GUYANA ENVIRONMENTAL CAPACITY DEVELOPMENT PROJECT: Mining Sector (GENCAPD)

KLONDIKE PLACER MINERS ASSOCIATION

GUYANA GOLD AND DIAMOND MINERS ASSOCIATION

YUKON/GUYANA ALLUVIAL MINING TECHNOLOGY EXCHANGE PROJECT

Prepared for
Canadian International Development Agency (CIDA)
Natural Resources Canada (CANMET)
Guyana Geology and Mines Commission
and
Guyana Gold and Diamond Miners Association

by

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Executive summary

The objective of this project was to facilitate the exchange of alluvial gold mining technology between the Klondike Placer Miners Association (KPMA, Yukon Territory, Canada) and the Guyana Gold and Diamond Miners Association (GGDMA). The managers from two active large-scale placer mines accompanied the author to Guyana for the period February 26th to March 6th, 2000. Several meetings were held with alluvial miners, their association (GGDMA), the Guyana Geology and Mines Commission (GGMC), and the honorable Samuel Hinds, Prime Minister of Guyana.

The Canadian miners traveled with the author by jet boat up the Essequibo, Mazaruni and Puruni Rivers to the Million Mountain area (see attached maps). They also traveled by road to the lower Konawaruk River area. Several land and river (Missile) dredging operations, local facilities, tropical road construction and other infrastructure were inspected. The Canadian miners showed pictures of their operations and held discussions regarding the application of heavy equipment and Canadian alluvial mining and reclamation methods to the Guyanese environment. Both Canadian miners indicated their intention to return to Guyana to conduct follow up examinations and further discussions with Guyanese miners.

The Guyanese and Canadian miners felt that they benefited from the exchange of each other's knowledge and recommended additional delegations to and from the Yukon alluvial mining areas.

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1.0 Introduction

Further to request from the Guyana Environmental Capacity Development Project (GENCAPD) Project Steering Committee (PSU), the author arranged and accompanied Canadian alluvial miners on a brief tour of Guyana alluvial mines to facilitate an exchange of alluvial mining technology.

The Canadian miners included John Alton, John Zogas and Chris Fawcus. Both Mr. Alton and Mr. Zogas have twenty years of alluvial mining experience and currently own and operate large-scale mines equipped with hydraulic excavators, bulldozers, and off-road haul trucks and/or scrapers. Mr. Alton is a director of the Klondike Placer Miners Association (KPMA). Mr. Alton has several mining properties near Dawson City, Yukon and mines on Hunker, All Gold or Bonanza Creeks. These creeks have typical Klondike placer deposits with 3 to 10 meters of frozen (perma-frost) black muck overlying alluvial gravels and a greenstone bedrock. Placer mines in the Klondike district are typically shallow (3 to 15 meters deep).

Mr. Zogas has a mine on Wright Creek near the town of Atlin in northwestern British Columbia. This area was extensively glaciated and the deposits are typically much deeper (up to 70 meters). The gold is also very coarse and nuggety. These deposits consist of fine mixed glacial till soils and boulders. Mr. Fawcus is an associate of Mr. Zogas and is an expert in investment risk analysis. Both Mr. Zogas and Mr. Alton brought pictures to illustrate their methods of alluvial mining.

The report is completed in Appendix by some specific topic summary (Guyanese land dredging, Guyana versus Canadian Mining conditions and Alluvial Exploration), by a series of pictures taken during the visit, by maps of Guyana, by a contact list of the people involved and encountered during the exchange and by an example of mining exploitation specifications as calculated by the author.

2.0 Schedule

The group arrived in Georgetown, Guyana late Sunday evening (February 27th). The following Monday the group had several meetings including: Jean-Marc Barbera (GENCAPD field manager); Karen Liven (GGMC Environmental Division); Brian Sucre (Commissioner of GGMC); Samuel Hinds (Prime Minister and Minister of Mines); Jacque Cretes (Canadian High Commissioner), Anna Iles (Canadian International Development Agency) and the Guyana Gold and Diamond Miners Association. Monday evening the group met with Andrew Mekdeci (Mazda Mining). A list of all the people involved encountered during the exchange is presented at Appendix F.

