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Zortman and Landusky Mines

HJR 43

Water Quality Impacts

A staff paper presented to the Environmental Quality Council

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INTRODUCTION

House Joint Resolution 43

The preamble of HJR 43, enacted by the 2003 Montana Legislature, describes in general terms the status of the reclamation efforts at the Zortman and Landusky Mines which have been conducted by the Montana Department of Environmental Quality (DEQ) and the federal Bureau of Land Management (BLM) following the bankruptcy of Pegasus Gold Corporation (Pegasus) and the abandonment of the mines by its operator, Zortman Mining Incorporated (ZMI). HJR 43 asks the Legislature to review how those efforts are addressing water quality issues at the mines and whether additional reclamation efforts are necessary. The mines are being reclaimed by the DEQ and its contractors with mine bond proceeds made available following a settlement agreement with the surety, with supplemental funds from the bankruptcy settlement, and with state and federal funds.

HJR 43 asks the Legislature specifically to:

- (1) identify the impacts on surface water and ground water, including the recent degradation of Swift Gulch, attributable to past or present activities at the mine sites;
- (2) determine if there are identifiable downstream impacts on the Milk and Missouri River drainages attributable to past or present activities at the mine sites;
- (3) determine whether the surface water and ground water resources in the watersheds affected by the mine operations are being protected by the current or proposed state reclamation; and
- (4) determine the potential impacts to surface water and ground water resources if additional funding for water treatment and reclamation does not become available.

Response

The Legislative Council assigned HJR 43 to the Environmental Quality Council (EQC) which decided to combine a review of the issues in HJR 43 with a review of the current status of metal mine bonding in Montana. The EQC decided that both topics would be reported in separate staff papers using currently available information from several sources. Additionally, the EQC heard presentations on the issues of metal mine bonding and the status of reclamation at the Zortman and Landusky mines at its regularly scheduled meetings during the interim.

Staff reviewed several of the many research reports and studies that have been prepared, especially since the early 1990's, on the operation and reclamation of the Zortman and Landusky Mines and their impact on water quality. However, a thorough review and understanding of these complex and sometimes contradictory technical reports is beyond the scope of this paper. Staff relied on key reports, court documents, and interviews with people who have a professional involvement with the mines and their reclamation. For a partial list of reports and documents that have been produced on the Zortman and Landusky Mines, see R1-R8, References, listed in the Final Supplemental Environmental Impact Statement for Reclamation of the Zortman and Landusky Mines, Phillips County, prepared by the DEQ and the BLM, December 2001.

LOCATION

Pegasus Gold Corporation through its subsidiary, ZMI, operated two open pit cyanide heap leach gold mines from 1979 until it filed for bankruptcy in early 1998 in the southern portion of the Little Rocky Mountains immediately south of the Fort Belknap Indian Reservation in north central Montana (**Figure 1**). The Zortman Mine permit covers approximately 406 acres (122 acres BLM; 284 acres private mining claims) and the Landusky Mine permit includes approximately 783 acres (472 acres BLM; 311 acres private mining claims).

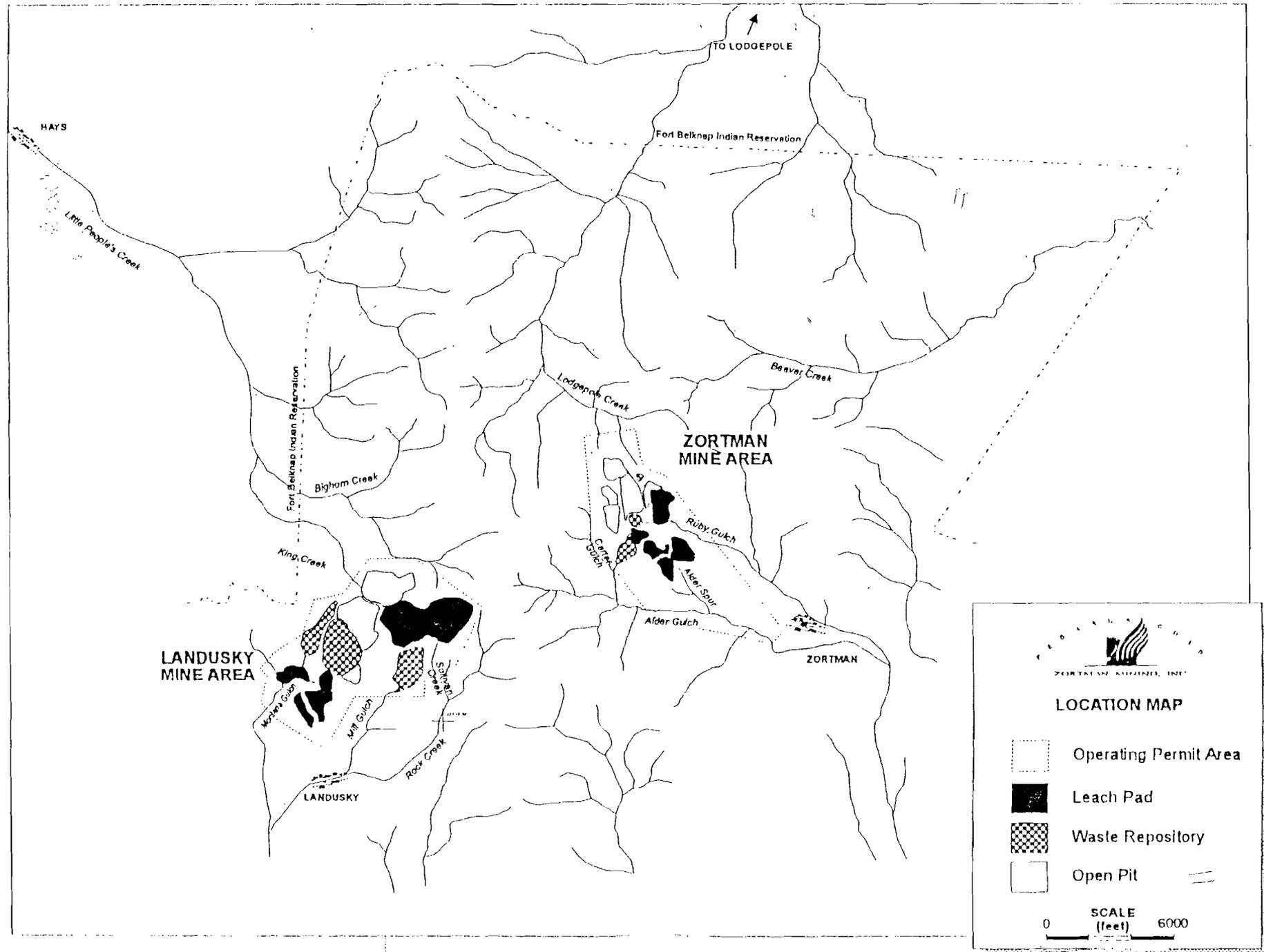
The Zortman Mine is located about one and one-half miles east of the much larger Landusky Mine. Both mines are located on a mountain divide that separates the Missouri River drainage to the south from the Milk River drainage to the north. The Fort Belknap Reservation boundary is approximately 3 miles north of the Zortman Mine and is approximately 1/4 mile to the nearest disturbance at the Landusky Mine.¹

BACKGROUND

The mines were granted a series of permit amendments that expanded the size of the operations until a major permit expansion was applied for in 1992 but which was ultimately not implemented. Discovery of significant acid rock drainage problems at both mines resulted in a need for a major revision of the existing mine reclamation plans and a review of existing bond amounts. It was determined that the proposed 1992 mine expansion would require a detailed analysis through the preparation of an environmental impact statement (EIS).

