characteristics and establishes the riparian width based on potential tree height (PTH) and actual site conditions (Appendix A). The majority of the assessments were based on on-site observations from private properties where permission to access was granted. Off-site assessments were based on observation from an off-site vantage point or review of maps and aerial photos.

Potential tree heights were generally based on either Douglas fir (120-foot PTH), western red cedar (120-foot PTH), or red alder (65-foot PTH). Riparian areas on steep slopes were generally forested or potentially forested with coniferous trees. Early successional trees such as red alder generally dominated riparian areas in flatter topographic areas. Figures 3A-3E show the location of the riparian assessments, the riparian reaches, and the width of the riparian areas. The following table summarizes the riparian area widths, lengths and potential tree heights.

Table 2. Riparian Corridors and Their Widths for the Howard Canyon Project

RIPARIAN AREA CODE	Potential Tree Height (PTH) (ft)	Actual Riparian Width (ft)	[illegible] Length (ft)
HC-1	120	120	
HC-2	65	65	
HC-3 (L)	120	120	
HC-3 (R)	65	20-65	
BC-1	65	65	
BC-2	120	50-120	
KC-1	65	20-65	
KC-2	65	65	

As the table shows, the majority of riparian widths are based on the PTH of Douglas fir, western red cedar, or red alder. In addition, many existing riparian areas are narrower than the PTH, indicating that development and land use practices have encroached on many of the riparian areas.

6.4.3 Riparian Assessment Results

An assessment of four riparian functions, water quality, flood management, thermal regulation, and wildlife habitat, was conducted for each of the riparian areas. The questions and answer sheets for the riparian assessment are included in Appendix B.

Answering a series of questions relating to the riparian functions completes the riparian assessment. Each answer is assigned a score that reflects its overall importance to the function. Questions that were answered "a" received a higher score than "c" answers. After the score was totaled for each function, it was assigned a rating of high (H), medium (M), or low (L) according to the results. Table 3 summarizes the results of the riparian functional assessment.

Table 3. Summary of Riparian Functional Assessments

Riparian Area	Water Quality	Flood Management	Thermal Regulation	Wildlife Habitat
HC-1	H	H	H	H
HC-2	H	H	M	M
HC-3	H	M	M	M
BC-1	H	H	H	H
BC-2	H	H	H	M
KC-1	H	M	H	H
KC-2	H	H	H	M

H = High M = Medium L = Low

In general, the riparian areas were relatively intact. All of the riparian areas received at least one high score and all received high rankings for water quality function due to a dominance of woody trees and shrubs in the riparian areas and minimal impervious surfaces. Thermal regulation and flood management functions were also generally assessed with a high functional integrity due to an east-west stream orientation and woody vegetation near the edge of the stream. The wildlife habitat category had more reaches receiving a medium ranking due to lack of a variety of vegetation strata in some reaches and lack of large woody debris in others.

6.4.4 Riparian Discussion

Riparian areas within the Howard Canyon Creek, Knieriem Creek, and Big Creek watersheds have been affected by logging, residential development, grazing, and roads. Although the results of the riparian assessment indicate that many of the riparian functions area high, these results likely reflect the rural nature of the area and the fact that the Riparian Guide is intended for more urban areas where impervious surfaces are high. In the watersheds assessed for this study, the riparian areas of the creeks have been impacted by grazing, agricultural activities, rural road construction, and landscaped areas associated with residential construction.

In general, and as discussed in the sections above, the upper reaches of Howard Canyon Creek and Knieriem Creek both have undisturbed sections of riparian vegetation and human influences are minimal. The lower ends of the drainages have already been altered. There are significant impacts to riparian widths and conditions from roads, development of rural residential houses and yards, and livestock access to the stream. Near the confluence of Knieriem Creek and Big Creek, tree cover is entirely lacking from the riparian areas.