The group left early (5 am) Tuesday morning by jeep for Parika at the mouth of the Essequibo River, where they took a jet boat along with Alfro Alphonso to his operations at Million Mountain (see Appendix E for location of maps). The jet boat traveled up the Essequibo River to Bartica, then up the Mazaruni River, past Marshall falls, (photo 1 see Appendix D) to the Puruni River (photo 2) and finally up the Puruni River past Peter's Mine (photos 3 and 4) to Million Mountain (photo 5). Several land dredge pits and land dredging were examined at Million Mountain (photos 6 and 7). The group departed that evening by all-wheel drive bush truck to inspect neighboring operations (photo 8). The truck was stuck frequently due to recent road construction and rains, and the group didn't return to Million Mountain until early the next morning.

On Wednesday, March 1st, the group traveled back by jet boat and stopped to inspect more land dredging (photo 9) and river (Missile) dredging operations en-route (photo10). One of the dredges inspected was a Brazilian owned suction dredge with a hydraulically operated cutter head (photos 11 and 12). The group met with Errol Tempow and Wayne Vieira (Guyanese mine owners) that evening.

On Thursday, the group departed early (5 am) by jeep to inspect operations on the Konawaruk River. The jeep traveled past Linden to Mabura Hill, crossed the Essequibo River at Mazda's ferry and continued up the laterite road along the lower Konawaruk River. The group inspected Errol Tempow's land dredging operations (photos 13 and 14). The author sampled the pit and conducted mass flow measurements on the pump and sluice box. The results of the calculated mass flow are presented at Appendix G. Then the group witnessed upgrading of Missile dredge concentrates and mercury amalgamation at Mazda's Jeanette Creek camp. The group traveled up river to inspect Mazda's Missile dredges at the North Fork camp (photos 15 and 16). Then they returned to Georgetown that evening.

On Friday, the group met with Alfro Alphonso, then with Andrew Mekdeci, and with Wayne Vieira to discuss Guyanese mining conditions and arrangements. Several more meetings with miners were held on Saturday and Sunday. The group departed from Guyana on Sunday evening (March 5th).

3.0 Observations

3.1 Tuesday, February 29th

Most of the day was spent traveling to Parika by road and then by jet boat. The jet boat traveled up the Essequibo River to Bartica where the group was able to inspect road building and pontoon construction at a camp operated by Greg Graham. They then continued up the Mazaruni River (photo 1) to the Puruni River (photo 2). The boat continued up the Puruni River past Peter's Mine to Million Mountain (photos 3, 4 and 5).

On Tuesday afternoon, the group inspected Alfro Alphonso's land dredging operations near Tiger Creek, Million Mountain area (06-17.55 north, 59-17.55 west, photos 6 and 7). Some of the pits were flooded due to recent rains. One of the dry pits consisted of 2 meters (7 feet) of older tailings on top of 2.5 meters (8 feet) of clay overburden soils, followed by 0.6 meters (2 feet) of cast-supported, fine quartz-rich gravels, in fine sand. The underlying bedrock was decomposed to a hard clay surface, which still displayed bedrock textures such as faulting (photo 7). The pit was being mined using high-pressure water jets, which eroded the gravels and overburden soils into a bedrock clay sump. A small Brazilian gravel pump pushed the gravel slurry to a simple wooden sluicebox.

Jack Morgan (GGMC) showed the Canadians some of the documentation required for alluvial mining in Guyana. The Canadian miners commented on the thinness of the pay gravel layers (0.3 to 0.6 meters or 1 to 2 feet). They felt that in general, the soils were suitable for mechanized mining with heavy equipment and that a large area of land would have to be prepared in advance of mining due to the thinness of the pay gravel layer and the greater capacity of their heavy equipment.

