TECHNICAL MEMORANDUM

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TO: Craig Goodings **DATE:** December 12, 2005

FROM: Cameron Clayton **JOB NO:** 05-1413-036A
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RE: MEADOWBANK GOLD PROJECT INTERNAL CONFORMITY TO PHC DECISION

The Nunavut Impact Review Board (NIRB) recently completed an internal conformity review of the Final Environmental Impact Statement (FEIS) for the Meadowbank Gold Project to determine if Cumberland Resources has complied with NIRB's direction provided in the Preliminary Hearing Conference (PHC) Decision of July 14, 2005.

1.0 KEY ISSUE 6.3

Based on the NIRB internal conformity review, the Board has requested further clarification of Key Issue 6.3 of the NIRB PHC Decision relating to Waste Rock and Tailings Management, which states:

"A better discussion of cover/capping program including cover materials, thickness, mitigation to avoid pollution of both surface and ground waters, and wind blown contaminants."

The conformity review provided the following comment with respect to Key Issue 6.3 of the NIRB PHC Decision:

"Discuss cover/capping mitigation program to avoid wind blown contamination."

1.1 Cover and Capping Mitigation Program to Avoid Wind Blown Contamination

The predominant wind direction in the project area is from the northwest, roughly paralleling the orientation of the tailings storage facility. Consequently, as part of the initial assessment of the various options and alternatives for the storage facilities the potential for wind erosion was considered as a key indicator to the development of the site selection criteria and the final site selection. The site selection used to evaluate the tailings and waste areas was described in detail in the ***Project Alternatives Report*** (see Appendix A and Appendix B). On-land disposal alternatives would have a greater potential for wind erosion and transport of particles from the tailings facility than would a facility with a low profile, at or below the current ground surface.

The current tailings facility has been designed with a low profile which will reduce the potential for wind erosion. During the operational phase of the project, the surface of the tailings beach within the proposed facility will remain below the current ground level for the early stages of the mine life, up to about the end of Year 3. Until this time, a small beach area will be exposed at the eastern end of the tailings facility. The tailings disposal facility would be operated to minimize dust and wind blown materials such as fine silts or sands. It is anticipated that during summer operating months, the surface of the tailings would be wet and this would minimize any wind blown particles. As the pond area and the deposition of the tailings moves west in Years 4 and 5, the east end of the pond area would be, if needed, treated with a dust management spray or surface treatment. This material dust management product has been used on other operating mines in the north successfully. In the winter months there is generally sufficient moisture in the pore spaces of the tailings that the pore water freezes and wind blown dust would not be an issue. Furthermore, the spigots could be moved along the beach to maintain wet conditions.

Beginning in about Year 4 or Year 5, progressive reclamation will result in the tailings facility being progressively covered from the east end moving in a westward direction. As the mine operation continues the tailings disposal facility will be covered with a minimum 2 meter thick layer of mine waste rock. Specifically, the placement of the ultramafic rock cover form the mine operation will reduce the potential for wind blown tailings.

The placement of cover over the tailings will reduce the potential for wind erosion of the tailings material. It is anticipated that initially there may be some wind blown dust from the mine rock just as or after it is placed, however experience at other operations, suggests that the amount of wind blown dust from the waste rock cover will be minor. A discussion of mine waste cover systems was presented in the ***Reclamation and Closure Plan*** (Section 4.5).

Finally if needed, wind breaks or low rock berms across the wind direction may be developed on the top of the tailings disposal facility to minimize dust issues at closure.

Full operational plans are not typically developed until the detailed planning and design phases for the tailings and waste rock facilities, once an initial permit is in place.

2.0 ITEM NO. 18 AND KEY ISSUE 6.4

Based on the NIRB internal conformity review, the Board has requested further clarification of Item No. 18 of the NIRB PHC Decision, which states:

"Provide statement in FEIS on monitoring tailings freezeback; Rationale to be provided for monitoring program."

The internal conformity review provided the following comment with respect to Item No. 18 of the NIRB PHC Decision:

"Thermal modelling results of the portage Tailings Facility predict times to freeze to depths into the talik. Discuss how these tailings freezeback predictions will be monitored. Provide a rationale for the above mentioned monitoring program."

2.1 Monitoring of Tailings Freezeback

The Portage Tailings Facility is predicted to freeze with time. The thermal modeling of the tailings facility and tailings dike was described in detail in several reports, including the ***Mine Waste and Water Management Plan*** (Section 6.6), the ***Project Alternatives Report*** (Section 7), and the ***Reclamation and Closure Plan*** (Section 4). Monitoring of the tailings and tailings dike was described in Section 7 on Monitoring and Maintenance in the ***Reclamation and Closure Plan***. A discussion of cover design systems was presented in Section 4.5 of the ***Reclamation and Closure Plan***.

During the development and mining of the deposits, an adaptive management plan will be implemented with respect to monitoring of the tailings storage facility. The plan will involve the installation of a series of thermistors at prescribed locations around the facility. The number and locations for the thermistors will be determined during the detailed engineering design phase for the project, and will be revised during the operational phase. During the operational phase, it is expected that a number of test pad stratigraphies will be developed to assess various cover designs, and to determine the most appropriate design for the actual site conditions. Such an approach has been used previously at northern mines such as Nanisivik where 5 test pads were evaluated. This was described in Section 4.5 of the ***Reclamation and Closure Plan***.

The thermistors would be installed in boreholes drilled around the perimeter of the facility, and inclined at angles towards the facility so as to penetrate the talik beneath the facility. The purpose of the perimeter thermistors would be to monitor the talik temperatures as freezing progresses. The thermistors would be monitored during the operational period. The results would be used to evaluate the predicted thermal response of the facility with the actual thermal response. This will allow adjustments to the tailings deposition plan to be made during the operational period to optimize the rate at which the tailings and talik freeze.

In addition to the perimeter thermistors, installation of thermistors within boreholes drilled from the surface of the tailings would be undertaken. These installations would take place as the facility is filled with tailings. Initially, some of the installations may be 'sacrificial'; in other words installations that are installed early in the life of the facility may become covered as the facility is filled. The rationale behind installing such thermistors is to monitor the thermal conditions within and beneath the facility from a very early stage in the facility's life. As the facility reaches final elevation, thermistors will be installed from the final tailings surface, and directly into the underlying bedrock. These will likely be on the order of 50 m to 75 m in length, with nodes placed at intervals to monitor temperatures within the tailings and within the bedrock. The thermistors will be monitored with time, and the results will be compared with the predicted temperatures and freeze back rates.

The design of such a layout for thermal monitoring is not practical until the detailed engineering design phase of the project.

2.2 Key Issue 6.4

Key Issue 6.4 states "The FEIS does not provide a plan for monitoring permafrost development in the tailings impoundment area, nor does the FEIS provide a plan for the case where tailings do not freeze as predicted."

A plan for monitoring the permafrost development in the tailings impoundment area is described under Section 2.1 above. It is expected that the proposed monitoring program will provide the data required to validate the predictions of freeze-back within the tailings. Field hydraulic conductivity testing of bedrock has shown the measured permeability to be very low, on the order of 10^{-8} m/s to 10^{-9} m/s. Modeling has shown that the rate of advance of the freezing front penetration through the tailings facility and into the bedrock will be greater than the rate of advective transport of constituents out of the tailings facility. Consequently, the tailings and any constituent release are predicted to be encapsulated by permafrost, based on the current available data. If it is determined by monitoring during operations that the tailings are freezing at lower rates than predicted, then mitigative procedures would be implemented.