In general, Big Creek's riparian areas have been impacted by adjacent roads, culverts, clearing and residential development. However, areas below Hurlburt Road appear to have an undisturbed riparian cover extending through Oxbow Park and to the Sandy River.

Except through the indirect impact of road construction and maintenance, riparian areas have not been impacted by the existing quarry operation.

6.5 Wetlands

In general, wetlands in the watersheds are generally directly associated with the three creeks. Overflow channels and low flood-prone benches are present. The National Wetlands Inventory (NWI) has mapped both riverine and palustrine wetlands within the watersheds. With the exception of a small pond, all the mapped wetlands are coincidental with the streams. Howard Canyon Creek, Knieriem Creek, and Big Creek are all mapped as riverine, upper perennial, unconsolidated bottom, permanently flooded (R3UBH) bodies of water. A small stretch of palustrine scrub shrub, seasonally flooded wetland (PSSC) is mapped along Knieriem Creek.

6.6 Fish Passage

There is no anadromous fish passage from the Sandy River into Big Creek, Howard Canyon, Creek and Knieriem Creek. A large natural 80 foot waterfall exists on Big Creek just above the confluence with the Sandy River (Shapiro 1994). PHS was unable to gain property access to view this barrier. The cutthroat trout that exist upstream of the barrier are not prevented from travelling downstream and may add to the genetic diversity of cutthroat trout in the Sandy River. No steelhead trout, coho or Chinook salmon or other fish can ascend the barrier. Upstream of this natural barrier, a number of culverts provide difficult or impossible barriers to upstream migration of juvenile and adult cutthroat on Big Creek, Howard Canyon Creek, and Knieriem Creek. The barriers result from the long length of several culverts, the steep slope of several culverts, and eroded outfalls creating jump barriers greater than 6 inches high.

7.0 PROPOSED MINING PLAN

The current mining operation extracts approximately 5,000 cubic yards of aggregate from the quarry annually. The proposed expansion would increase this amount up to approximately 75,000 cubic yards, though less may be extracted. The mining area would affect an approximately 24-acre area, though the specific footprint of the site has not yet been determined. Within the 24-acres, five acres is proposed to be impacted at any one time.

The information reviewed for this BA indicates that if the quarry continues with its limited extraction of up to 5,000 cubic yards per year, the quarry operator will not install erosion control devices, provide buffers from adjacent creeks, or implement other conservation measures that would ensure protection of natural resources and the quality of water in the Sandy River downstream.

If, however, the extraction is increased, the quarry operator would be required to implement additional conservation measures. A summary of the measures proposed by the quarry operator is included in Table 4.

Table 4. Proposed extraction quantities per year and conservation measures currently offered by the quarry operator.

Proposed Conservation Measures	Extraction Quantity Per Year (cubic yards)		
	5,000	35,000	75,000
Buffers	No	Yes	Yes
Sediment control	Yes	Yes	Yes
Truck washdown	No	Yes	Yes
Quantity (runoff) control	No	Yes	Yes
Maintain stream flows	No	Yes	Yes
Erosion control in disturbed areas	Yes	Yes	Yes

No description of off-site construction activity associated with the quarry expansion has been provided. Off-site construction could include the construction of new roads, improvements to existing roads, or the construction and siting of new utilities to serve the quarry.

8.0 POTENTIAL EFFECTS OF EXPANDING THE QUARRY ON THE ENVIRONMENTAL BASELINE

Expanding the quarry from 5,000 cubic yards per year to a maximum of 75,000 cubic yards per year may have an effect on the environmental baseline of the watersheds. However, whether the effect is sufficient to adversely affect the continued survival and recovery of salmonid populations within the watersheds and within the Sandy River is dependent on numerous parameters of watershed health. This section discusses the possible effects of expanding the quarry on these parameters.