Later that afternoon the group traveled by all-wheel drive bush truck on the newly constructed dirt road, which branched off from the landing at Peter's mine (Puruni River) to Million Mountain. This branch road connected with the newly reconstructed Kartabu-Puruni road. Heavy rains made passage difficult and the truck had to be winched out of muddy holes several times (photo 8). While en-route, the miners stopped and discussed mining conditions and infrastructure with personnel at Greg Graham's camp. Mr. Graham was preparing to extend the Kartabu-Puruni road further up the Puruni River. Due to poor road conditions, the group walked the last 2 kilometers to Peter's Mine and took the jet boat back to Million Mountain.

3.2 Wednesday, March 1st

Most of Wednesday was spent traveling by jet boat and car back to Georgetown. Several operations were visited en-route including a land dredging operation, a Missile suction dredge and a Brazilian suction dredge.

Clinton Alphonso's land dredging operation was located near the west bank of the Puruni River downstream from Million Mountain (06-10.44 north, 59-22.27 west, photo 9). This was a typical land dredging operation, which was mined using high-pressure water jets, which eroded the gravels and overburden soils into a bedrock clay sump. A small

Brazilian gravel pump pushed the gravel slurry to a simple wooden sluicebox fitted with a short section of dredge riffles, followed by bare Nomad and Brazilian carpeting. The pit indicated 1.5 meters (5 feet) of sandy overburden overlying 0.5 meters (1.5 feet) of fine rounded and angular quartz-rich gravels. The Canadian miners again noted the thinness of the pay gravel layer and the potential applicability of mechanized mining equipment. The author panned a sample of the pay gravels. The numerous gold particles ranged in size from 75 microns (200 mesh) to 600 microns (48 mesh). There was minor illmenite (black sands) in the concentrate.

Norman Parkes was operating a Missile suction dredge on the Puruni River (06-08.09 north, 59-22.12 west, photo 10). This was the first opportunity of the group to inspect the large-scale Missile river dredges. These dredges commonly process from 50 to 200 cubic meters of pay gravels per hour using a submerged gravel pump developed and fabricated in Guyana. The Missile nozzle is supported on a forward set of pontoons and it is raised and lowered onto the river gravels with a winch. The river gravels were sucked by the submerged pump through 0.3 meter diameter (12 inch) pipe and pushed onto a wide sluicebox on the main pontoons. The tailings slurry flowed over the end of the sluicebox and back into the river. Missile river dredges are less common due to the exhaustion of most of the river dredge able gravels. Unfortunately Mr. Parkes was operating without all of the required documentation and was shut down by Jack Morgan.

A large Brazilian suction dredge with cutter head assembly was moored below rapids on the Mazaruni River (photos 11 and 12). The group was able to examine the dredge, compare it with Guyanese Missile dredge, and talked briefly with the operators. Jack Morgan interviewed the operators and was able to show the Canadian miners what documentation and permits were required for non-Guyanese persons to mine in Guyana. The group returned to Georgetown that evening and met with miners Errol Tempow and Wayne Vieira.

3.3 Thursday, March 2nd.

The group left Georgetown early in the morning (5 am) and drove via Linden on the Mabura Hill laterite road to the lower Konawaruk River. The group had to cross the river at Mazda Mining's Essequibo River ferry and drove on to inspect Errol Tempow's land dredging operation and Mazda's Missile dredging operations.

Errol Tempow's land dredging operation (05-08.18 north, 59-04.40 west) was located on a concession leased from Mazda near the Konawaruk River (photos 13 and 14). The land consisted of 1.5 meters (5 feet) of fine sand overlying 3 meters (10 feet) of consolidated sand, overlying 1.5 meters (5 feet) of angular/sub-rounded clast-supported quartz-rich gravels. Several seams of cemented iron-rich sediments (catch cow) occurred throughout the section. The author panned a sample of the pay gravels. The numerous gold particles ranged in size from 75 microns (200 mesh) to 600 microns (48 mesh). There was minor illmenite (black sands) in the concentrate.