A number of mitigative measures are available to control ground temperature and to enhance freezing. These include the use of passive or active thermosyphon systems. Passive systems rely on natural (or wind induced) ventilation while active systems rely on forced ventilation or circulation of refrigerants through a heat exchanger. The passive systems utilizing natural circulation are less costly, and are easily implemented, consisting essentially of an air convection pile, or pipe, that is open to the atmosphere. Heat is exchanged by convective circulation resulting from the cold air from the surface environment sinking within the open pipe, and warm air inside the pipe rising. These systems can also be closed systems having some internal fluid that is used as the heat transfer medium. Active (forced ventilation) systems utilize pumps and refrigerants to achieve the same cooling effect but at an accelerated rate. Both systems are used reliably in northern climates to preserve or promote freezing.

Although freezing of the tailings is predicted and expected, as a secondary preventive measure, provision has already been included for the covering of the tailings with a minimum 2 m thickness of non-acid generating ultramafic waste rock. In addition to providing a layer to limit the depth of potential frost penetration into reactive tailings pile, the layer will also serve a number of purposes that are independent of the strategy to develop permafrost within the pile. The cover layer will also serve the following beneficial purposes: the cover will reduce the potential for wind blown tailings; the cover will be composed of acid buffering waste rock; the cover will contribute to shedding of water from the surface of the tailings, and consequently will limit infiltration of water into the tailings pile. The beneficial effects of the cover layer will provide an alternative, and preventive, strategy for the management of the tailings facility in the event that permafrost develops more slowly than predicted, or not at all. A discussion of possible cover design systems for the project was presented in Section 4.5 of the ***Reclamation and Closure Plan***, and included options that could be considered at the design phase in consideration of climate change.

The design for the operational period of the mine does not consider climate change as the proposed facility will be operated over a short period of time, approximately 8.3 years. However, in the long term, the most successful strategy for managing the site will be to minimize the infiltration of water into the system, and more importantly to minimize the flux through the system. The current plan to cover the tailings facility will contribute to this strategy by shedding water from the surface of the facility. Furthermore, the facility could conceivably be designed to maintain the predicted water table within the facility at a level that is below the level of the surrounding lake systems. Consequently, the groundwater flux would be towards the facility, opposing advective flow out of the facility.

3.0 ITEM NO. 28

Based on the NIRB internal conformity review, the Board has requested further clarification of Item No. 28 of the NIRB PHC Decision, which states:

"Provide confirmation of the capacity of the tailings impoundment area to provide for extra volume needed for ice entrapment potential, use for lake sediment disposal, and future mine expansion."

The internal conformity review provided the following comment with respect to Item No. 28 of the NIRB PHC Decision:

"Confirm capacity of the TIA to provide for lake sediment disposal and future mine expansion."

3.1 Tailings Facility Capacity

A stage-storage volume curve for the tailings storage facility was presented as Figure 7.2 in the ***Mine Waste and Water Management Plan***. A discussion of the potential for ice entrapment, and the effect this may have on the available storage volumes was presented in Section 7.2 of the ***Mine Waste and Water Management Plan***. A stage-storage volume curve for the tailings storage facility, incorporating 10%, 20%, and 30% ice by volume was presented on Figure 7.9 of the same report, and indicated that the current design of the storage facility had the capacity to accommodate ice entrapment of up to 20% by volume, and up to 30% by volume with a nominal increase in the final surface elevation by 3 m above the height that would be require if no ice is entrapped.

Section 8.1 of the ***Mine Waste and Water Management Plan*** presents estimates of lake bottom sediment volumes that could be generated during stripping of mining areas. The thickness of sediments may range from centimeters to several metres. Other projects in the north have reported soft sediments of up to about 4 metres. A range of possible volumes was provided for the areas that will likely require stripping, and based on 1 m and 2 m average sediment thicknesses. The estimated volumes range from about 0.6 Mm^3 to 1.2 Mm^3, or approximately 4% to 8% of the total capacity of the facility to elevation 142 m. For planning purposes at certain mines in the north, a value of 20% ice entrapment is sometimes used. Assuming 20% ice entrapment, then the maximum estimated volume of soft sediments could be accommodated by the current facility design with a nominal increase in the final tailings surface of less than about 3 m. An advantage of the current facility layout relative to other possible storage areas is that increases in storage volume requirements can be accommodated by relatively small increases in the final tailings surface elevation, while maintaining a low overall profile relative to the surrounding terrain.

4.0 ITEM NO. 28A

Based on the NIRB internal conformity review, the Board has requested further clarification of Item No. 28a of the NIRB PHC Decision, which states:

"CRL will clarify the source of the till for the construction of the East dike, the construction stage at which Ultramafic (UM) rock will be placed on the dikes, whether the placement of the UM rock can be used to isolate the work area, and the level to which the UM will be placed in the context of the range of water levels in 2nd and 3rd Portage Lakes."

The internal conformity review provided the following comment with respect to Item No. 28a of the NIRB PHC Decision:

"The reports and sections indicated in the commitments table do not clarify the construction stage at which UM rock will be place on the dikes, whether the placement of UM rock can be used to isolate the work area, and the level to which the UM will be placed in the context of the range of water levels in 2nd and 3rd Portage Lakes."

4.1 Construction Sequencing for the Placement of UM rock on East Dike

Table 4-1 summarizes the estimates of surface areas to be covered using ultramafic rock for the East Dike, Goose Island Dike, and Finger Dikes. The surface areas have been determined based on the feasibility drawings for the dike alignments. Volumes are based on an assumed minimum 2 m thick layer placed on the dikes. The thickness is an initial estimate to provide adequate cover to reduce the potential for thaw penetration into the rock used for the dike construction. During detailed engineering design, additional thermal modeling will be undertaken to further define the required thickness. During operations, thermal monitoring of the dikes will be used to assess the performance of the cover layer in the context of its intended purpose and the actual thickness of material placed on the dikes will be adjusted accordingly.

Table 4-1: Estimate of Required Tonnage of Ultramafic Rock as Dike Cover During Operations

Dike	Estimated Area of Coverage, m^2	Estimated Volume Req'd (based on 2 m thickness), m^3	Estimated Tonnage Req'd (kt)
East Dike	73,000	146,000	277
Goose Dike	206,000	412,000	783
Finger Dikes	98,000	196,000	372
Total			**1,432**

Notes: Volumes assume a 2 m thick layer of ultramafic rock placed as cover.
Tonnage assumes 1.9t/m^3 for placed rockfill.

Table 4-2 summarizes the availability of ultramafic rock, and is based on Table 2.1 that was presented previously in the ***Mine Waste and Water Management Plan***, and based on mined tonnage provided by Amec Americas Ltd (Amec).

Table 4-2: Estimate of Available Tonnage of Ultramafic Rock

Pit	Pre-Mining (kt)	Year 1 (kt)	Year 2 (kt)	Year 3 (kt)	Year 4 (kt)	Year 5 (kt)	Year 6 (kt)	Total (kt)
Portage	723	6,671	4,270	4,562	4,711	2,669	535	24,141
Goose	0	0	8,138	7,454	2,173	5	0	17,770
Total								**41,911**

The above table does not extend past Year 6, as this is the last year the ultramafic material will be available from the mining operations. The current mine life is projected to be approximately 8.3 years.

The sequence of mine development was described in Section 9 of the ***Mine Waste and Water Management Plan***, Table 9.2, which describes the timing of the construction for the East and Goose Island Dike. The East Dike will be constructed in Year -2. Based on the current mining schedule, sufficient tonnages of ultramafic rock will be produced during pre-mining activities to provide cover material for the East Dike. It is expected that covering of the East Dike with ultramafic rock will begin in approximately Year -1 once construction of the dike has been completed, and can likely be completed by approximately Year 1.