The list of functional parameters is taken from *Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Watershed Scale* (NMFS 1996). These parameters include: temperature, turbidity, chemical contaminants/nutrients, physical barriers, substrate, large woody material, percent pool area, pool quality, pool frequency, off-channel habitat, refugia, width/depth ratio, streambank condition, floodplain connectivity, peak/base flows, drainage network increase, road density/location, disturbance history, and riparian reserves.

As no specific mining plan is available, impacts to the environmental baseline of the watersheds from the expansion of the quarry must be inferred from the likely location and type of mining.

Water Quality

Temperature: Water temperatures in Howard Canyon Creek and Knieriem Creek are considered **functioning properly, but at risk**.

An elevation of water temperatures could occur if the current riparian cover surrounding the creeks is impacted by the quarry expansion or if runoff from future on-site water quality facilities is not sufficiently moderated before flowing into the surrounding creeks.

It is unlikely that the expansion of the quarry will impact riparian vegetation along the creeks, though vegetation at stream crossings may be impacted if surrounding roads are required to be improved.

It is also unlikely that runoff from the expansion site will adversely impact water temperatures of the surrounding streams. This is based on the fact that much of the water draining from the site will be during the wettest portions of the year when ambient temperatures are cooler. During the summer when ambient temperatures are warmer, off-site flow will be severely reduced, or more likely, virtually absent, and should not influence the water temperatures of Howard Canyon Creek and consequently the Sandy River. The lack of adverse impact can be facilitated by ensuring that runoff from future on-site water quality facilities flows through a dense canopy before flowing into Howard Canyon Creek. This is currently the situation with the existing water quality pond (**maintain**).

Turbidity: Based upon field data determinations, fine sediment bedload in the system appears to be high. In the lower sections of all the creeks embeddedness was generally higher than 50%. Percent embeddedness increased in each of the creeks going downstream. The sediment parameter is considered **not functioning properly**.

The existing pastures and other human disturbance (e.g. riparian vegetation removal) along Knieriem Creek, Big Creek and lower Howard Canyon Creek will continue to keep banks unstable and result in the delivery of large amounts of fine sediment within the system.

The quarry expansion could also become a very large sediment source if removed overburden is stockpiled onsite where it could be washed downhill and into Howard Canyon Creek. Conservation measures must require the overburden be stockpiled away from drainage areas and sufficiently protected from being deposited off-site.

Sufficient control of water quality leaving the site is also imperative. With the implementation of conservation measures and proper use and maintenance of sediment retention/detention facilities, the impact of the quarry expansion is not expected to alter the present status of sediment delivery to Howard Canyon Creek, Big Creek, and consequently the Sandy River. Since the project site is situated away from the creeks, attention to sediment retention before it enters Howard Canyon Creek will greatly diminish the potential for fine sediment transport.

Increased truck traffic on adjacent roads may also contribute to sediment entering the system. However, road improvements will likely be required and proper measures to control stormwater runoff from new impervious surfaces must be required. With the implementation of strict conservation measures, impacts from increased sediment are not expected to occur **(maintain)**.

Chemical /Nutrients.

The current condition for this parameter is **not properly functioning**. The large number of pastures and residences abutting the creeks results in this parameter being at risk for the watersheds. Manicured lawns down to the creek banks, grazed pastures and nearby septic tanks result in chemical additions to the creeks. Livestock is allowed into the creek in many locations for watering, and a barn with adjacent stockyard is located immediately adjacent to Howard Canyon Creek. Though algae growth was not apparent during the winter sampling period and water temperatures were good, it is expected that there are elevated nutrient and other detectable chemicals in all three creeks.

Expansion of the quarry will require conservation measures to control vehicle refueling, water quality treatment, and accidental chemical spills. As such, the expansion of the quarry is not expected to adversely change the environmental baseline **(maintain)**.