Between 1993 and 1995, Water Quality Act litigation was initiated in state and federal courts alleging unpermitted mine discharges to state waters. Settlement discussions resulted in the signing of a Consent Decree between Pegasus, the DEQ, the Environmental Protection Agency (EPA), a citizen's group, and the Fort Belknap Tribes effective in September 1996.² The Consent Decree obligated Pegasus to construct water collection systems and water treatment plants, bond for the immediate operation of the water treatment plants, and establish a trust reserve for their long term operation and maintenance. It also provided for a penalty and required the company to perform ground water, aquatic, and health studies, implement monitoring programs, and provide improvements to drinking water systems on the reservation. The Consent Decree established temporary water quality standards and obligated the company to obtain MPDES permits for each discharge to state waters based on more stringent water quality standards once the water treatment plants and water discharge capture systems were in place. The Consent Decree did not address surface reclamation of the mines because the decree was a settlement of alleged violations of the Water Quality Acts which do not extend to surface reclamation requirements.

Figure 1: Map of the Zortman-Landusky Area



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The BLM and the DEQ completed an EIS for the proposed mine expansion which included a revised land reclamation plan and the agencies issued a Record of Decision approving the expansion in October 1996. The BLM decision to expand the mine was appealed by citizen's groups and the Fort Belknap Tribes to the federal Interior Board of Land Appeals (IBLA) in late 1996. The state's decision to approve the expansion was challenged in state court in early 1997 by citizen's groups and the Fort Belknap Tribes. The IBLA issued an order in June 1997 to stay the mine expansion approval pending further administrative review of the BLM decision. In January 1998, Pegasus and ZMI filed for bankruptcy protection before the IBLA issued a ruling and in March 1998, the companies announced their decision to not proceed with the mine expansion but to close and reclaim the mines instead. The agencies voided the now moot 1996 mine expansion decision in June 1998 and attempted to increase the surface reclamation bond based on the revised reclamation plan reviewed in the 1996 EIS, acknowledging at that time that the existing bonds were an estimated \$8.5 million less than what was needed to implement the agencies' preferred reclamation alternative. Pegasus objected and appealed the decision to increase the bond amount to the IBLA.

In November 1998, the DEQ signed a settlement agreement with Pegasus' sureties, National Union Fire Insurance Company and the United States Fidelity and Guarantee Company, that made available to the state the balance of the unspent reclamation bonds and water treatment bonds required under the previously approved reclamation plan and the Consent Decree. The bond funds available to the DEQ for the Zortman and Landusky mines are as follows:

\$10,024,000	Zortman reclamation bond
\$19,600,000	Landusky reclamation bond
\$ 2,040,970	Construction assurance - for water capture and treatment plants (bond was \$10,100,00 but Pegasus had built much of the infrastructure)
\$13,895,101	Water treatment bond for 20 year operation and maintenance (bond was \$14,626,422 but Pegasus had paid for 1 of the 20 years prior to settlement)
\$ 389,000	Exploration permit reclamation bond
\$ 295,485	Open cut mine reclamation bond for an off site clay pit.

Additionally, the DEQ received \$1,050,000 from the bankruptcy court in partial settlement of state claims filed against the assets based on an identified need for additional reclamation. The court directed that the amount be split between the mine sites; \$450,000 for Zortman and \$600,000 for Landusky.

In 1998, the IBLA issued a decision on Fort Belknap's 1996 appeal of the BLM mine expansion decision and in November 1998 the IBLA ordered the BLM to work with the Tribes in the selection of a reclamation alternative for the mines that considered their potential impacts on Tribal water resources. This action basically vacated the decisions made under the 1996 EIS which were based on the company's now abandoned expansion plans. The BLM was also directed to develop additional information about ground water conditions at the mines. Since

then, the BLM and the DEQ in consultation with the Fort Belknap Tribes and others produced a Final Supplemental Environmental Impact Statement (SEIS) which was completed in December 2001. In May 2002 the agencies issued a new joint Record of Decision that selected preferred reclamation alternative Z6 for the Zortman mine and preferred reclamation alternative L4 for the Landusky mine.

However, these alternatives were dependent on the receipt of an additional \$22.5 million in reclamation funds beyond what was available from the mine reclamation bonds. The agencies planned to reclaim the mines under alternatives Z3 and L3 if the additional funding could not be found. These alternatives were less costly and perceived to be less protective than the preferred alternatives Z6 and L4. With either choice, the SEIS also determined that the trust fund provided by Pegasus under the Consent Decree for the long-term maintenance and operation of the water treatment facilities at the mines was \$11 million less than what would be needed to run the plants beginning in July 2017 when the short-term water treatment bond was expended.

Following the May 2002 Record of Decision, the DEQ began reclaiming the two mine sites with reclamation bond settlement funds performing tasks that were common to both Z3 and Z6 alternatives at the Zortman mine site and common to both L4 and L6 alternatives at the Landusky mine site. In June 2002, the Fort Belknap Tribes filed an appeal of the May 2002 BLM Record of Decision with the IBLA on several grounds including that failure to reclaim the sites in accordance with at least the preferred alternatives, Z6 and L4, would violate the BLM's obligation to protect the Tribes' resources.³ In July 2002, the Fort Belknap Tribes and three citizen's groups also filed suit in state District Court challenging the May 2002 DEQ Record of Decision alleging that failure to implement alternatives Z6 and L4 would violate the Montana Constitution and the state Metal Mine Reclamation Act.⁴

(1) IMPACTS ON SURFACE WATER AND GROUND WATER

HJR 43 asks the Legislative Council to identify the impacts on surface and ground water, including the recent degradation of Swift Gulch, attributable to past or present activities at the mine site. A review of only a selection of the many documents prepared on this subject cannot help but conclude that there have been impacts to both the ground water and surface water at the mine sites from both historic and more recent mining activities. However, the extent, severity, and effect of those impacts is more difficult to describe with any certainty.