Construction of the Goose Dike will begin in approximately Year 1, as construction materials become available, and will be completed in Year 1 to allow mining at the Goose Pit to begin in Year 2. It is expected that covering of the Goose Dike will begin once construction of the dike has been completed, in approximately Year 1. Covering of the dike could potentially be completed by Year 2.

The dikes are designed for a minimum free-board of 2 m, excluding any additional free-board that is gained by covering of the dikes with the ultramafic rock. Covering of the dikes with a minimum 2 m thick layer will result in a total free-board of approximately 4 m above the existing lake levels. This will accommodated annual variations in the water level of the lakes. The cover of ultramafic rock on the dike shoulders will be placed by trimming back a slot on the outside and inside dike alignments in order to 'notch in' the ultramafic material after the initial dikes are constructed. A figure presenting the conceptual cross section of the covered water retention dikes, and showing the various rock types that are currently planned to be used for construction, including the capping material, was presented on Figure 9.1 of the ***Mine Waste and Water Management Plan***.

The construction timing for the de-watering dikes, and the quantities of ultramafic rock available at early stages of mine development, preclude the use of the ultramafic rock to isolate the working area. Furthermore, the mine waste management plan relies on substantial quantities of ultramafic rock later in the mine life for use as cover material for the Portage Rock Storage Facility, and for the Portage Tailings Storage Facility. Therefore, the use of ultramafic rock to isolate the working area is not considered to be viable in the context of the overall waste management plan for the project.

5.0 ITEM NO. 31

Based on the NIRB internal conformity review, the Board has requested further clarification of Item No. 31 of the NIRB PHC Decision, which states:

"Include a discussion of mitigation measures for the potential effects of the fault under the tailings dike (i.e. possible grouting and/or artificial freezing) in FEIS within the context of groundwater modelling during operation and post closure period."

The internal conformity review provided the following comment with respect to Item No. 31 of the NIRB PHC Decision:

"Discuss the extent to which the tailings dike grout curtain mitigates the effects of seepage through the fault under the tailings dike during operation and post closure."

5.1 Tailings Dike Grout Curtain

A description of the tailings dike foundation conditions, based on geotechnical drilling, was described in Section 7.1 of the ***Project Alternatives Report***. Possible design alternatives to address the mitigation of seepage beneath the tailings dike were presented in Section 7.2 of the same report. Among the design alternatives that were presented was the consideration of a tailings dike cross section that would include a full cut-off through the foundation tills to bedrock, and a pressure grouted curtain within the fractured bedrock. Figure 7.4 in the ***Project Alternatives Report*** presented the design alternatives that were considered.

A series of seepage analyses were carried out for the full cut-off alternative, and considered a fractured zone of rock extending along the most of the proposed alignment of the dike. The seepage analyses were carried out for the maximum dike section. The results were presented in a report titled "Meadowbank Gold Project, Tailings Dike Basic Engineering Design", and dated February 13, 2004. A preliminary design for an injection-grouted curtain was presented for costing purposes, and included specifications for numbers of grout holes to be drilled and total drilling length, volume of grout required, number of consolidation grouting holes and total drilling length, and volume of grout to be used.

The hydraulic conductivity used for the dike foundation was on the order of 10^{-5} m/s, and was based on the hydraulic conductivity measured in boreholes drilled along the alignment and within the surficial fractured bedrock. This provided a level of conservatism in the analyses, as this value was higher by approximately one order of magnitude than the hydraulic conductivity of the fault (10^{-6} m/s). Assuming that the reclaim pond is situated at the face of the tailings dike, the seepage flux through the dike, as measured at the Portage Pit West Wall, is estimated to be 3.3 x 10^{-5} m^3/s/m. The total flow through the dike was estimated to be approximately 26 L/s which will be easily managed by the pit dewatering system, and returned to the tailings reclaim pond. More realistically, during the operational period of the tailings facility, the tailings pond will be some distance back from the tailings dike, separated by the tailings beach. It has been estimated that at the time mining begins in the area of the Portage Pit east of the tailings dike, the tailings pond will be on the order of 300 m west of the tailings dike. This will have the effect of increasing the seepage flow path. As a conservative estimate of the amount of seepage that could potentially reach the pit from the tailings facility, a scenario was analysed, and the seepage flux for the full cut-off design with tailings beach at 100 m upstream of the dike face was estimated to be 1.5 x 10^{-5} m^3/s/m, or 12 L/s. By comparison, the partial seepage cut-off design analysed with the tailings pond located some 200 m back of the dike resulted in an estimated seepage flux of 9.0 x 10^{-5} m^3/s/m, or 71 L/s. Both flows can be managed by the pit dewatering system, and returned to the reclaim pond. Based on these analyses, the use of a grout curtain could conceivably reduce the seepage flux through the dike by slightly less than one order of magnitude.

The requirement for such a grout curtain will need to be considered during detailed engineering design. The estimates of seepage flux, and inflows to the pit do not consider the effect of freezing of the tailings dike itself, as well as freezing of the lake bottom prior to excavation of the Portage Pit adjacent to the tailings dike. During the operation of the mine, it is expected that the tailings dike and the dike foundations will freeze over the period of time these are exposed to the environment. Consequently, the actual seepage flux through the dike may be less than estimated due to the additional influence of freezing. Freezing of the fault could be encouraged through the use of passive or active thermosyphons. The effect of natural freezing of the dike and its foundations on seepage flow rates cannot be quantified at this time, although the dike and foundations are predicted to freeze. The results of the thermal analyses predicting the freezing of the dike and foundations were discussed in Section 6.6 of the ***Mine Waste and Water Management Plan,*** and Section 7 of the ***Project Alternatives Report***. The dike and foundation are predicted to remain frozen in the long term. This will provide an additional mitigative effect to potential seepage along the fault by reducing the potential for seepage to occur.

6.0 ITEM NO. 32A

Based on the NIRB internal conformity review, the Board has requested further clarification of Item No. 32a of the NIRB PHC Decision, which states:

"Provide details of different rock lithologies (mineralogy, geochemistry, Acid Rock Drainage (ARD) and Metal Leaching (ML) potential). Detailed sulphide and carbonate mineralogy, including heterogeneity in UM rocks to assess impact of capping Potentially Acid Generation (PAG) and ML rocks."

The internal conformity review provided the following comment with respect to Item No. 32a of the NIRB PHC Decision:

"*The report and section indicated in the commitments table do not provide detailed sulphide and carbonate mineralogy or heterogeneity in UM rocks."*

Mineralogical details on the kinetic test samples are provided in Appendix G of Volume 2 of the ***Static Test Results for Overburden, Mine Site Infrastructure Rock, Pit Rock and Tailings Report*** (Golder, September 2005). This Appendix contains the report entitled: ***Mineralogical Examination of Rock and Tailings Samples from the Meadowbank Project, Nunavut***, (Jambor, January 2003).

The heterogeneity of UM rock samples is described in the ***Static Test Results for Overburden, Mine Site Infrastructure Rock, Pit Rock and Tailings Report*** (Golder, September 2005), in Section 3.4 of Volume 1 (report text) and in Appendix E of Volume 2 (appendices). The report text and tables provide a description of the central or average chemical characteristics of UM rock as well as the range (maximum, minimum, and dispersion from the mean characteristics, or standard deviation). These characteristics are provided for groups of UM samples segregated in terms of potential end use: Third Portage starter pit UM waste rock (material that will be used for construction of infrastructure – dikes, roads, building pads), and the rest of Portage and Goose Island pit waste rock (from which cover rock will be obtained). Examination of the chemical characteristics of UM rock for both groups of samples provides an understanding of the heterogeneity, or in this case, the relative homogeneity of UM rock, judging from the relatively small spread or dispersion from the mean values for chemical characteristics of environmental interest (acid-buffering capacity and arsenic content), relative to other rock types on site.