Habitat Access

Physical Barriers: Presently there is no passage for listed anadromous salmonids from the Sandy River up Big Creek toward the project site. An approximately 80-foot high waterfall/barrier exists just upstream of the Big Creek confluence with Sandy River. A number of other culverts on Howard Canyon Creek, Knieriem Creek, and Big Creeks prevent unrestricted upstream migration for cutthroat trout adults and juveniles. Passage, therefore, is considered **not properly functioning**.

All road improvements that affect stream crossings should be constructed following the ODFW recommended designs to ensure fish passage for juvenile salmonids. No other impacts to fish passage is expected from the expansion of the quarry. Therefore, there is no change to the environmental baseline (**maintain**).

Habitat Elements

Substrate: This indicator is considered to be **at risk** due to the fine sediments entering the creeks. Better than adequate gravels exists in portions of Howard Canyon, Ross Creek (tributary to Knieriem Creek) and Big Creek for successful spawning by cutthroat trout. Due to the geology of the basin, gravels appear plentiful. The quarry will be mining a basalt bedrock lens. Bedload does not appear to be dominated by this material and other geologic formations appear to be providing the gravel to the creeks. In Knieriem Creek, the bedload consists entirely of fines, except for an area immediately adjacent with the confluence to Ross Creek.

The quarry will not influence the recruitment of gravel and thus will not alter the environmental baseline (**maintain**).

Large Woody Material: The LWM indicator is **not properly functioning**. Except for a few sections of a Howard Canyon Creek, virtually no LWM was found in the streams. It is apparent that humans are clearing the streams along their properties and that fallen trees are being dragged out rather than being left in the streams (likely a way to alleviate the threat of flooding). Even in areas of good LWM recruitment potential, the habitat was distinguished by the lack of LWM providing instream structure.

The existing environmental baseline for LWM for the watershed will be maintained since the project will have no direct effects upon LWM recruitment. (**maintain**).

Pool frequency: Pool frequency in Big Creek and it's tributaries is considered **not properly functioning** due to human caused channel straightening and the lack of LWM. An upper reach of Howard Canyon creek just above the small unnamed tributary that drains the existing water quality facility has the best pool forming features. A complex channel exists due to large woody debris in the channel, and a large cedar on the bank has created a lateral scour pool. Exposed bedrock was only observed once and is not a dominant channel structure feature. There will likely be no impact to this parameter from expansion of the quarry (**maintain**).

Pool Quality: Pools are infrequent except for the upper portions of Ross Creek and Howard Canyon Creek. Large pool forming features are rare. Since so little large woody debris is present, and banks are generally unstable, few quality pools exist. This parameter is considered to be **at risk.**

The quarry project will not likely influence the quality of existing pools unless heavy sedimentation occurs and fills the few existing pools downstream. As mentioned before, conservation measures will ensure that future degradation of pool quality does not occur (**maintain**).

Off-Channel Habitat: Very little off channel habitat was observed on any of the creeks. Howard Canyon Creek had a side channel just above the confluence with the tributary draining the existing quarry. Due to the simplified channel structure, little complex habitat exists in these streams either in-channel or off-channel. This indicator is **not properly functioning.**

Placement of the LWM in the channel could create additional off-channel habitat, though the proposed project is not altering riparian habitat. It is recommended that ODFW work with the quarry operators to obtain some of the trees removed with the overburden and place them in the creeks. The quarry project will not alter the existing off channel habitat (**maintain**).

Refugia: Due to the lack of LWM, off channel habitat, undercut banks and other backwater types of habitat, there is little refugia along much of the creeks for fish. Only the upper portions of Ross Creek and Howard Canyon Creek contain structure in the stream offering refugia from predators and high flows. Consequently, this indicator is considered **not properly functioning.**

As there will be no direct impacts to the creeks, refugia will not be decreased by the proposed action (**maintain**).

Channel Condition and Dynamics

Width/Depth Ratio: this parameter is considered **not properly functioning** for the watershed as a whole. W/D ratios increase in a downstream direction due to bank disturbance by landowners and from past land use practices. With well-maintained conservation measures, sediment delivery to Howard Canyon Creek and Big Creek will not increase. The proposed project should not alter existing width to depth ratios (**maintain**).