The 1993 and 1995 federal and state water quality complaints that resulted in the Consent Decree also resulted in a \$2 million fine against Pegasus for unlawful discharges to surface and ground waters. A review of agency files between 1977 and 1995 documented acid mine drainage from historic and contemporary mine workings, multiple releases of cyanide to surface and ground water from leaks, spill, overflows, emergency cyanide solution disposals, and elevated metals in surface and ground water samples in many areas of the Zortman and Landusky mines.⁵ In a recent case in which federal District Court judge Donald Molloy declined to rule on whether

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the federal government broke its trust obligations to the Fort Belknap Tribes in its oversight of the mines, Judge Molloy stated, without citing specifics that "It is undisputed that the Zortman-Landusky mines have devastated portions of the Little Rockies, and will have effects on the surrounding area, including the Fort Belknap Reservation for generations. That devastation, and the resulting impact on tribal culture cannot be overstated."⁶

In a recent action, the Tribes filed a federal Clean Water Act complaint in federal District Court in Missoula against the DEQ, the BLM, and Mr. Luke Ployhar who recently purchased 71 private mining claims totaling 1,080 acres from the Pegasus bankruptcy trustee and who now owns much of the mine property. The complaint alleges that the defendants discharged pollutants in excess of water quality standards and they failed to obtain or issue state or federal discharge permits as required by law.⁷ The suit and its exhibits cite numerous instances when watersheds have been contaminated by acid mine drainage and it provides selected sampling data that allege violations of certain water quality standards for nitrates, cyanide, selenium, manganese, copper, and iron.

In response to another pending lawsuit, the DEQ admits that acid mine drainage, cyanide, selenium, and nitrates impact surface and ground waters that are hydrologically connected to the mines and that the impacts from acid mine drainage will continue in the long term.⁸ The Fort Belknap tribal community, through comments and litigation, has repeatedly expressed its concern about the mines' impact on the water quality of the Reservation.

Studies of domestic water supplies prepared by the federal Agency for Toxic Substances and Disease Registry (ASTDR) in 1998 concluded that based on a review of available data, there was no apparent public health hazard to the residents of the Fort Belknap Reservation from mine activities. The study found no evidence that people on the Reservation were exposed to dangerous levels of contaminants in sediments, surface water, or ground water. Hydrologic studies conducted in 1983 and 1993 found that natural water quality on the Reservation away from the mountains was naturally variable and often poor but that none of the studies cited mine activities as contributing to poor quality of the aquifers.⁹ Further, at the request of the Tribes, the EPA conducted a sampling study of domestic water supplies and streams on the Reservation in June 2000 and found no evidence of impact to water resources from the mines. No cyanide was detected in any of the wells sampled on the Reservation. Water quality in the wells closest to the mines showed no exceedences of drinking water standards.¹⁰ There are a number of public water supplies owned and operated by the Tribe in the Hays and Lodgepole area. Hays is downstream from the Landusky mine, and Lodgepole is downstream from the Zortman mine. The EPA is not aware of any violations of chemical standards in any of these community water supplies based on periodically required reporting requirements.¹¹

The DEQ has stated that there have been no exceedences of water quality standards on the Fort Belknap Reservation.¹² Part of the conflicting information is that there is a dispute over which water quality standards apply. The Consent Decree provided for temporary technology based

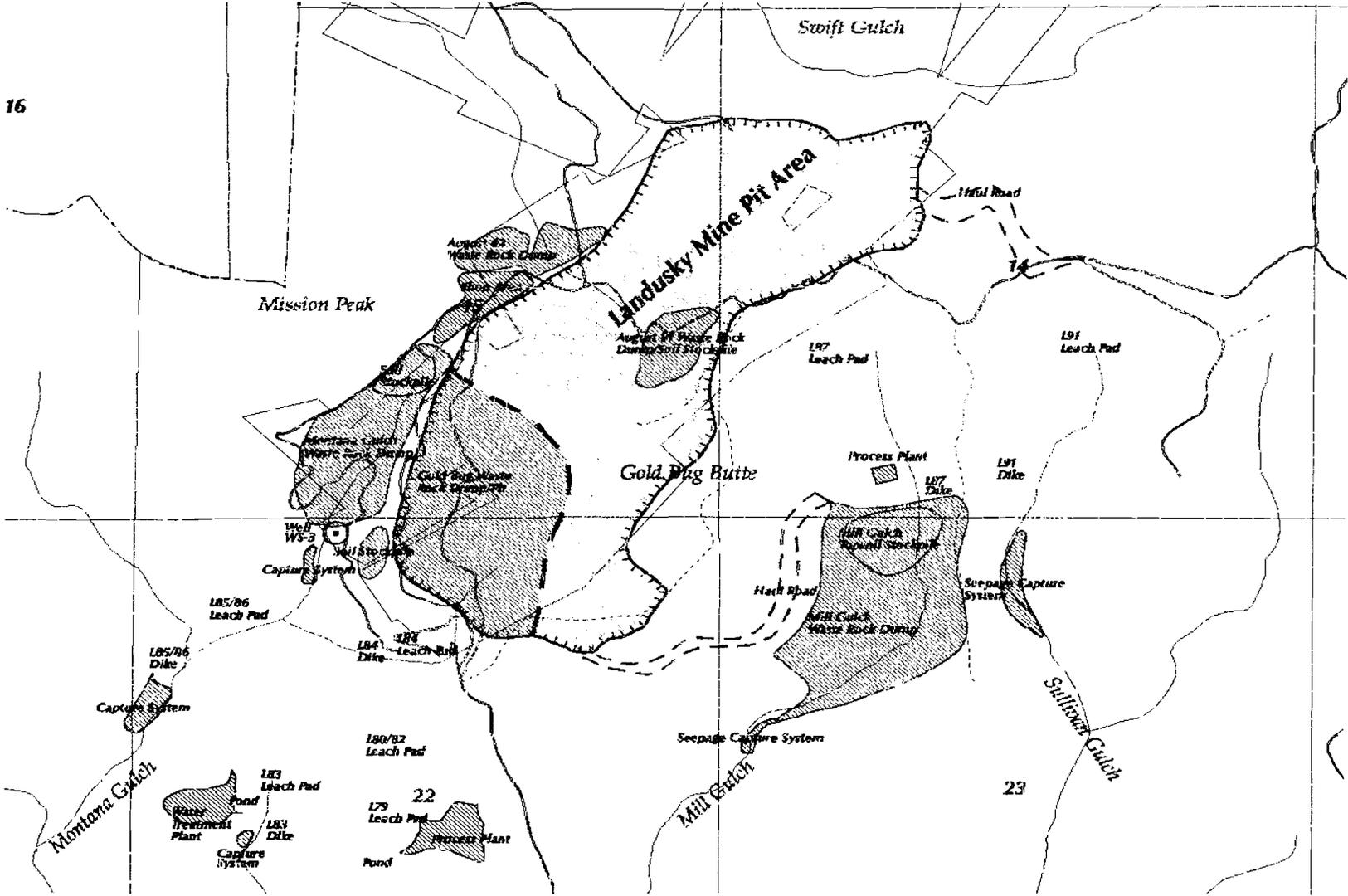
water quality standards that Pegasus was required to meet pending completion of the ground water and surface water collection systems and the construction of water treatment plants at Zortman and Landusky. Following construction of the systems, the DEQ intended to issue Pegasus Montana Pollution Discharge Elimination System (MPDES) permits that would include more stringent effluent standards. Pegasus constructed the collection and treatment systems but the 1998 bankruptcy eliminated the existence of Pegasus as a MPDES permit applicant. Since then the DEQ has been operating the water collection and treatment systems under the Consent Decree standards. This is one of the complaints being forwarded in the Tribes' Clean Water Act 2004 lawsuit.