Water jets washed the sandy seams into a clay/bedrock sump; however, the cemented catch cow layers were difficult to break up. A hydraulic excavator was normally used to break-up the catch cow layer, but it was undergoing repairs at the time of the inspection. Two six by six Dambrose (Brazilian) gravel pumps directed the slurry to twin sluice boxes. Bulldozers were available for rent from Mazda to strip the overburden soils. This site would make a good medium scale demonstration site since it has access to heavy equipment, is readily accessible by road from Georgetown, and is close to many other mining operations.

The two sluice boxes consisted of a 200-liter fuel drum distributor followed by a 5.5 meters (18 feet) length of sluicebox, which was 1.8 meters (6 feet) wide and sloped at 7 degrees (2 inches/foot). The upper 2.7 meters (9 feet) of both sluice boxes were fitted with 6 cm (2.25 inch) tall dredge riffles. The lower 2.7 meters (9 feet) of one sluicebox was fitted with one-inch angle iron riffles (3 inch gap) over un-backed Nomad matting. The lower section of the other sluicebox was fitted with coarse expanded metal riffles over un-backed Nomad matting. Both boxes had a narrow (1 meter, 3 feet wide) "Bloodeye" sluicebox located at the end of the main sluicebox. The slurry feed to both sluice boxes surged constantly from full output to no output.

The author measured the mass flows (see Appendix G). About 0.03 cms (500 USgpm) of pay gravel slurry was flowing thinly and slowly over the twin sluice boxes. Each sluicebox was surging and processing about 8 loose cubic yards per hour. The sluice boxes should be rebuilt and refitted according to the appended sketch and calculations. Every effort should be undertaken to ensure a more steady feed to the sluice boxes.

The group traveled to Mazda's Jeanette Creek camp and observed a Missile sluicebox concentrate being upgraded with amalgamation (photos 15 and 16). The black sand concentrate was washed in jig boxes to eliminate some of the black sand. Mercury was added and mixed until the amalgamation was complete. Then the amalgam was rinsed, filtered in a cloth and heated in a retort. The amalgamation operation was conducted in closed circuit and the final tailings were reprocessed on Gemini shaking tables. The group also drove up to the North Fork area to inspect Mazda's Missile dredges in operation. These sluice boxes on these Missiles had been widened to 12.8 meters (42 feet) and were fitted with coarse expanded metal over un-backed Nomad matting according to recommendation from previous testing by the author (in 1997 and 1998).

3.4 Friday, March 3rd through Sunday March 5th

The group met with several individual miners to show them photographs and gold samples from their Canadian operations and to discuss Guyanese mining conditions and Canadian alluvial mining methods. A summary of the observations made by the groups is summarized at Appendix A, B and C with the respective following topics: Summary of Guyanese Land Dredging, Guyanese versus Canadian Mining Conditions and Alluvial Exploration.

4.0 Conclusions

The objective of this project was to facilitate the exchange of alluvial gold mining technology between the Klondike Placer Miners Association (KPMA, Yukon Territory, Canada) and the Guyana Gold and Diamond Miners Association (GGDMA) and this has been done through many sites visited and people meeting.

The Canadian miners met with the Prime Minister of Guyana, with GGDMA Executive Committee and traveled with the author by jet boat up the Essequibo, Mazaruni and Puruni Rivers and by road to the lower Konawaruk River area. Several land and river (Missile) dredging operations, local facilities, tropical road construction and other infrastructure were inspected. The Canadian miners showed pictures of their operations and held discussions regarding the application of heavy equipment and Canadian alluvial mining and reclamation methods to the Guyanese environment. Both Canadian miners indicated their intention to return to Guyana to conduct follow up examinations and further discussions with Guyanese miners.

The Guyanese and Canadian miners felt that they benefited from the exchange of each other's knowledge and recommended additional delegations to and from the Yukon alluvial mining areas.

To complete this visit, the author remarks that Errol Tempow's lower Konawaruk River land dredging operation should be considered for a medium scale demonstration site because it has access to bulldozers and an excavator, and it is readily accessible by road from Georgetown. Mr. Tempow's sluicebox should be refitted as indicated in the appended sketch.