Streambank Condition: The current streambank condition along all the streams except Ross creek is poor. Riparian vegetation has been removed and many banks are eroding. There are few trees or shrubs to provide stabilizing root structure in many of the reaches observed. In several of the reaches, disturbance and the open canopy has allowed the invasive Himalayan blackberry (*Rubus discolor*) to establish. This woody vine does little to stabilize banks. This parameter is **not properly functioning.**

The proposed project will not alter existing conditions since it is not directly in contact with the streams. In addition, flows to Howard Canyon Creek should not increase to a point that will influence streambank condition if strict conservation measures are imposed (**maintain**).

Floodplain Connectivity: The floodplain of the watersheds has been directly and indirectly affected by channelizing and riparian management practices. The resultant incision along the downstream portions of the creeks has disconnected the floodplain from the creeks in many places. Floodplain connectivity is considered **not properly functioning**.

The proposed expansion will occur well away from the creeks and will not alter floodplain connectivity.(**maintain**).

Flow/Hydrology

Peak/Base Flows: Actively eroding banks and W/D ratios indicate that peak/base flows are **not properly functioning.**

The increased exposure of impervious surface in the expanded quarry has the potential to exacerbate peak/base flows. Some local impact to the groundwater table due to excavation will occur. However, the impact should be minor, as the quarry is located on a ridge and any existing ground water flow will become surface water as the pit is expanded. The collected water will flow into the natural tributary running south from the site and into Howard Canyon Creek. Methods to detain water on-site should be implemented (**maintain**)

Drainage Network Increase: No data on the drainage network were obtained; however, given the generally low amount of urban development in the watershed, this parameter is determined to be **properly functioning** but at risk.

The environmental baseline for the watershed will not be altered; though increased truck traffic may require the widening of roads. There will be a minor, localized increase in the drainage network within the quarry. It is unlikely that new roads will be built and that all new roads will control stormwater runoff (**maintain**).

Watershed Conditions

Road Density and Location: The watershed is rural residential with valley bottom roads paralleling portions of the creeks. Road density is a parameter considered placing the streams **at risk.**

As new roads will likely not be constructed to facilitate truck traffic, the existing environmental baseline of the watershed will not be changed (**maintain**).

Disturbance History: Disturbances within the Howard Canyon Creek, Knieriem Creek and Big Creek watersheds include minor commercial, moderate residential, and moderate agricultural "pasture" development. Portions of Howard Canyon Creek, Ross Creek and Knieriem Creeks have been logged recently. The degree of riparian disturbance from the pastures along much of the creek banks forces a **not properly functioning** determination.

The expansion of the quarry will impact approximately 24 acres. In addition, there may be disturbance related to the improvement of local roads. However, the expansion area is relatively small from a watershed perspective and should not significantly influence the existing watershed disturbance history (**maintain**).

Riparian Reserves: There is no riparian reserve system for the area. Riparian reserves are determined to be **not properly functioning** since much of the riparian areas have been significantly modified.

The proposed quarry expansion is on a ridge above the creeks and will not decrease riparian reserves (**maintain**).

9.0 SUGGESTED CONSERVATION MEASURES

Expanding the quarry will have to be accomplished in an environmentally sensitive manner to ensure that it will not adversely affect the environmental baseline of the watersheds and impact salmonid populations or their habitat. To ensure that impacts are avoided and where necessary minimized and even mitigated, a series of conservation measures will need to be implemented. A description of each of these conservation measures is included below.