Swift Gulch

The final 2001 SEIS describes the existing conditions of surface and ground water near the mines in detail on a drainage by drainage basis in Chapter 3.¹³ Swift Gulch is a tributary of the South Fork of Bighorn Creek which crosses the Reservation boundary and becomes a tributary of Little Peoples Creek which flows through the town of Hays. Swift Gulch is in a canyon approximately 700 feet below and 500 feet north of the northern edge of the Landusky mine. **(Figure 2)**. Stream distance between the Landusky mine and the Fort Belknap Reservation boundary is approximately 6,000 feet. The stream flows during the spring runoff, but at other times it is intermittent, surfacing and submerging along its length until it is joined by the North Fork of Bighorn Creek, a perennial stream. The SEIS describes concerns about the water quality of Swift Gulch from ground water seeps that enter the stream between the mine pit and the stream. There was some indication that the water was acidic and had elevated levels of sulfate and metals. Red orange iron precipitates coat a portion of the stream bottom. The water quality in the headwaters of Swift Gulch near the mine has been deteriorating since about 1999.¹⁴ The water has become more acidic, decreasing from about pH 7.5 to pH 3.7 according to tribal officials, and it is high in iron. The iron precipitate discoloration appears to be moving downstream towards the Reservation boundary and is now visible near the confluence of Swift Gulch and the South Fork of Bighorn Creek.¹⁵

The specific causes or sources of this degradation have not yet been conclusively identified. There is geologic evidence of historic iron staining in the canyon so there may be a natural component to the contamination.¹⁶ Also, Pegasus partially backfilled the north end of the Landusky pit in 1995-1996 with low pH acid producing rock which the DEQ in 2002 attempted to isolate with additional non acid rock backfill which was then covered with an impermeable barrier in an effort to limit the infiltration of precipitation to the area. It was not anticipated that this effort would produce any immediate positive results if, in fact, this was the source of the contaminated water that was appearing in the seeps along the upper reaches of Swift Gulch. To

Figure 2: Landusky Mine. Facilities and Land Status Map



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Source: BLM Action Memo, June 2004

date, the situation has not improved. There are several monitoring sites along Swift Gulch and South Bighorn Creek that are monitored routinely. Although Swift Gulch is clearly impacted, there have been no exceedences of the Consent Decree or draft MPDES water quality limits at the Reservation boundary monitoring site designated as L-48.¹⁷

(2) IMPACTS TO THE MILK AND MISSOURI RIVER DRAINAGES

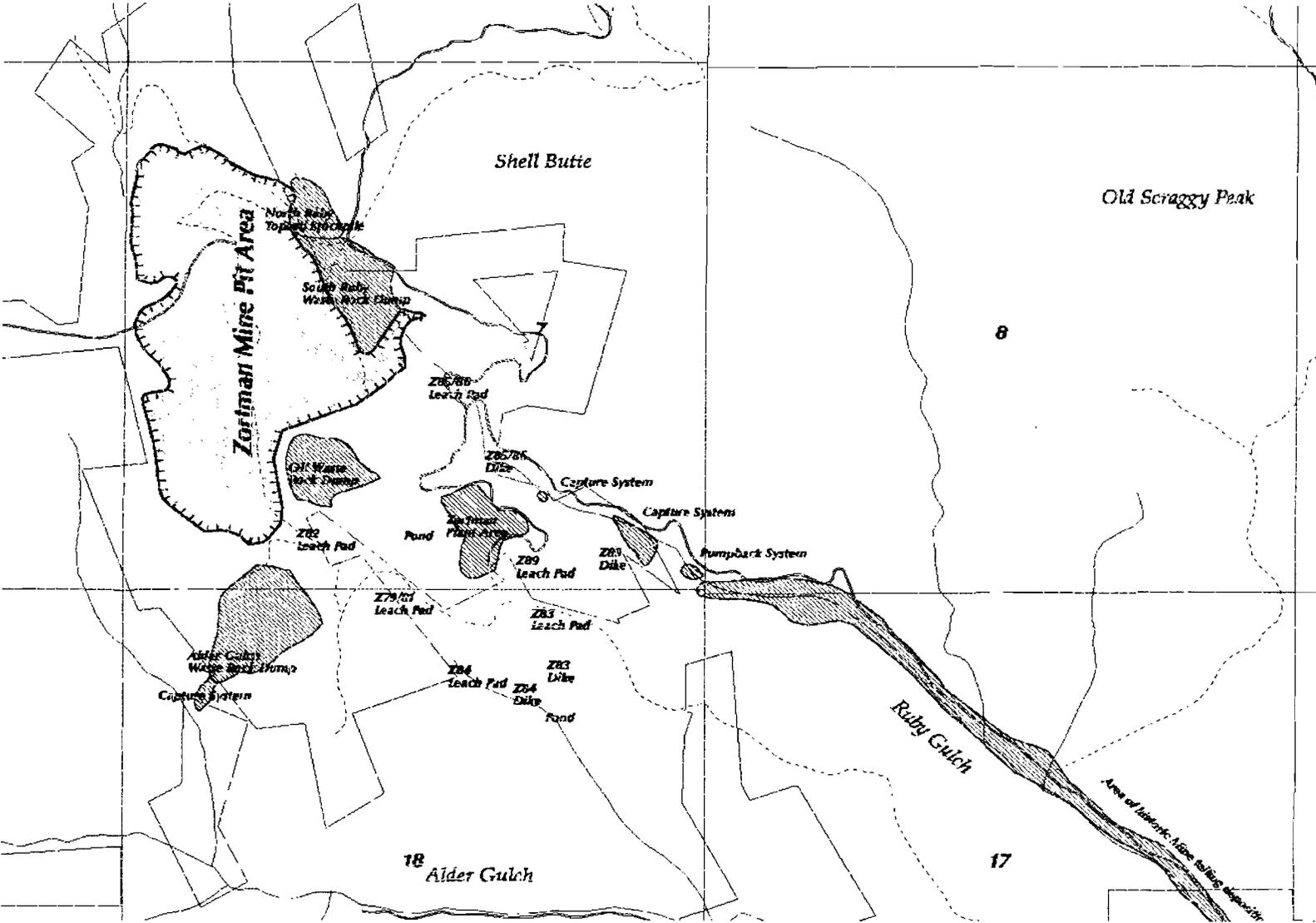
The Landusky Mine is the headwaters area for King Creek and Swift Gulch which drain to the northwest through the Fort Belknap Reservation as tributaries to Little Peoples Creek and on to the Milk River. The Landusky mine is also the headwaters area for Montana Gulch, Mill Gulch, and Sullivan Gulch which are tributaries of Rock Creek which flows south to the Missouri River. All of these streams are intermittent near the mine site. Perennial segments of Rock Creek and Little Peoples Creek several miles downstream of the mine support small brook trout populations.