The acid-buffering potential of UM rock is well documented, having a large excess of reactive, acid-buffering carbonate minerals, mainly dolomite [$CaMg(CO_3)_2$], and some calcite [$CaCO_3$]. This observation on a limited number of samples is corroborated in the database of all UM samples by measurements of bulk and carbonate neutralization potential (NP), in waste rock from both the starter pit and the remaining Portage and Goose Island pit. The arsenic content and readility-soluble arsenic content of UM rock is slightly more variable, however the water quality predictions incorporate this variability by using a range of probable arsenic leaching rates, including samples that are representative of the 75th percentile arsenic content (Section 3.2.1 of ***Water Quality Predictions Report****;* Golder, October 2005).

7.0 ITEM NO. 37

Based on the NIRB internal conformity review, the Board has requested further clarification of Item No. 37 of the NIRB PHC Decision, which states:

"Provide long term post closure groundwater flows, pit lake stratigraphic, and chemistry analysis."

The internal conformity review provided the following comment with respect to Item No. 37 of the NIRB PHC Decision:

"Provide long term post closure pit lake stratigraphy and chemistry analysis."

Long-term post-closure Portage pit lake stratigraphy and expected chemistry is provided, along with inferences on the Vault pit lake, in Appendix F of the ***Water Quality Predictions Report*** (Golder, October 2005). The appendix contains the ***Meadowbank Portage Pit Lake Water Quality Modeling Report*** (Golder, November 2005). The latter report provides details on the pit lake water quality model used for this evaluation, input data and assumptions and discusses expected lake water quality and stratification.

8.0 ITEM NO. 38

Based on the NIRB internal conformity review, the Board has requested further clarification of Item No. 38 of the NIRB PHC Decision, which states:

"Provide inflow modeling to determine the groundwater inflow quantity and Total Dissolved Solids (TDS) concentration during mine operation to NRCan."

The internal conformity review provided the following comment with respect to Item No. 38 of the NIRB PHC Decision:

"Confirm that NRCan has received the groundwater inflow model."

A report titled "Predictions of Brackish Water Upwelling in Open Pits, Meadowbank Project, Nunavut" and dated March 12, 2004 is contained in Appendix B of the ***Water Quality Predictions Report*** (Golder, October 2005). The baseline hydrogeological conditions were described in a report titled "Hydrogeology Baseline Studies" and dated February 3, 2004. The report includes a discussion on salinity and Total Dissolved Solids, and freezing point depression. The post closure groundwater flow conditions were discussed in a Technical Memorandum titled "Items 24a and 37, Predictions of Regional Groundwater Flow Directions after Mine Closure", and dated October 5, 2005. The report and the technical memorandum are contained in Appendix F (Hydrogeology Baseline Studies) of the ***Baseline Physical Ecosystem Report***. The reports were also summarized in Section 2.4.3 of the ***Mine Waste and Water Management Plan***.

The reports identified above are available on the NIRB ftp site and can be retrieved by NRCan.

9.0 ITEM NO. 44

Based on the NIRB internal conformity review, the Board has requested further clarification of Item No. 44 of the NIRB PHC Decision, which states:

"Provide a materials balance showing available waste rock types (UM, IV, IF/PAG, non-PAG) versus volumes of disposal in waste rock pile and volumes needed for construction of various mine components. If waste rock is going to a waste rock pile, indicate which pile."

The internal conformity review provided the following comment with respect to Item No. 44 of the NIRB PHC Decision:

"Materials balance should compare the types of material available with the types of material required for construction of various mine components."

9.1 Materials Balance

A materials balance was presented in Table 2.1 of the ***Mine Waste and Water Management Plan***. The table identified the tonnages of waste produced during mining, and indicated the destination for the waste. The tonnages presented in that table have been used to develop a materials balance table which accounts for materials volumes required by the construction of the various structures required for the project, such as the dewatering dikes, tailings dike, and other construction activities. These are shown on the attached Table 9.1. The table indicates the destination for the various material types, and includes capping materials for dikes, rock storage facilities, and tailings facility. The volume estimates have been based on an assumed handled density of 1.9 t/m^3 for waste rock, and 1.7 t/m^3 for overburden. Surplus and deficit volumes are noted on an annual basis. Where deficit volumes are identified, appropriate mine planning will resolve issues of material shortages. The mining schedule can be adjusted to accommodate any shortfalls in required quantities that may be encountered. Minor variations in the volume estimates presented in Table 9.1 and presented elsewhere in the Feasibility Study may result from rounding errors and variations in other assumptions. However the overall magnitude of quantities remains consistent.

10.0 ITEM NO. 45

Based on the NIRB internal conformity review, the Board has requested further clarification of Item No. 45 of the NIRB PHC Decision, which states:

"Provide maps indicating locations of samples for PAG rock determination in FEIS."

The internal conformity review provided the following comment with respect to Item No. 45 of the NIRB PHC Decision:

"*Drawings 1 and 2 are very difficult to impossible to read. Consider separating groups of samples onto separate drawings and ensure labels are legible*."

Revised versions of Drawing 1 (made into two drawings: 1a and 1b) and Drawing 2 are provided as attachments.

11.0 ITEM NO. 53

Based on the NIRB internal conformity review, the Board has requested further clarification of Item No. 53 of the NIRB PHC Decision, which states:

"Provide more detail on adaptive management and monitoring in relation to Vault waste rock pile."

The internal conformity review provided the following comment with respect to Item No. 53 of the NIRB PHC Decision:

"*Provide details of an adaptive management plan should water quality monitoring of the waste rock drainage not confirm predictions*."

The Vault waste rock pile drainage quality predictions are based on test results that are considered to be reliable and representative of the range of possible water quality generated from the pile (see ***Water Quality Predictions Report***, Golder, October 2005). Nonetheless, part of the management plan of the Vault and Portage rock storage piles will be to conduct routine testing of waste rock prior to disposal in the pile to optimize the management of waste rock. This could include segregating the most appropriate materials for placement within the chemically active, upper-most thaw zone or alternatively, to place PAG or more arsenic-rich materials in the central, eventually frozen portion of the pile.

Should the operational practices generate higher loads of suspended solids or higher concentrations of explosive-derived constituents than predicted; the following factors will assist in containing the effects within the mine footprint:

- During mining operations (Vault pit operational period Year 4 to 9):

  - Run-off and drainage from the Vault waste rock pile will be redirected to the Vault attenuation pond by a series of sumps and diversion ditches;

  - Vault waste rock pile drainage is predicted to represent a maximum of 18% of the total annual inflow (TAI) to the Vault attenuation pond. Other inflows include direct precipitation (~ 1% of TAI), pit inflows (<13% of TAI), and non-contact run-off water (>69% of TAI) such that the attenuation pond will provide effective water quality buffering; and

  - The water collected within the attenuation pond will be monitored, and can be treated if necessary, prior to discharge to Wally Lake.