Erosion Control Functional Parameter(s): *Turbidity, Chemical Contaminants/ Nutrients;*

- Strict erosion control measures should be instituted throughout the life of the quarry. It is imperative that extraction activities do not increase the sediment load within the surrounding creeks. Increasing the sediment load decreases the viability of the cutthroat trout populations, many of which are isolated to certain reaches of the creeks by substandard culverts that do not allow fish passage and, therefore, escape from impaired water quality conditions. Impacts to water quality can have a detrimental effect on fish populations within the Sandy River. Pro-active implementation of an Erosion Control Plan (ECP) should be a priority. At a minimum erosion control measures should be designed to keep turbidity below 10% ambient (background) conditions, 30 m (100 ft) downstream from the quarry at all times. The largest source of sediment could originate from haul roads, processing areas at the site, and stockpiles of overburden. Specific measures that could be implemented to reduce erosion include:
    - Weed-free straw bales and silt fences at the bottom of newly constructed slopes. Whenever straw bales are used, they should be staked and dug into the ground at least 12 cm (5 in);

- Construction of sediment settling basins, where appropriate. Berms should be constructed where appropriate, to divert runoff into these basins;

- Temporary plastic sheeting for immediate protection of open areas (where seeding/ mulching are not appropriate);

- Erosion control blankets or heavy duty matting (e.g., jute) can be used on steep unstable slopes;

- Sills or barriers may be placed in drainage ditches along cut slopes and on steep grades to trap sediment and prevent scouring of the ditches. The barriers should be constructed from rock and straw bales and be regularly maintained. Sills or barriers will be necessary in roadside ditches if water bars or cross-ditches are constructed within the haul roads to intercept and direct runoff from a road;

- On the pit or quarry floor, establish a slope that directs turbid water to flow to a low point where it can be collected in a detention pond;

- Biobags, weed-free straw bales and loose straw may be used for temporary erosion control. Temporary erosion and sediment controls should be used on all exposed slopes that could potentially create sediment-laden runoff into the creeks;

- On cut slopes steeper than 1:2 (v:h) where runoff may impact the creeks, a tackified seed mulch should be used so that the seed does not wash away before germination and rooting occurs. In steep locations, a hydro-mulch should be applied at 1.5 times the rate;

- Material removed during excavation should only be placed in locations where it cannot enter the surrounding creeks or their riparian areas;

- Stockpiles of overburden should be completely protected to ensure that sediment-laden runoff does not enter the adjacent creeks;

- Coir mats and coir logs or filter berms built or porous materials, such as sand and gravel that contains no 200-mesh or smaller material, should be used where appropriate to control erosion;

- Erosion control devices that are failing should be immediately repaired to ensure that sediment-laden water does not leave the project site and discharge into the surrounding creeks;

- A permanent truck wash or wheel wash facility should be constructed to ensure that excess dirt and mud is washed off of all truck tires. The design could incorporate a series of railroad rails spaced approximately 2 to 8 inches apart to shake off the excess dirt while the truck is driving through the wheel wash. All water used to clean the trucks should be treated to remove sediment;

- Regular inspections should be made to inspect all erosion control devices; needed repairs and/or replacement should be identified; quarry staff should be provided with written directives to replace and/or update the devices, as needed; field inspections shall be made to ensure repairs and/or replacement of devices has occurred within specific timelines, and;
- Regular inspections with County staff should be made to review all erosion control devices and identify needed corrections and/or enhancements.

Water Quality / Hazardous material Functional Parameter(s) *Turbidity, Chemical Contaminants/ Nutrients, Substrate, Off-channel habitat*

- A Pollution Control Plan (PCP) should be prepared by the quarry operator to prevent point and non-point-source pollution.
- No pollutants of any kind (petroleum products, fresh concrete, silt, blasting material, etc.) shall come in contact with an active flowing stream or its riparian area;
- Vehicle maintenance, refueling of vehicles and storage of fuel should be conducted at designated refueling areas located at least 150 feet from the creeks. The refueling areas should only be used if they are sufficiently contained and present no possibility for contamination;
- No toxicant (including petroleum products) should be stored within 150 feet of the creeks. Fuel and lubricant storage areas should be regularly monitored for leakage. A spill control kit should be maintained onsite at all times, and;
- Flocculants used to clean stormwater discharges or water recycled from rock-washing operations must be non-toxic and not harmful to fish or aquatic organisms. At least two ponds should be used to remove suspended solids. Settling time should be at least eight hours. The ponds should be easily accessible and maintained on a regular basis. Material removed from the ponds should be disposed of in an upland location.