The Zortman Mine is a headwaters area for Lodgepole Creek which drains north through the Fort Belknap Reservation and on to the Milk River and for Ruby Gulch and Alder Gulch which drain south to the Missouri River (**Figure 3**). Lodgepole Creek is intermittent near the mine but it flows perennially in its lower reaches and supports a brook trout population several miles north of the Zortman Mine. Ruby Gulch and Alder Gulch are intermittent streams but they may have significant flows following storm events or during spring runoff.¹⁸

The Milk River is an estimated 30-35 air miles from the Zortman and Landusky Mines and further by stream miles along Little Peoples Creek and Lodgepole Creek. The Missouri River is an estimated 20-25 air miles from the mines and further by stream miles along Rock Creek and Ruby Gulch. There are no known mine related sampling results for the Missouri or Milk Rivers in the vicinity of the mines. The DEQ, BLM, and their consultants consider both rivers to be far beyond the area that is potentially influenced by the mines. The agencies have been following a sampling and monitoring plan in the Consent Decree, and a more recent long-term water monitoring program that was developed by technical specialists from the agencies, the EPA, and the Tribes.¹⁹ Water monitoring is concentrated in the immediate area of the mines in areas known to have been impacted. There are a few sampling stations approximately two miles from the mines but they are no longer used.

The current ground water monitoring plan involves sampling about 44 wells twice each year. Water quality trends in most wells are reportedly stable and the ground water chemistry meets drinking water standards. There are some exceptions. A few wells that are located between mine waste facilities and the water collection and treatment systems sometime exceed standards. Others that were drilled into unmined mineralized rock show results that exceed drinking water standards for arsenic with no evidence of any influence from mining activity. Deep monitoring wells located between the north edge of the Landusky pit and Swift Gulch show deteriorating

Figure 3: Zortman Mine. Facilities and Land Status Map



Source: BLM Action Memo, June 2004

water chemistry for the past few years.²⁰ The surface and ground water monitoring program costs approximately \$60,000 per year, and it is deemed adequate for current needs.

The SEIS concluded that the surface and ground water in Lodgepole Creek is not impacted by mining activities. Very little mining occurred at the Zortman Mine in the headwaters of Lodgepole Creek. Water quality monitoring on Lodgepole Creek at the Reservation boundary shows no change in water chemistry during mine operations. Alder and Ruby Gulch join near the town of Zortman and Ruby Gulch typically infiltrates into the ground near there. Mine impacted water near the mine site upstream from the town is captured at several locations and treated in the Zortman water treatment plant.

On the north side of the Landusky Mine, there are no water capture and treatment facilities for King Creek and Swift Gulch. Swift Gulch wasn't identified as a problem when the Consent Decree was signed in 1996. The company was required to construct a water collection and passive treatment facility for King Creek but failed to complete the project prior to bankruptcy. As noted, there are contaminated seeps entering Swift Gulch from an as yet unidentified source and water quality in Swift Gulch appears to be getting worse with time. In 2000, the EPA removed some sediments that resulted from historic mining activities in King Creek. The water in the headwaters of King Creek is impacted by mining. Although the water is not acidic, nitrate and selenium exceed some standards.²¹

Table 1: Consent Decree Violations May 2003 to May 2004

LOCATION	PARAMETER	STANDARD	SAMPLE/DATE
Zortman water treatment plant	Total suspended solids	daily maximum level = 30 ppm	35.4 ppm / 7-31-03
Ruby Gulch Pond underdrain	Copper	30 day average = 0.15ppm	0.442 ppm / 9-30-03
	pH	range = 6.0 - 9.0	5.12 / 9-30-03
	Zinc	30 day average = 0.75ppm	1.17 ppm / 9-30-03
Landusky - lower Montana Gulch pond overflow	Total suspended solids	daily maximum level = 30 ppm	34 ppm / 1-31-04

Source: Tom Reid, DEQ Water Protection Bureau, 7-1-04

The intermittent streams that drain from the south side of the Landusky Mine all have ground and surface water capture facilities that route water through the Landusky water treatment plant. Water monitoring below these capture facilities indicates that the water quality in Mill Gulch, Sullivan Gulch, Montana Gulch, and Rock Creek meets the Consent Decree standards as well as the draft MPDES permit standards.²²

Much of the water at the mines is high in sulfate. There are no standards for sulfate in the Consent Decree or in the draft MPDES permits. A DEQ compliance report for violations of the

Consent Decree standards at the Zortman-Landusky Mines between May 2003 and May 2004 lists only five violations (**Table 1**).

(3) PROTECTION OF THE SURFACE AND GROUND WATER RESOURCES BY CURRENT AND PROPOSED RECLAMATION EFFORTS

With the exception of Swift Gulch, the DEQ believes that the surface and ground water resources in the area are being protected by the current and proposed mine reclamation and water treatment efforts. The purpose of the mine reclamation is spelled out in the SEIS and in the Record of Decision. Essentially, the reclamation of the mines has two primary components, both intended to address the protection of surface and ground water quality. The first is the physical reclamation of the mine pits, roads, waste rock dumps and leach pads. This effort is designed to improve the long-term stability of mine excavation features, isolate and cover acid producing materials, provide for proper drainage, reduce infiltration by precipitation and runoff, reestablish vegetation, and improve aesthetics. The second effort is to capture and treat surface and shallow ground water and leach pad drainage until contaminants can be reduced to acceptable levels. The magnitude and duration of the water treatment effort is largely dependent on the success of the of the land reclamation effort. But in no case short of the physical encapsulation of the mine facilities will the need for long term water treatment be unnecessary.

The mine operations, particularly the larger and deeper Landusky Mine, exposed sulfide rock which produces acid rock drainage when it is exposed to air and water. This acid rock drainage, or ARD, in the presence of the exposed surfaces of mineralized rocks, can mobilize metals in the rock and contaminate surface and ground water. The reclamation plans focus on identifying the sources of acid generating materials and isolating them from ground water and surface water infiltration to control the source of contaminated water and reduce the amount that needs to be treated.

Before the 1998 bankruptcy and in partial fulfillment of the requirements of the Consent Decree, Pegasus was required to capture all surface and shallow ground water at each discharge and construct a water treatment plant at each mine. Buried capture systems collect water from beneath the leach pads and below the waste rock dumps before it flows off site and routes it to either the water treatment plant at the Zortman Mine or the one at Landusky. These plants use lime to treat the acidity and precipitate metals out of the water collected by the capture systems. Since 1999, these plants have captured and treated over a billion gallons of mine drainage.²³

The Zortman water treatment plant treats between 50 and 75 million gallons of water per year. The treated water from the Zortman plant meets the Consent Decree limits and would meet most of the draft MPDES limits most of the time (**Table 2**). Treated water is returned to Ruby Gulch.

Table 2: Zortman Water Treatment Plant - Typical Chemistry*

Parameter	Water In	Water Out	% Removal	Consent Decree limit (daily max)	Possible MPDES limits	Water Quality Standard**
pH	3.5 3.5	7.5 7.5	---	6.0-9.0	6.5-9.0	6.5-8.5
TSS (total suspended solids)	20	25		30		20
arsenic	0.015 0.080	< 0.003 <0.003	> 80%	NA	0.018	0.018
cyanide (total)	0.015	0.010		<0.005		0.0052
cadmium	0.2 0.2	0.004 0.005	98%	0.10	0.005	0.005
copper	3.50	0.015		0.30		0.031
iron	35 40	0.2 0.5	99.7%	NA	1.0	1.0
lead	0.005 0.005	< 0.003 <0.003	50%	0.60	0.015	0.015
manganese	30 35	3 3.5	90%	NA	---	0.05
mercury	ND	ND		0.002		0.00005
selenium	0.015	0.010		NA		0.005
sulfate	3000 3000	2400 2600	20%	NA	---	250
zinc	5.0	0.05		1.50		0.388

* in mg/L or parts per million (ppm): **Bold Source; Jepson, DEQ, Testimony before EQC; Non bold Source; BLM Action Memorandum**

** These include primary and secondary standards from a variety of sources and are presented only to assist in characterizing the potential for contaminants in a release.