- During reclamation and closure (YR 10+):

  - Vault Lake will be re-flooded (21.5 Mm^3 to Elev. 139 m) over which time water quality will be monitored and can be treated in-pit if necessary. Pit water will not be discharged until the pit is fully flooded;

  - The waste rock pile will be re-graded to direct, where practicable, the run-off from the pile to Vault Lake via gravity flow;

  - The sumps and diversion ditching will be maintained to collect and re-direct run-off from the waste rock pile not reporting to Vault Lake until monitoring indicates the drainage water collected meets discharge water quality standards;

  - If necessary, Vault Lake water levels will be managed through the treatment and controlled discharge of water to Wally Lake so as to maintain sufficient storage capacity to contain the 1:100-year, 24-hour run-off event and the average annual inflow while maintaining 1 meter freeboard; and

  - Removal of the Vault dike and restoration of the direct hydraulic connection between Vault and Wally lakes will not occur until water quality meets agreed-to targets within Vault Lake.

12.0 ITEM NO. 54

Based on the NIRB internal conformity review, the Board has requested further clarification of Item No. 54 of the NIRB PHC Decision, which states:

"Include information/sensitivity analysis regarding how extreme events and above normal lake levels could impact the GoldSim water balance graphs, to ensure that the design and impact assessments takes extreme events into consideration."

The internal conformity review provided the following comment with respect to Item No. 54 of the NIRB PHC Decision:

"The Mine Waste and Water Management report section 10.2.2 provides water management infrastructure design criteria for extreme events but does not explain how extreme events were incorporated into the GoldSim water balance model or how extreme events impact the water balance assessment."

12.1 Water Management Objectives and Strategies

As outlined in Section 10.1 of the ***Mine Waste and Water Management Plan***, the primary objectives of the Meadowbank Gold Project Water Management Plan are to:

- Minimize impacts of the proposed project on the quantity of surface water; and
- Minimize impacts of the proposed project on the quality of surface and groundwater.

The strategies to implement the above objectives include:

- Reduce the intake of fresh water from the neighbouring lakes by recycling and reusing water wherever practicable;
- Implement measures to avoid the contact of clean run-off water with areas affected by the mine or mining activities;
- Collect, transport, and treat as necessary mine water, camp sewage, and run-off water in contact with project activities;
- Manage potentially acid-generating or metal-leaching materials;
- Monitor quality of discharges; and
- Adjust management practices if monitoring results indicate discharge quality does not meet discharge criteria.

For the purposes of the ***Mine Waste and Water Management Plan***, surface water was grouped into two categories, contact and non-contact water. Contact water is defined as any water that may have been physically or chemically affected by mining activities;

while non-contact water is limited to run-off originating from areas unaffected by mining activity that does not come into contact with developed areas.

All contact water will be intercepted, contained, analyzed, re-used, treated if required, and discharged to receiving environment when water quality meets the discharge criteria. Non-contact water will be intercepted and directed away from developed areas by means of natural or man-made diversion channels and allowed to flow to the neighbouring lakes untreated.

12.2 Water Management Infrastructure

Sections 10.2.2 and 11 of the ***Mine Waste and Water Management Plan*** provide the water management infrastructure design criteria and sizing requirements for extreme events; while Section 10.3 describes the proposed water management systems. As outlined, the various components of the water management system will be designed to meet the following criteria:

- Water management infrastructure along the perimeter of the developed areas must be able to intercept and convey to proper handling facilities contact water from a 1:100-year, 24-hour precipitation event;

- Water management infrastructure located within the mining affected areas where contact water has no chance of overflow outside of developed areas should be able to handle the run-off from a 1:10-year, 24-hour precipitation event;

- Water management infrastructure along the perimeter of the developed areas must be able to divert non-contact water from a 1:100-year, 24-hour precipitation event;

- Dewatering capacities for contact water sumps and ponds should be selected to handle the greater of:

    - The average year freshet volume in a 30-day period

    - The 1:100-year freshet volume in a 90-day period

- Attenuation ponds should be sized to accommodate the run-off from a 1:100-year, 24-hour precipitation event in excess of their maximum operating storage volume under average year climate conditions, while maintaining 1 m freeboard.

12.3 GoldSim Water Balance

The GoldSim Water Balance Model was developed to assist in the evaluation of the maximum operating storage volume of the proposed contact water management infrastructure under average year climate conditions over the life the mine and under closure conditions. The model focuses specifically on *contact water* management infrastructure and areas that have been physically or chemically affected by mining activities. Therefore it is not impacted by water levels in the neighbouring lakes.

The GoldSim water balance model results presented in the FEIS assumes average year climate conditions. Extreme events were not incorporated into the assessment as it was assumed that the following contact water management contingencies would be in place:

- The contact water management infrastructure will be designed, sized and operated to intercept and contain extreme event run-off from the mine affected areas (see Section 11 of the ***Mine Waste and Water Management Plan***).

- Any excess contact water would be directed to the tailings storage facility or to open pits if available for temporary storage prior to recycle, re-use, and/or treatment (if necessary) and release to the environment.

With the exception of the Portage storm water attenuation pond (operational until Year 5), non-contact water is not considered within the model. The attenuation basin has a capacity of approximately 800,000 m^3 and should accommodate the non-contact water storage needs until the end of Year 4. Up to the end of Year 3, any excess non-contact water above this storage capacity is assumed to be released to the neighbouring lakes after monitoring confirms it may be released untreated, or can be managed within the tailings storage facility if necessary. Following the construction of the stormwater dike across Second Portage Arm in Year 3, the northwest basin could have the capacity to store up to 2.8 Mm^3 if necessary.

In Year 5, the attenuation pond and reclaim pond combine, and this facility becomes a component of the contact water management system managed using the same contingency planning as described above for the other contact water management infrastructure (see Section 11 of the ***Mine Waste and Water Management Plan***).

Based on the above, the uncontrolled release of contact water to the neighbouring lakes is not anticipated. The current mine waste management plan allows for storage of excess water and run-off from extreme events within the tailings storage facility up to approximately Year 5, while after Year 5 storage of excess water and run-off from extreme can be managed within the inactive Goose Pit.

As indicated above, one of the strategies of the ***Mine Waste and Water Management Plan*** is to recycle and reuse site water wherever practicable. From a water balance perspective, recycling and reusing excess contact water from extreme run-off events would act to reduce freshwater intake requirements from the neighbouring lakes. Any remaining water would be analyzed and treated (if necessary), prior to controlled release to the environment.

13.0 CLOSING REMARKS

We trust the information contained in this Technical Memorandum addresses the additional requests for information. Should you have any questions regarding the information contained in this document, or require further clarification on any issues, please do not hesitate to contact us.

CJC/VJB/DRW/kt
N:\Final\2005\1413\05-1413-036A\TM-1212_05 Cumberland - Internal Conformity to PHC Decision.doc

REFERENCES

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APPENDIX A

DRAWINGS 1A, 1B, 2
TABLE 9.1

REVISION DATE: 05/11/29 4:45pm By:NVeloso CADD FILE: N:\Bur-Graphics\Projects\2004\1413\04-1413-086\Drafting\cad\DRAWING 1\P04-1413-086-9.dwg

LEGEND

- Pit Outline (>10 g/t Au)
- Starter Pit Outline
- Geotech Hole
- Diamond Drill Hole
- Geochemical Sample Location; 2002, 2003, 2004 studies
- Geochemical Sample Location; 1997 study
- Detailed Geotechnical Logging
- Thermistor Installation
- Metallurgical Assay Drillhole
- Groundwater Wells

REFERENCE

Information supplied from AMEC, Dated April 2005, Drawing # A1-131395-100-C-0001 Revision A

0 30 60 90 120 150

Scale in Meters

PROJECT

CUMBERLAND RESOURCES LTD.