Clearing, grubbing and reclamation Functional Parameter(s) *Turbidity; Temperature, Large Woody Material*

- No clearing and grubbing within the 100-feet of the creeks should be allowed unless mitigation is provided;
- Overburden should be removed from limited areas; concurrent or segmental reclamation should be encouraged to limit the disturbed areas within the quarry[1].

---

[1] Concurrent (progressive or continuous) reclamation occurs as minerals are removed; overburden and soil are immediately replaced. Segmental reclamation occurs following depletion of minerals in a sector of the mine (Washington Department of Natural Resources, 1997).

10.0 FINDINGS OF EFFECT

Four salmonid species with distributions potentially overlapping the expanded quarry project area have been listed or are proposed for listing under the federal and state Endangered Species Acts. An evaluation of the potential affect of the project on each species has been conducted.

10.1 Federally-Listed Species

National Marine Fisheries Service

The expansion of the quarry described herein will likely result in a more than negligible probability of adverse effects to **Chinook salmon** in the **Lower Columbia River ESU** listed as threatened under the federal ESA. Chinook salmon do not occur in the Big Creek watershed and are not within in the project area; nevertheless, the determination of **may affect, not likely to adversely affect** with regard to this ESU is appropriate given the fact that a spawning gravel bar is located just downstream of the mouth of Big Creek. This gravel bar could be detrimentally influenced by an increase in sediment deposition resulting from the proposed quarry expansion. The potential for direct impact to Chinook salmon is extremely low unless a large-scale failure occurs in the storage of overburden. With a large scale failure, sediment movement downstream would end up influencing any spawning beds in the mainstem Sandy River below the confluence with Big Creek.

The proposed action described herein will result in more than a negligible probability of adverse effects to **steelhead trout** in the **Lower Columbia River ESU**. Therefore, we make a determination of **may affect, likely to adversely affect** with regard to this ESU. Both summer and winter steelhead exist in the Sandy River and both juveniles and adults are present in sections of the river nearly all year long. If steelhead also spawn in the gravel bar just downstream of Big Creek on the Sandy River, there is the potential for sedimentation impacts upon juvenile to fry stages of the species.

The proposed action **may affect, but is not likely to adversely modify** the critical habitat of **Chinook salmon** or **steelhead trout** in the **Lower Columbia River ESU**. As stated above, NMFS has recently withdrawn this designation pending a review of its economic effects. The determination of the project's effects on critical habitat in this report is based on the possibility of this designation being reinstated. It is anticipated that conservation measures will be implemented during the life of the quarry to contain any project-related effects to critical habitat. All impacts associated with the project are not expected to degrade existing baseline conditions. The quarry expansion should not directly affect the riparian areas of Knieriem Creek and Howard Canyon Creek. Changes in water delivery to Howard Canyon Creek are expected to be insignificant as the project site rests on a ridge rather than intercepting ground water farther down the slope. Increases in impervious surfaces will be minimal and will be addressed by treating and detaining runoff. Conservation measures will likely include sediment fencing, straw bales, no touch zones, grass seeding, jute mats, log check dams, and coir.