The Landusky water treatment plant treats between 250 and 275 million gallons of water per year. The treated water from the Landusky plant achieves the Consent Decree standards and would likely meet most draft MPDES limits (**Table 3**). Treated water is discharged to Montana Gulch.

However, the lime precipitation water treatment plants are not effective in treating the cyanide, nitrate, and selenium from the leach pad process solution. There is an estimated 145 million gallons of residual cyanide process solution stored within the leach pad circuits with additional accumulations expected in the future from water infiltration. In 2001, the agencies built a bioreactor water treatment system on the Landusky Mine site with remaining construction bonds from Pegasus' surety to treat the heap leach solutions that drain from the leach pads at the mine. Because the ore placed on the heap leach pads was treated with alkaline materials to enhance the

gold recovery process, the heap leach solutions are not yet acidic, but they are generally too high in selenium, nitrates, and cyanide to meet stream discharge limits (**Table 4**).

Table 3: Landusky Water Treatment Plant -Typical Chemistry*

Parameter	Water In	Water Out	% Removal	Consent Decree limit (daily max)	Possible MPDES limits	Water Quality Standard**
pH	6.0 6.0	7.5 7.5	---	6.0-9.0	6.5-9.0	6.5-8.5
TSS (total suspended solids)	20	7		30		20
arsenic	0.150 0.15	0.025 <0.025	83%	NA	0.018	0.018
cyanide (total)	0.05	ND		<0.005		0.0052
cadmium	0.010 0.015	0.001 0.004	90%	0.10	0.005	0.005
copper	0.03	0.005		0.30		0.031
iron	10 10	0.3 0.3	97%	NA	1.0	1.0
lead	0.004 0.004	<0.003 <0.003	>50%	0.60	0.015	0.015
manganese	3.0 4.0	1.5 3.0	50%	NA	---	0.05
mercury	ND	ND		0.002		0.00005
selenium	0.005	0.005		NA		0.005
sulfate	600 650	500 900	17%	NA	--	250
zinc	0.80	0.05		1.50		0.388

* in mg/L or parts per million (ppm): **Bold Source; Jepson, DEQ, Testimony before EQC**; Non bold Source; BLM Action Memorandum

** These include primary and secondary standards from a variety of sources and are presented only to assist in characterizing the potential for contaminants in a release.

The treated Landusky heap leach water from the bioreactor is discharged to a land application area on Goslin Flats below the town of Zortman where it is sprinkler irrigated. Approximately 80 million gallons of precipitation collected in the Landusky leach pads and required treatment prior to reclamation. DEQ is hopeful that land reclamation efforts will reduce this to 15-30 million gallons per year.

The leach pad water from the Zortman Mine is also collected and piped to the land application area on Goslin Flats. Prior to reclamation of the leach pads at Zortman, the pads drained approximately 30 million gallons of water per year. DEQ believes that the reclamation and

revegetation of the leach pads may eventually reduce this flow to about 5 -10 million gallons per year. This may make other disposal options available instead of using the land application area.²⁴

Table 4: Bioreactor for Leach Pad Process Water*

Parameter	Typical Heap Leach influent	Typical effluent to Land Applic or water treatment plant	Water Quality Standard**
pH	6.8	7.2	6.5 - 8.5
arsenic	0.010	0.002	0.018
cyanide(total)	0.37	0.29	0.0052
cadmium	0.75	0.03	0.005
copper	0.100	0.01	0.031
lead	0.002	ND	0.015
nitrates	82	1.0	10.0
selenium	0.47	0.06	0.005
zinc	2.00	0.75	0.388

* in mg/L or parts per million (ppm): Source; BLM Action Memorandum

**These include primary and secondary standards from a variety of sources and are presented only to assist in characterizing the potential for contaminants in a release.

The DEQ and its federal partner, BLM, have been reclaiming the mines using bonds from the settlement agreement with Pegasus' sureties. The preferred alternative in the SEIS for the reclamation of the Zortman Mine was option Z6 and the preferred alternative for the reclamation of the Landusky mine was option L4. As stated previously, these options were estimated to cost \$22.5 million more than what the agencies had available from the sureties; \$5 million more for Zortman and \$17.5 million more for Landusky. Alternatives Z3 and L3 were reclamation choices that the agencies believed would comply with the applicable laws but which could be accomplished with the available bond funds. These alternatives are perceived by the Tribes and others to be less protective of the environment than the preferred alternative. The SEIS provides detailed descriptions and comparisons between each alternative. There is litigation pending in the courts to require the agencies to implement alternatives Z6 and L4.

The agencies, through competitive bidding, significant cooperation from Spectrum Engineering and its subcontractors, and with the infusion of over \$5 million in federal funds from the BLM, have been able to reduce costs and implement most of the reclamation projects in alternatives Z6 and L4. The \$22.5 million reclamation shortfall has been reduced to about \$1.53 million.²⁵ Reclamation at Zortman is complete under the Z6 alternative with the exception of relocating the top portion of the Alder waste rock dump to the North Alabama pit and covering and revegetating both areas. Reclamation at Landusky is complete under the L4 alternative with the exception of partially backfilling portions of the pit with the 85-86 leach pad which is currently located in the headwaters of Montana Gulch and the completion of some ongoing contracts.

(4) POTENTIAL IMPACTS TO SURFACE AND GROUND WATER IF ADDITIONAL FUNDING IS NOT AVAILABLE FOR WATER TREATMENT AND RECLAMATION

Reclamation

Through March 2004, the DEQ has spent approximately \$37,281,163 to reclaim the Zortman and Landusky Mines including \$33,666,658 in bond settlement funds, \$2,017,905 in federal dollars, and \$1,596,600 in state funds.²⁶ The agency's efforts at source control through mine reclamation appear to be nearing completion with the reclamation of the mines in accordance with the preferred alternatives Z6 and L4 despite the initial shortage of bond money. The DEQ believes that it will need approximately \$2.7 million more to complete Z6 and L4.

The BLM believes that it will be able to obtain an additional \$1.2 million through its abandoned mine program to complete the L4 alternative and remove and reclaim the Landusky 85-86 heap leach pad and the use of the material to help backfill and further isolate materials in the Landusky pit.²⁷ This leaves the reclamation project short by \$1.5 million, mostly for completion of the Z6 alternative at Zortman. The DEQ has submitted an application to the Department of Natural Resources and Conservation (DNRC) for a \$300,000 Reclamation and Development Grant (RDG) to help cover some of those costs. Grant applications are ranked by the DNRC and the priority projects are recommended to the 2005 Legislature for funding in House Bill No. 7. The revenue is generated from interest on the Resource Indemnity Trust Fund.