TITLE

GEOCHEMICAL SAMPLING LOCATIONS THIRD PORTAGE AND NORTH PORTAGE

Golder Associates

PROJECT No. 04-1413-086			FILE No. P04-1413-086-9.dwg	
DESIGN	PA	SEPT. '05	SCALE AS SHOWN	REV. –
CADD	SRR	SEPT. '05	**DRAWING 1A**	
CHECK	PA	SEPT. '05		
REVIEW				

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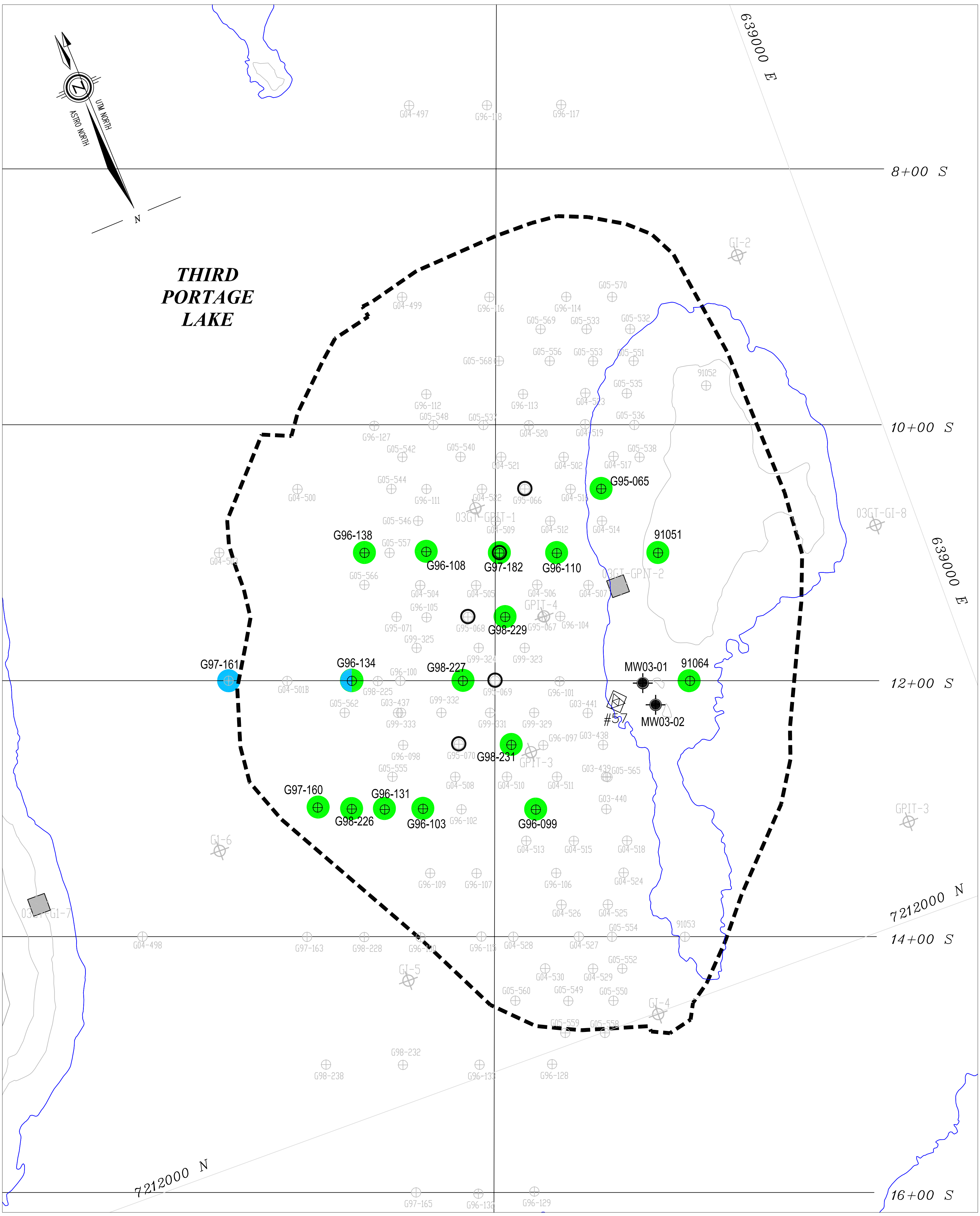

LEGEND

Pit Outline (>10 g/t Au)

Geotech Hole

Diamond Drill Hole

Geochemical Sample Location; 2002, 2003, 2004 studies

Geochemical Sample Location; 1997 study

Detailed Geotechnical Logging

Thermistor Installation

Metallurgical Assay Drillhole

Groundwater Wells

0 30 60 90 120 150

Scale in Meters

REFERENCE

Information supplied from AMEC, Dated April 2005,
Drawing # A1-131395-100-C-0001 Revision A

PROJECT

CUMBERLAND RESOURCES LTD.

TITLE

GEOCHEMICAL SAMPLING LOCATIONS GOOSE ISLAND

Golder Associates

PROJECT No.	04-1413-086	FILE No.	P04-1413-086-9
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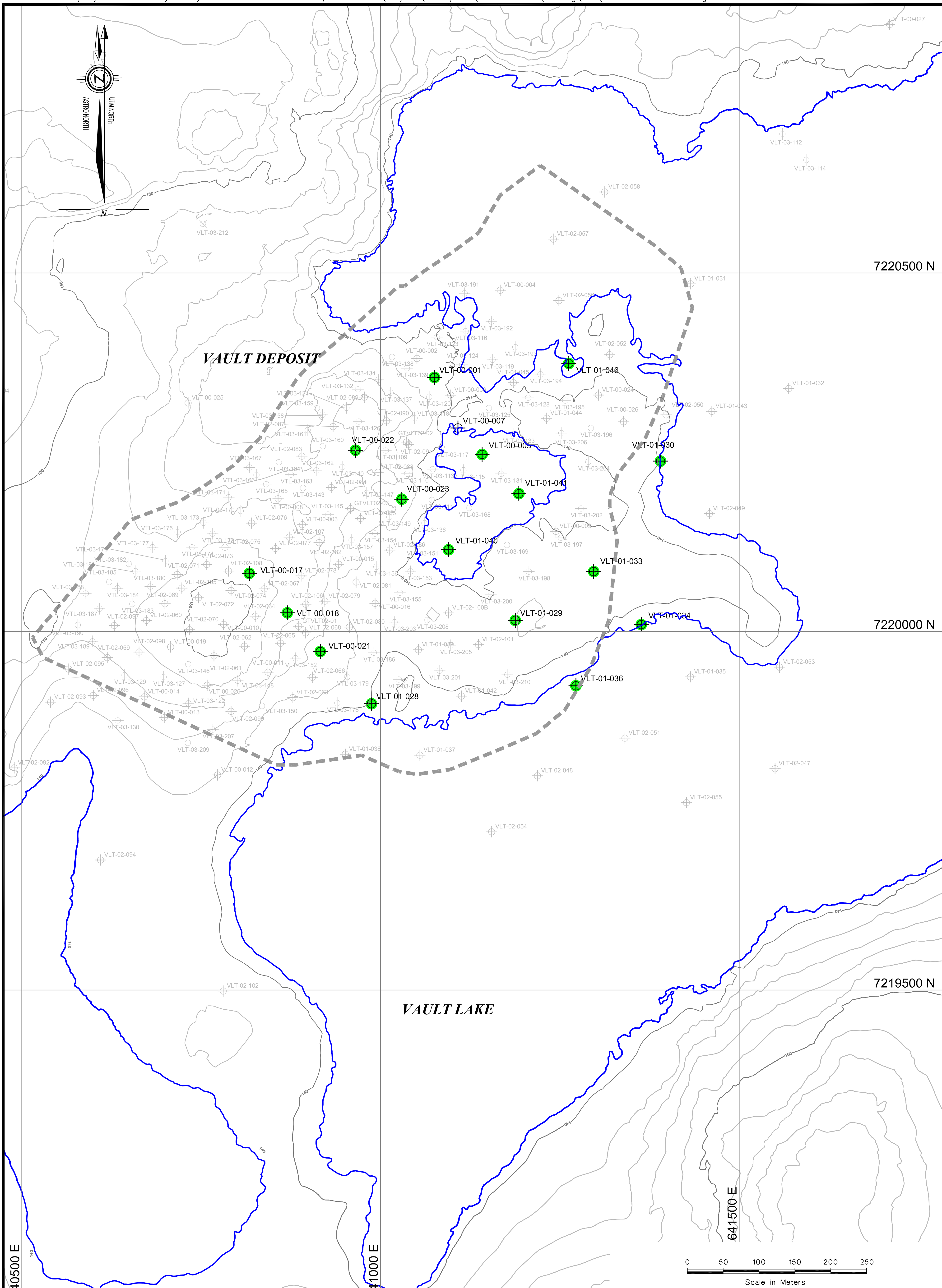
REVIEW			