U. S. Fish and Wildlife Service

The proposed action described herein will result in more than a negligible probability of adverse effects to **coastal cutthroat trout** in the **Southwest Washington/Columbia River ESU**. Therefore, we make a determination of **may affect, not likely to adversely affect** with regard to this ESU. As stated above, the US Fish and Wildlife Service has decided to not designate cutthroat trout under the ESA at this time. However, the population within the project site remains very vulnerable to water quality impacts from adjacent landuses. The ability of the population to withstand a catastrophic event (e.g. fuel spill) or longterm water quality degradation (e.g. increased sediment levels that could decrease egg to fry survival) is limited by the fact that the population is isolated from the Sandy River and that our data collection appears to indicate the population is small. As such, although presently there is no ESA status afforded to cutthroat trout, the population is likely to be negatively impacted unless conservation measures are closely followed.

No determination has been made on the affect of the project on critical habitat for coastal cutthroat trout because USFWS has not designated critical habitat for coastal cutthroat trout in the Southwest Washington/Columbia River ESU. Nevertheless, the affect of the project on cutthroat trout habitat is likely to be similar to that expected for Chinook salmon and steelhead trout habitat.

10.2 State-Listed Species

The proposed action described herein will result in a negligible probability of adverse effects to **coho salmon** listed as endangered under Oregon's Endangered Species Act. Therefore, we make a determination of **not likely to adversely affect** with regard to this species. Coho salmon are within the Sandy River watershed and some juveniles may rear for short periods of time during spring outmigration in the lower portion of Big Creek below the falls. During the winter high flows, juveniles washed downstream may also escape the Sandy River and retreat up Big Creek. It is not expected that any increases in sediment transport that may result from the expanded quarry would adversely affect coho spawning and juvenile survival.

11.0 LITERATURE CITED

Behnke, 1992. Native trout of western North America. 92-72941. American Fisheries Society, Bethesda, Maryland.

Busby, P., T. Wainwright, G. Bryant, L. Lierheimer, R. Waples, F. Waknitz and I. Lagomarsino. 1996. Status Review of West Coast Steelhead from Washington, Idaho, Oregon and California. NOAA Technical Memorandum NMFS-NWFSC-27. 261 p.

Friesen, Thomas A., Mark P. Zimmerman. October, 1999. *Distribution of Fish and Crayfish, and Measurements of Available Habitat in Urban Streams of North Clackamas County Final Report, 1997-1999.*

Groot and Margolis, 1991. Pacific Salmon Life Histories. UBC Press, Vancouver, British Columbia. 564 pp.

Murtagh, T., J. Massey, and D. Bennett. 1997. Sandy River Basin Fish Management Plan (DRAFT). Oregon Department of Fish and Wildlife. Portland, Oregon.

National Marine Fisheries Service (NMFS). 1996. Making Endangered Species Act determinations of effect for individual or grouped actions at the watershed scale. Environmental and Technical Services Division, Habitat Conservation Branch.

Pacific Habitat Services. 1998. Urban Riparian Inventory and Assessment Guide. Prepared for the Oregon Division of State Lands.

Rodrick, E. and R. Milner, eds. 1991. Management recommendations for Washington's priority habitats and species. Wildlife Management, Fish Management, and Habitat Management Divisions, Washington Department of Wildlife, Olympia, Washington.

Scott, W.B. and E.J. Crossman. 1973. *Freshwater fishes of Canada.* Bulletin 184. Fisheries Research Board of Canada, Ottawa.

Spence, B. C., G. A. Lomnicky, R. M. Hughes, and R. P. Novitzki. 1996. An ecosystem approach to salmonid conservation. TR-4501-96-6057. ManTech Environmental Research Services Corp., Corvallis, OR.

Washington Department of Natural Resources. 1997. *Best Management Practices for Reclaiming Surface Mines in Washington and Oregon.*

Willis, R.A., M.D. Collins, and R.E. Sams. 1960. Environmental survey report pertaining to salmon and steelhead in certain rivers of eastern Oregon and the Willamette River and its tributaries. Part II. Survey reports of the Willamette River and its tributaries. Fish Commission of Oregon.

Wydoski, R.S. and R.R. Whitney. 1979. Inland fishes of Washington. Univ. of Washington Press, Seattle, Washington.