APPENDIX

Appendix A: Summary of Guyanese Land Dredging

The mines inspected used hand-held water monitors to erode the alluvial gravels or weathered lode veins. They all used small (6 inch) gravel pumps to pump the gravels to a raised wooden sluicebox, a mining method referred to as "land dredging" in Guyana. In the deeper lode vein deposits, open pit walls tended to be very steep and often appeared unsafe for the men working at the bottom of the pit. This generally was most severe near the advancing face of the pit. All of the soils, including barren overburden clays were moved with the gravel pumps and processed by the sluice boxes. This resulted in excessive dilution of the ore with barren overburden, which could otherwise be stripped (if heavy equipment is available) and moved prior to mining. This also led to unnecessary discharge of sluicebox effluent from overburden soils, which had clays and high-suspended solids.

A lack of exploration and delineation of the deposit by drilling, trenching or pitting, meant that the deposits were advanced on a day-to-day basis. This sometimes resulted in erratic and inefficient mining, the dumping of tailings on virgin gold-bearing areas, unnecessary re-handling of gravels, and/or unnecessary land disturbances. Drilling, trenching and/or sample pitting in advance of mining would allow all of the alluvial miners to mine more efficiently and safely. The use of heavy equipment, in combination with advance drilling, would also allow them to excavate the pit walls in benches and/or at shallower slopes, thus reducing pit wall failures and improving worker safety.

The basic equipment required for land dredging is a gravel pump and water pump powered by small diesel engines, which is mounted on a skid and/or floating frame. The capital costs of these two pumps and related accessories are about US$25,000 to $30,000. Operating costs are also typically very low with fuel consumption of about 100 liters per day. Labor requirements are very high with large numbers of unskilled and semi-skilled men at each camp. Unfortunately production is also usually relatively low (5 to 12 cubic yards per hour) due to the inability of the jets to rapidly break up and fluidize the gravels, unless the gravels are sandy or previously worked. The barren overburden is moved by jetting dilutes the pay gravels. The construction of settling ponds, stream diversions and the recon touring/filling of waste piles and pits are usually difficult or impractical with typical land dredging equipment.

Appendix B: Guyanese versus Canadian Mining Conditions

There are several modifications and additions required to transform any of these sites into a Canadian style dry mining demonstration (using heavy mobile equipment). The specific requirements for each site would be variable, and would depend on site conditions, and the financial and technical capabilities of the individual owner/manager. Canadian mining methods and equipment may have to be adapted to typical Guyanese mining conditions. For example, the soils in Guyana are typically very soft and rich in clays. This could make heavy equipment operation difficult, especially in the rainy seasons (June-July and December-January), however, modifications such as wide tracks and the use of smaller and/or lighter bulldozers (newer D6 or older D7 sizes) and lighter excavators may mitigate this problem to some extent. Pay gravels may have to be stockpiled in advance so that the mines can continue to produce gold through the rainy seasons.

In Guyana, the alluvial gold particles are generally finer sized and more difficult to liberate from the clays. However, very coarse nuggets were recovered on the West Kaburi River and Puruni River mines, even though these sluice boxes were not well outfitted for the recovery of coarse gold. Guyana's alluvial gravels often contain a very small proportion of stone sized aggregate with greater amounts of clay and sand. In some cases, the limited amount of coarse aggregates may make screening less important for optimum gold recovery. Where screening is warranted, trommel screens should be used due to their superior scrubbing action. Either efficient trommel screens and/or gravel pumps would be required to wash the gravels and free the gold particles from the clays. If trommels are used, some of the stones in the pay gravels may have to be recycled from the trommel discharge back to the feed, or retained within the trommel to help break-up the clays.