One major reclamation problem exists. The BLM, DEQ, and the Tribes are concerned about the seeps on the north side of the Landusky Mine pit that are degrading Swift Gulch. Source control reclamation efforts to address the problem have not produced the desired results so far. The BLM is currently conducting a \$60,000 study of the problem in Swift Gulch.²⁸ The DEQ has also applied to the DNRC for a \$300,000 RDG to investigate the hydrology of the area in an attempt to identify the source of the problem and craft a possible solution. Depending on the solution, additional reclamation funds or water treatment funds may be necessary in the future.

The DEQ also has some remaining bond funds from the Pegasus bonds dedicated to construct a passive water treatment system in the headwaters of King Creek if source controls and waste rock removals that were implemented prove to be inadequate.

Water Treatment

The major problem and most critical financial need at the Zortman and Landusky Mines is the fact that there are insufficient funds to maintain the water treatment system. Pegasus provided two sources of funding for the operation and maintenance of the water treatment plants. Both are considered to be insufficient.

The first is the \$14,626,422 short-term (20 year) water treatment bond which was intended to pay for the maintenance and operation of the Zortman and Landusky water treatment plants from

June 30, 1997 until June 30, 2017. One twentieth of this bond or \$731,321 is provided to DEQ by the surety each year. Since Pegasus operated the plants during 1997, the actual bond funds provided to DEQ will total \$13,895,101. Actual costs to operate and maintain the water treatment plants are shown below:²⁹

<u>Year</u>	<u>Cost</u>	<u>Bond</u>	<u>Shortage</u>
1999	~\$1,200,000	\$731,321	~\$468,700
2000	\$843,387	\$731,321	\$112,066
2001	\$879,727	\$731,321	\$148,406
2002	\$905,899	\$731,321	\$174,578
2003	\$758,267	\$731,321	\$ 26,936

The BLM has provided \$500,000 to cover the shortfall for the past few years, but those funds are nearly expended. The DEQ estimates that there is a \$4.2 million shortage in what will be needed over the next 13 years to cover the costs of operating and maintaining the water treatment plants. The DEQ has applied to the DNRC for a third \$300,000 RDG to help cover the shortages of operating the water plants for approximately three years.

The costs of operating the plants could increase or decrease over time depending on the amount of water that requires treatment based on precipitation and the success of reclamation efforts and the inflationary costs of operation, repair, and maintenance. Added to the cost of water treatment is the maintenance and operation of the bioreactor process which was not anticipated in the Consent Decree and not bonded for.

Perhaps more important in terms of budget short falls is the bond that is available for long-term water treatment after June 30, 2017. Pegasus was required to establish a trust fund that would pay for long-term water treatment defined in the SEIS as until the year 2080. The difficulty of predicting needs, technology, and financing that far into the future or beyond are described in detail in the SEIS. A bond package of zero coupon bonds have been purchased by Pegasus and the DEQ to provide a long-term trust reserve estimated to be worth approximately \$14.8 million by the year 2017. The DEQ and its consultants have calculated that given the current costs of operating the water treatment plants, the \$14.8 million is about \$11 million in 2002 dollars short of what may be needed to pay for long-term water treatment. The SEIS also predicted that the trust reserve was \$11 million less than what was needed to be invested in 2001 in order to fund long-term water treatment after 2017. That number is estimated at \$12.4 million today.³⁰

A simple annuity calculation shows that a trust reserve valued in 2017 at \$14.8 million earning a 5% return would provide approximately \$800,000 for 43 years or until the year 2060. Of course the annual costs are not likely to remain at \$800,000 and there are no extra funds to pay for replacing the water treatment plants using whatever technology may be available or necessary at the time.

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The 2003 Legislature in HB 2 authorized the sale of hard rock mining reclamation bonds, backed by metaliferrous mine tax revenues, up to the amount of \$2.5 million provided that Congress appropriates at least \$10 million during the current biennium for the purpose of providing a total of \$12.5 million to fund the long-term water treatment trust reserve for Zortman and Landusky. The Department of Interior and Related Agencies appropriations bill (S. 1391) for 2004 included a request for funds but it was not accepted. In rejecting the request the Committee on Appropriations stated that "the Committee understands a proposal is being prepared for FY 2005 to address the plan set forth in the Record of Decision for Reclamation. The Committee continues to believe protecting water quality in the region should be a top priority for the BLM budget request." There have been no federal appropriations to date.

SUMMARY

The water quality problems at Zortman and Landusky are better now than they were before the Pegasus mine began operating according to the DEQ.³¹ The historic discharges from several old mine adits have been captured and are now being treated. The historic tailings in Ruby Gulch and tailings dams and sediments in King Creek have been removed. Waste rock dump water discharges are now being captured and routed through one of the water treatment plants. However, the scale of the disturbance and the acid producing rock at the site have created reclamation and water treatment challenges that may continue for many years.

Much effort, research, and funding has been applied to these mines in an effort to produce and implement an environmentally sound reclamation plan in the absence of a mine operator. That task may not be complete given the continuing challenges about discharge permits, water quality violations, diversions of water, and other issues that have been raised in pending litigation. There is no disagreement that conditions in Swift Gulch on the north side of the Landusky mine pit merit additional research and attention. With land reclamation efforts nearing completion, emphasis may need to be focused on implementing the surface and ground water monitoring plan in an effort to determine how successful the reclamation efforts have been. There may be a time lag between the completion of reclamation, the establishment of vegetation, and noticeable changes in water quantity and quality at the mine site. There may be a need for additional re-engineering and design. There may be a need for additional source isolation and reclamation. Meanwhile, water capture and treatment will be a fact of life at these mines for the indefinite future. Unless costs can be reduced, there are immediate and future needs for adequately funding these water treatment efforts.