REVISION DATE: 05/10/17 11:38am By: sreddy CADD FILE: N:\Bur-Graphics\Projects\2004\1413\04-1413-086\Drafting\cad\04-1413-086sk-32.dwg



LEGEND

- Geochemical Sample Location; 2002, 2003 studies
- Lake
- Pit Outline
- Drill Hole

REFERENCE

1) Information supplied from AMEC, Dated April 2005, Drawing # A1-131395-100-C-0001 Revision A

PROJECT

CUMBERLAND RESOURCES LTD.

TITLE

GEOCHEMICAL SAMPLING LOCATIONS
VAULT

Golder Associates

PROJECT No.	04-1413-086	FILE No.	04-1413-086sk-32
DESIGN	PA	20SEP05	SCALE AS SHOWN REV. –
CADD	SRR	20SEP05	
CHECK	PA	20SEP05	DRAWING 2
REVIEW			

TABLE 9.1
MEADOWBANK GOLD PROJECT
MATERIALS BALANCE

	Estimate of Required Material Quantities by Year (m3)											
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	TOTAL
	-2	-1	1	2	3	4	5	6	7	8	9	
Overburden												
East Dike	44,000	-	-	-	-	-	-	-	-	-	-	44,000
Second Portage Causeway	-	-	-	-	-	-	-	-	-	-	-	-
Bay Zone Dike	47,000	-	-	-	-	-	-	-	-	-	-	47,000
Second Portage Tailings Dike	-	45,000	-	91,740	-	-	35,750	-	-	-	-	172,490
Tailings Dike Full Cut-off (if required)	162,500	-	-	-	-	-	-	-	-	-	-	162,500
Stormwater Dike	-	-	-	-	72,420	-	-					72,420
Goose Island Dike	-	-	269,000	-	-	-	-	-	-	-	-	269,000
Vault Dike	-	-	-	-	6,600	-	-	-	-	-	-	6,600
Tailings Containment Berms	-	-	-	-	16,522	-	-	-	-	-	-	16,522
Total Volume Required for Dike	253,500	45,000	269,000	91,740	95,542	-	35,750	-	-	-	-	790,532
Road to ANFO Storage	-	-	-	-	-	-	-	-	-	-	-	-
Plant Roads	-	-	-	-	-	-	-	-	-	-	-	-
Vault Haul Road	-	-	-	-	-	-	-	-	-	-	-	-
Airstrip	-	-	-	-	-	-	-	-	-	-	-	-
Mill Foundations	-	-	-	-	-	-	-	-	-	-	-	-
Total Volume Required for Construction	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL OVERBURDEN REQUIRED	253,500	45,000	269,000	91,740	95,542	0	35,750	0	0	0	0	790,532
TOTAL OVERBURDEN AVAILABLE	367,000	714,941	1,217,941	1,791,235	0	1,266,118	33,372	0	0	0	0	5,390,607
SURPLUS (DEFICIT)	113,500	669,941	948,941	1,699,495	(-95,542)	1,266,118	(-2,378)	0	0	0	0	4,600,075
UM+QZ												-
East Dike (Surfacing)	-	-	146,000	-	-	-	-	-	-	-	-	146,000
East Causeway (Surfacing)	-	-	5,759	-	-	-	-	-	-	-	-	5,759
Bay Zone Dike (Surfacing	-	-	81,002	-	-	-	-	-	-	-	-	81,002
Tailings Dike (Surfacing)	-	15,000	-	7,000	-	-	7,000	-	-	-	-	29,000
Goose Island Dike (Surfacing)	-	-	-	412,000	-	-	-	-	-	-	-	412,000
Vault Dike (Surfacing)	-	-	-	-	-	-	6,760	-	-	-	-	6,760
Tailings Containment Berms (Surfacing)	-	-	-	-	-	-	-	-	-	-	-	-
Finger Dikes (Surfacing)	-	-	-	-	39,200	39,200	39,200	39,200	39,200	-	-	196,000
Total Volume Required for Dikes	-	15,000	232,761	419,000	39,200	39,200	52,960	39,200	39,200	-	-	876,521
Capping Portage Dump	-	-	-	-	-	-	264,000	264,000	264,000	264,000	264,000	1,320,000
Capping Vault Dump	-	-	-	-	-	-	-	-	-	-	-	-
Capping Tailings Pond	-	-	-	-	-	-	580,000	580,000	580,000	580,000	580,000	2,900,000
Total Capping Volume Required	-	-	-	-	-	-	844,000	844,000	844,000	844,000	844,000	4,220,000
Road to ANFO Storage (Capping)	-	25,349	-	-	-	-	-	-	-	-	-	25,349
Plant Roads (Capping)	-	34,644	-	-	-	-	-	-	-	-	-	34,644
Vault Haul Road (Capping)	-	-	-	36,000	-	-	-	-	-	-	-	36,000
Airstrip	-	-	-	-	-	-	-	-	-	-	-	-
Mill Foundations	20,000	20,000	-	-	-	-	-	-	-	-	-	40,000
Total Volume Required for Construction	20,000	79,993	-	36,000	-	-	-	-	-	-	-	135,993
TOTAL UM+QZ REQUIRED	20,000	94,993	232,761	455,000	39,200	39,200	896,960	883,200	883,200	844,000	844,000	5,232,514
TOTAL UM+QZ AVAILABLE	123,290	279,607	3,522,355	7,583,302	6,599,308	4,050,175	1,438,513	281,587	0	0	0	23,878,136
SURPLUS (DEFICIT)	103,290	184,614	3,289,595	7,128,302	6,560,108	4,010,975	541,552	(-601,613)	(-883,200)	(-844,000)	(-844,000)	18,645,622
IV												-
East Dike (Construction)	83,500	-	-	-	-	-	-	-	-	-	-	83,500
East Causeway (Construction)		-	-	-	-	-	-	-	-	-	-	-
Bay Zone Dike (Construction)	-	80,500	-	-	-	-	-	-	-	-	-	80,500
Tailings Dike (Construction)	110,000	110,000	-	742,260	-	-	401,000	-	-	-	-	1,363,260
Stormwater Dike (Construction)	-	-	-	-	242,580	-	-	-	-	-	-	242,580
Goose Island Dike (Construction)	-	-	456,000	-	-	-	-	-	-	-	-	456,000
Vault Dike (Construction)	-	-	-	-	-	-	12,380	-	-	-	-	12,380
Tailings Containment Berms (Construction)	-	-	-	-	71,640	-	-	-	-	-	-	71,640
Finger Dikes (Construction)	-	-	-	-	840,000	840,000	840,000	840,000	840,000	-	-	4,200,000
Total Volume Required for Dikes	193,500	190,500	456,000	742,260	1,154,220	840,000	1,253,380	840,000	840,000	-	-	6,509,860
Road to ANFO Storage	-	75,000	-	-	-	-	-	-	-	-	-	75,000
Plant Roads	-	103,932	-	-	-	-	-	-	-	-	-	103,932