Appendix C: Alluvial Exploration

Alluvial deposits by their nature are difficult to "prove" with exploration methods due to the erratic distribution and coarse size of the gold particles. In general, the larger the sample of gravel, the more representative it is. Drilling and/or trenching and/or bulk sampling can be employed by an experienced alluvial mining engineer or alluvial geologist to help determine the location and estimate the grades of the gold-bearing zones. Banka churn drills are commonly used in Guyana for alluvial exploration. These drills are very labor-intensive and relatively slow but they are very portable and usually provide a good quality (although small) samples when operated by experienced and competent drillers, and when supervised by experienced engineers and/or geologists. Generally the maximum drilling depth is about 50 to 60 feet with drilling rates of about 30 to 40 feet per day, depending upon the ground conditions. Most alluvial deposits are linear in shape and are generally drilled with relatively close spacing between the holes (50 to 200 feet, 15 to 60 m) and much larger spacing between the drill lines (300 to 1000 feet, 100 to 330 m).

If the deposits are shallow, (less than 20 feet, 6 m), they can often be sampled by digging small pits with an excavator and processing the individual samples on a sampling sluice. With pitting, larger and more representative samples can be obtained and the geology can be examined in detail. If ground water is encountered, a pump may be required to de-water the hole. Trenches would also provide useful samples of lode deposits, which outcrop near the surface.

Appendix F: Contacts List (in order of meeting)

John Alton, Henry Gulch Placers, P.O. Box 5509, Whitehorse, Yukon, Canada Y1A 5H4, telephone/fax 867- 633-8244

John Zogas, Sisters Resources, 1096 West 3rd Street, North Vancouver, B.C., Canada V7P 3J6, telephone 604-980-7434 fax 604-980-2279

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Brian Sucre, Commissioner of Guyana Geology and Mines Commission (GGMC), Upper Brickdam, P.O Box 1028, Georgetown, Guyana, Guyana telephone 592-2-52862 ext. 223, fax 592-2-53047, e-mail ggmc@sdnp.org.gy

Samuel Hinds, Prime Minister of Guyana and Minister of Mines, Oranapai Towers Wight's Lane, Kingston, Georgetown, Guyana, Guyana telephone 592-2-66955, fax 592-2-67573, e-mail opm@sdnp.org.gy

Jacques Cretes, High Commissioner, Canadian High Commission, High and Young Streets, Kingston, P.O Box 10880, Georgetown, Guyana, Guyana telephone 592-2-72081, fax 592-2-58380, e-mail jacques.cretes@extott18.x400.gc.ca

Anna Iles, Canadian International Development Agency (CIDA) Program Officer, Canadian High Commission, High and Young Streets, Kingston, PO Box 10880, Georgetown, Guyana, Guyana telephone 592-2-72081 ext. 3452, fax 592-2-58380, email anna.iles@extott18.x400.gc.ca

GGDMA - Guyana Gold and Diamond Miners Association – **Patrick Pereira,** President, **Edward Shields,** Executive Secretary, **Patrick Harding,** Treasurer, 350 A New Market Street, North Cummingsburg, Georgetown, Guyana, telephone 592-2-52217 fax 51828

Andrew Mekdeci, Co-Chairman, Mazda Mining (MMC Group), 95-99 Commercial Blvd., Happy Acres, E.C.D., Guyana, telephone 592-2-020-5416, fax 592-2-020-5426, e-mail mmcgroup@guyana.net.gy

Alfro Alphonso, Managing Director, Alfro Alphnonso and Sons Enterprises, 13-15 University Garden, Turkeyne, Guyana, telephone 592-2-022-4858, fax 592-2-022-4336, e-mail alf@solutions2000.net

Dennis Dublin, c/o (GGDMA) Guyana Gold and Diamond Miners Association, 350 A New Market Street, North Cummingsburg, Georgetown, telephone 592-2-52217, fax 592-2-51828, home 592-2-65678

Jack Morgan, Guyana Geology and Mines Commission (GGMC), Upper Brickdam, P.O Box 1028, Georgetown, Guyana, telephone 592-2-52862

Greg Sparks, Heritage Mines, 1199 Main Avenue, Suite 221, Durango, CO 81301

Bill Shaffer, GHD Resources, 316 Rio Verde, El Paso, Texas 79912

Errol Tempow, 80 Hadfield Street, Werk-en-Rust, Georgetown, telephone (office) 592-2-53860 (home) 592-2-75517, (cellular) 592-2-2944050, e-mail errol@guyana.net.gy