ENDNOTES

1. Record of Decision for Reclamation of the Zortman and Landusky Mines, Bureau of Land Management and Montana Department of Environmental Quality, May 2002. (ROD, 2002).
2. U.S.A. and State of Montana v Pegasus Gold Corp. and Zortman Mining, Inc, and Gros Ventre Tribe, Assiniboine Tribe, Fort Belknap Community Council, and Island Mountain Protectors Assn, vs Pegasus Gold, Inc., Pegasus Gold Corp, and Zortman Mining, Inc; Consent Decree page 35; Civil Action No. 95-95-BLG-JDS (Consent Decree).
3. Assiniboine and Gros Ventre Tribes and Fort Belknap Community Council vs Bureau of Land Management, Before the United States Dept. of Interior Office of Hearings and Appeals Board of Land Appeals, BLM Nos. MTM 77778-77779, MT-0670-05-1990-01, June 27, 2002.
4. Assiniboine and Gros Ventre Tribes and Fort Belknap Community Council, Montana Environmental Information Center, Mineral Policy Center, National Wildlife Federation vs Montana Department of Environmental Quality, Kelvin Buchanan in his Capacity as Trustee for Zortman Mining Inc., and Pegasus Gold Corporation, Montana First Judicial District Court, Cause No. ADV-2002-473, July 2002.
5. Impacts to Surface and Ground Water From Ten Montana Metal Mines, pp 32-40, Stuart Levit, Public Education for Water Quality Project, August 1996.
6. Gros Ventre Tribe, Assiniboine Tribe, and the Fort Belknap Indian Community Council. vs United States Bureau of Land Management, et.al.; Order, pg 12; CV 00-69-M-DWM; June 28, 2004.
7. Assiniboine and Gros Ventre Tribes vs Luke Ployhar, owner of Zortman and Landusky mines;; Jan Sensibaugh, Director of MDEQ; and Kathleen Clarke, Director of US BLM,; CV 04-17-M-DWM.; January 28, 2004.
8. See endnote 4, page 4.
9. Final Supplemental Environmental Impact Statement for the Zortman and Landusky Mines; BLM and DEQ; December 2001; pages 3-102, 6-71. (SEIS, 2001)
10. SEIS, 2001 p 6-72.
11. Phone Log, Jay Sinnott, EPA Water Program, Helena office, June 30, 2004.
12. Phone log, Jan Sensibaugh, DEQ director, July 6, 2004.
13. SEIS, 2001

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14. Wayne Jepson, DEQ, e-mail correspondence, June 23, 2004
15. Phone Log, Dean Stiffarm, Fort Belknap Environmental Office, July 9, 2004.
16. Supplemental Declaration of Scott Haight, BLM; Cause No.00 CV-69-M-DWM, page 5.
17. Deposition of Wayne Jepson, DEQ; Cause No. 00 CV-69-M-DWM, page 59.
18. Action Memorandum for Zortman and Landusky Mines; Time Critical Removal, BLM, June 2004, pages 5-6.
19. Zortman and Landusky Mines Ground Water and Surface Water Monitoring Plan, April 2002, Interagency Technical Working Group.
20. Wayne Jepson, DEQ, e-mail correspondence, July 2, 2004.
21. Wayne Jepson, testimony before the Environmental Quality Council, October 9, 2003 .
22. Deposition of Wayne Jepson, pages 76-80.
23. Action Memorandum, pages 4-5.
24. Wayne Jepson, DEQ, testimony before the EQC.
25. Action Memorandum, page 4.
26. Fiscal spreadsheet, DEQ, June 9, 2004.
27. Deposition of Wayne Jepson, page 29.
28. Phone Log, Bill Maehl, Spectrum Engineering, June 3, 2004.
29. Action Memorandum, page 4
30. Wayne Jepson, DEQ, testimony before the EQC.
31. Personal communication with Wayne Jepson, DEQ project manager, June 2004.

Appendix 1

2003 Montana Legislature

HOUSE JOINT RESOLUTION NO. 43

INTRODUCED BY WINDY BOY, BALLANTYNE, BECKER, BERGREN, BIXBY, BRANAE, BUZZAS, CALLAHAN, CARNEY, P. CLARK, COONEY, CYR, DICKENSON, DOWELL, ELLINGSON, ELLIOTT, FACEY, FRANKLIN, GALLUS, GALVIN-HALCRO, GIBSON, GOLIE, GUTSCHE, HAINES, HANSEN, HARRIS, HEDGES, JACOBSON, JAYNE, JUNEAU, KITZENBERG, LAMBERT, LANGE, LENHART, LINDEEN, MATTHEWS, MUSGROVE, NEWMAN, PARKER, RASER, SMALL-EASTMAN, TESTER, TOOLE, WANZENRIED, WEISS

A JOINT RESOLUTION OF THE SENATE AND THE HOUSE OF REPRESENTATIVES OF THE STATE OF MONTANA REQUESTING AN INTERIM STUDY OF THE SURFACE WATER AND GROUND WATER IMPACTS OF THE ABANDONED ZORTMAN AND LANDUSKY MINE SITES ON THE MILK AND MISSOURI RIVER WATERSHEDS AND THE EFFECTIVENESS OF THE STATE RECLAMATION EFFORTS AT THE ZORTMAN AND LANDUSKY MINE SITES IN PROTECTING THE WATERSHEDS; AND REQUESTING THAT THE RESULTS OF THE STUDY BE REPORTED TO THE 59TH LEGISLATURE.

WHEREAS, Pegasus Gold Corporation (Pegasus), through its subsidiary, Zortman Mining Incorporated (ZMI) and its predecessors, owned and operated the Zortman mine and the Landusky mine located in the Little Rocky Mountains of Phillips County, Montana, from 1979 until ZMI entered Chapter 7 bankruptcy in 1998 and abandoned the site; and

WHEREAS, the State of Montana's Department of Environmental Quality (DEQ) is presently directing the land reclamation and water treatment activities and operating the water treatment plants at the mine sites; and

WHEREAS, in 2002, the Bureau of Land Management and the DEQ prepared a joint supplemental environmental impact statement to evaluate alternatives for the final reclamation of the Zortman and Landusky mine sites; and

WHEREAS, the effectiveness and sufficiency of the current and proposed reclamation are not universally acceptable, and the reclamation is admittedly underfunded; and

WHEREAS, water discharges from the mine sites require treatment efforts, possibly into perpetuity; and

WHEREAS, the Little Rocky Mountains are upland water recharge areas for several watersheds and tributaries that supply the Milk River and the Missouri River; and

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WHEREAS, current reclamation plans for water treatment at the mine sites contemplate the complete cessation of water treatment as soon as the year 2028.

NOW, THEREFORE, BE IT RESOLVED BY THE SENATE AND THE HOUSE OF REPRESENTATIVES OF THE STATE OF MONTANA:

That the Legislative Council be requested to designate an appropriate interim committee, pursuant to section 5-5-217, MCA, or direct sufficient staff resources to review the reclamation efforts at the Zortman and Landusky mine sites to:

(1) identify the impacts on surface water and ground water, including the recent degradation of Swift Gulch, attributable to past or present activities at the mine sites;

(2) determine if there are identifiable downstream impacts on the Milk and Missouri River drainages attributable to past or present activities at the mine sites;

(3) determine whether the surface water and ground water resources in the watersheds affected by the mine operations are being protected by the current or proposed state reclamation; and

(4) determine the potential impacts to surface water and ground water resources if additional funding for water treatment and reclamation does not become available.

BE IT FURTHER RESOLVED, that the study be conducted by reviewing available research reports and by soliciting testimony and information from knowledgeable individuals, academic institutions, and the appropriate local, state, tribal, and federal agencies.

BE IT FURTHER RESOLVED, that, in particular, representatives of the Fort Belknap Reservation Environmental Department be included in the study and participate in developing findings and recommendations.

BE IT FURTHER RESOLVED, that, if the study is assigned to staff, any findings or conclusions be presented to and reviewed by an appropriate committee designated by the Legislative Council.

BE IT FURTHER RESOLVED, that all aspects of the study, including presentation and review requirements, be concluded prior to September 15, 2004.

BE IT FURTHER RESOLVED, that the final results of the study, including any findings, conclusions, comments, or recommendations of the appropriate committee, be reported to the 59th Legislature.

- END -