Vault Haul Road	-	-	-	356,450	-	-	-	-	-	-	-	356,450
Airstrip	-	18,700	-	-	-	-	-	-	-	-	-	18,700
Mill Foundations	60,000	60,000	-	-	-	-	-	-	-	-	-	120,000
Total Volume Required for Construction	60,000	257,632	-	356,450	-	-	-	-	-	-	-	674,082
												-
TOTAL IV REQUIRED	253,500	448,132	456,000	1,098,710	1,154,220	840,000	1,253,380	840,000	840,000	0	0	7,183,942
TOTAL IV AVAILABLE	239,784	392,234	3,446,746	3,956,876	2,508,588	3,772,222	8,565,341	11,023,425	9,262,245	5,566,085	547,297	49,280,843
SURPLUS (DEFICIT)	(-13,716)	(-55,899)	2,990,746	2,858,166	1,354,368	2,932,222	7,311,961	10,183,425	8,422,245	5,566,085	547,297	42,096,900
IF												-
East Dike (Construction)	83,500	-	-	-	-	-	-	-	-	-	-	83,500
East Causeway (Construction)	54,000	-	-	-	-	-	-	-	-	-	-	54,000
Bay Zone Dike (Construction)	-	80,500	-	-	-	-	-	-	-	-	-	80,500
Tailings Dike (Construction)	-	-	-	-	-	-	-	-	-	-	-	-
Stormwater Dike (Construction)							-	-	-	-	-	-
Goose Island Dike (Construction)	-	-	456,000	-	-	-	-	-	-	-	-	456,000
Vault Dike (Construction)	-	-	-	-	-	-	-	-	-	-	-	-
Tailings Containment Berms (Construction)	-	-	-	-	-	-	-	-	-	-	-	-
Finger Dikes (Construction)	-	-	-	-	-	-	-			-	-	-
Total Volume Required for Dike	137,500	80,500	456,000	-	-	-	-	-	-	-	-	674,000
Road	-	-	-	-	-	-	-	-	-	-	-	-
Plant Roads	-	-	-	-	-	-	-	-	-	-	-	-
Vault Haul Road	-	-	-	-	-	-	-	-	-	-	-	-
Airstrip	-	-	-	-	-	-	-	-	-	-	-	-
Mill Foundations	-	-	-	-	-	-	-	-	-	-	-	-
Total Volume Required for Construction	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL IRON FM. REQUIRED	137,500	80,500	456,000	0	0	0	0	0	0	0	0	674,000
TOTAL IRON FM. AVAILABLE	217,225	830,122	5,956,608	2,025,875	1,745,133	4,407,913	2,469,286	308,533	0	0	0	17,960,695
SURPLUS (DEFICIT)	79,725	749,622	5,500,608	2,025,875	1,745,133	4,407,913	2,469,286	308,533	0	0	0	17,286,695
WASTE MATERIALS BALANCE												
WASTE REQUIREMENTS	664,500	668,626	1,413,761	1,645,450	1,288,962	879,200	2,186,090	1,723,200	1,723,200	844,000	844,000	13,880,988
WASTE ROCK PRODUCTION	947,299	2,216,904	14,143,650	15,357,288	10,853,028	11,524,859	4,775,520	793,407	0	0	0	60,611,955
SURPLUS (DEFICIT)	282,799	1,548,278	12,729,889	13,711,838	9,564,066	10,645,659	2,589,429	(-929,793)	(-1,723,200)	(-844,000)	(-844,000)	46,730,966
ROCK TO PORTAGE PIT	0	0	0	0	0	0	0	0	4,508,772	4,508,772	4,508,772	13,526,316
WASTE TO PORTAGE DUMP	282,799	1,548,278	12,729,889	13,711,838	9,564,066	10,645,659	2,589,429	(-929,793)	(-6,231,972)	(-5,352,772)	(-5,352,772)	33,204,650
WASTE TO VAULT DUMP	0	0	0	0	0	1,971,569	7,730,992	10,820,138	9,262,245	5,566,085	547,297	35,898,326
MINED TONNAGES	**Year - 2**	**Year -1**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Total**
PORTAGE AREA												
Intermediate Volcanic (m3)	239,784	392,234	3,446,746	1,198,329	885,436	1,224,598	797,091	203,287	0	0	0	8,387,504
Ultramafic (m3)	123,290	257,178	3,510,979	2,247,242	2,401,272	2,479,555	1,404,847	281,587	0	0	0	12,705,949
Iron Formation (m3)	217,225	830,122	5,956,608	1,254,465	1,149,964	3,811,261	2,349,923	308,533	0	0	0	15,878,101
Quartzite (m3)	0	22,429	11,376	0	0	427,153	30,817	0	0	0	0	491,776
Overburden (m3)	367,000	714,941	1,217,941	0	0	1,266,118	33,372	0	0	0	0	3,599,372
Total Waste (m3)	947,299	2,216,904	14,143,650	4,700,035	4,436,672	9,208,685	4,616,050	793,407	0	0	0	41,062,701
GOOSE AREA												
Intermediate Volcanic (m3)	0	0	0	2,758,547	1,623,152	576,056	37,258	0	0	0	0	4,995,013
Ultramafic (m3)	0	0	0	4,283,136	3,922,954	1,143,466	2,848	0	0	0	0	9,352,405
Iron Formation (m3)	0	0	0	771,410	595,168	596,653	119,363	0	0	0	0	2,082,594
Quartzite (m3)	0	0	0	1,052,924	275,082	0	0	0	0	0	0	1,328,006
Overburden (m3)	0	0	0	1,791,235	0	0	0	0	0	0	0	1,791,235
Total Waste (m3)	0	0	0	10,657,253	6,416,356	2,316,174	159,470	0	0	0	0	19,549,253
VAULT AREA												
Intermediate Volcanic (m3)	0	0	0	0	0	1,971,569	7,730,992	10,820,138	9,262,245	5,566,085	547,297	35,898,326
Ultramafic (m3)	0	0	0	0	0	0	0	0	0	0	0	0
Iron Formation (m3)	0	0	0	0	0	0	0	0	0	0	0	0
Quartzite (m3)	0	0	0	0	0	0	0	0	0	0	0	0
Overburden (m3)	0	0	0	0	0	0	0	0	0	0	0	0
Total Waste (m3)	0	0	0	0	0	1,971,569	7,730,992	10,820,138	9,262,245	5,566,085	547,297	35,898,326

Material balance based on mined
tonnages provided by Amec, and on Feasibility Mine Plan layout.

O:\Active_2005\1413\05-1413-036ACumberland_EISSupport_Meadowbank\ConformityReview\Table9.1Material BalanceRevisedMiningSequenceDec2005.xls

Minor variations in estimates of
material quantities may result
from rounding errors and
variations in assumptions.