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Dominic O'Sullivan, 231 Camp Street, Georgetown, telephone 592-2-76983

Leandro Pires, 62 Zinnia Avenue, Bel Air Park, Georgetown, telephone 592-2-57198

George Griffith, 51G Sheriff Street, Campbellville, Georgetown, telephone 592-2-52192

John Phillips, 212 Barr Street, Kitty, Georgetown, telephone 592-2-63799

Appendix F: Appended Calculations: Errol Tempow's Operation Mass Flow and Feed Rates

Lower Koniwaruk River Sluicebox Data
Harold Tempow's Operation Lower Koniwaruk River

Location:	05-08.18N	59-04.40W	WGS 84
	568,152N	270,230E	SAM 69

PROCESSING EQUIPMENT DIMENSIONS (Imperial) 1 m = 3,2808 feet

Description	Length ft	Width ft	Depth ft	Area ft2	Volume yd3	
Boil Box	1,5	6,0		9	0,17	Wooden Box 6" deep
Top Sluice	9,5	6,0		57	0,40	Hungarian 2.25x1x4 O/C
Bottom Run	9,0	8,0		72	0,22	One inch angle iron 3"gap Coarse exp metal/Nomad on other twin sluicebox
Bloodeye	4,5	3,0		14	0,02	Bare Nomad & Carpet
Combined	20,0	6,7		152	0,81	Total Con Volume yd3
Feed Rate					10	yd3/hour each sluicebox
					19	yd3/hour both sluiceboxes
	10	days @	8	hours	77	yd3/day
Clean up Volume			50%	operation	0,81	yd3
Concentration Ratio			80	hours	1: 479	Extremely Low Due to low feed rate and Low Density
Gravel Pump	6 by 6	Dambrose Gravel Pump				
Pipeline	6	inch PVC	200	ft length	20	lift in feet

Notes: These data are similar for both of the twin sluiceboxes.

The extremely low density of the pumped slurry has resulted in low combined feed rates of 17 cubic yards per hour or about 66 cubic yards per day when low flow pumping periods (about 50% of the time) are considered for both sluiceboxes.

MASS FLOWS

WATER FLOW RATES

The water and pay gravel feed rates were derived from sampler data and time studies. These were compared to recommended values for expanded metal riffles derived from previous research: feed rate at 8 loose cubic yards/hr and water rate of 160 Igpm of water per foot of sluice width. (One inch angle iron riffles require 320 Igpm and can be loaded at up to 16 loose cubic yards/hr per foot of sluice width.

Description	Factor	**Harold Tempow**	
Slurry Velocity m/s		1.30	1.30
Slurry Velocity ft/s		4.27	4.27
Depth of Water cm		1.90	1.90
Depth in inches		0.75	0.75
Width of Sluice Run m		1,8	1,8
Width in feet		6,0	6,0
Slurry cms	0,800	0.036	0.036
Slurry Flowrate lgpm		477	477
Slurry Flowrate USgpm		573	573
% Recommend by Width		50%	50%
For Angle Iron Riffles		25%	25%

Note: Water flow rates less than 100% or greater than 150% of recommended values usually low gold recoveries.

All of these sluiceboxes would have to be narrowed to about 50% of their present width if they were refitted with coarse expanded metal riffles and narrowed to .20% of their present width if they were refitted with one inch angle iron riffles.

The slurry velocities would have to be increased to between 5 to 7 feet per second.

PAY GRAVEL FEED RATES

Description	Factor		
Solids %		6%	6%
Solids cms	1,00	0.0020	0.0020
Sluice Solids Lyd3/hr		10	10
% Recommend by Feed		20%	20%
For Angle Iron Riffles		10%	10%

Notes: Pay gravel feed rates which exceed 100% of recommended values are one of the greatest factors contributing to gold losses. Pay gravel feed rates below 100% of recommended values may improve gold recovery slightly.

None of these twin sluiceboxes are operating near its potential feed rate.