ISSUES REPORT
WESTERN COPPER HOLDINGS LIMITED
CARMACKS COPPER PROJECT

Prepared by:
Environment Directorate,
Department of Indian Affairs and Northern Development

2001

INTRODUCTION

The purpose of this report is to bring forward and summarize the outstanding issues that the Regional Environmental Review Committee (RERC) has identified with the Western Copper Holdings Limited Carmacks Copper project. This report also clarifies DIAND's position on the minimal solution storage capacity for heap draindown.

Western Copper Holdings Limited should review this report, as well as all RERC correspondence provided to them previously, and address the outstanding issues in Addendum #4. While this report has been prepared by DIAND to assist Western Copper Holdings Limited in their preparation of Addendum #4, the onus rests on Western Copper Holdings Limited to demonstrate that all potentially adverse environmental impacts of the proposal are insignificant or mitigable with known technology for DIAND to determine that the proposal may proceed to the regulatory process.

The order of the topics in the Issues Report is the same as Draft Table of Contents - Addendum #4, prepared by Access Mining Consultants Ltd for Western Copper Holdings Limited. While some sections in the Draft Table of Contents - Addendum #4 are not in the Issues Report, Western Copper Holdings Limited should still review RERC comments and DIAND correspondence to confirm that all issues raised previously are captured and addressed as appropriate. Appendix 1 at the end of this report lists the correspondence from the RERC and DIAND that have been sent to Western Copper Holdings Limited.

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SECTION 3 - BASELINE ENVIRONMENTAL CONDITIONS AND UPDATE

Concerns have been raised in the past regarding the lack of site specific data to support modelling and design criteria being proposed. Failure to design structures by considering site specific environmental baseline conditions may result in the structures not performing as proposed. This in turn may result in loss of fluids and materials which then negatively impact the downstream environment.

RERC Recommendation

The RERC recommends that all environmental baseline information be compiled and provided in Addendum #4. This updated baseline data base should be used in all applicable models, assumptions, design criteria and preliminary designs. Areas where there is inadequate baseline data should be described, including the implications this has on proposed designs for relevant structures.

3.3 Meteorological

With the limited baseline meteorological data available the proponent should be using appropriate conservative values in water storage and water balance calculations. Modelling should be transparent and appropriate. Inappropriate input parameters estimated from insufficient site data, and unconservative or unsubstantiated estimations may result in an inaccurate water balance model. An inaccurate water balance model increases the potential for loss of control of contaminated solutions to the environment.

Site precipitation and analysis, derivation of critical wet periods, distribution of annual snowmelt runoff, and annual evaporation and evaportranspiration losses were presented in the report: Carmacks Copper Project - Site Hydrology Revisions, Draft Design Memorandum CCL-CC2 Clearwater Consultants, Mar. 12/98. The

RERC technical sub-group reviewed the report and concurred that the parameters presented likely provide adequate conservativeness to proceed with water balance modelling. Western Copper was also advised to continue to collect baseline meteorological data to validate the input parameters used in the water balance model.

RERC Recommendation

The RERC recommends that Western Copper incorporate new baseline data collected into the calculation of the precipitation and evapotranspiration water balance input parameters to ensure they reflect the regional trends and climatic characteristics that would be found at the mine site.

3.4 Hydrology and Streamflow Assessment

The methodology used to estimate Williams Creek flows based on regional data has not been described. Inappropriate methods to estimate stream-flows may result in inaccurate impact evaluations which in turn may result in inappropriate effluent quality standards. Furthermore, section 4.2.2 of Addendum #3 estimates the Williams Creek mean annual discharge to be 0.6 m^3/s while section 1.4.3 identifies it to be 0.3 m^3/s (Marg Crombie May 8/95).

RERC Recommendation

The RERC recommends that in Addendum #4 Western Copper describe the methodology used to generate Williams Creek steamflow. This methodology should use regional data. Western Copper should also clarify the discrepancy of the mean annual discharge for Williams Creek, and identify whether this changes the predicted contaminant concentrations in Williams Creek, or has any other implications.

3.5.2 Ground Water Quality

The ground water sampling procedures used by Western Copper have not been described and there are questions regarding the validity of the data presented. Groundwater data may be considered to be unreliable since they are based on readings taken shortly (3 to 14 days) after the completion of the drilling and during seasonable low conditions (February and March) (Milos Stepanek, Jul. 9/97). Table 4.1 in Addendum #3 indicates the depth to water for DH96-14 and 15 is noted as 7.3 and 14.3m respectively, but the footnote 2 states that no groundwater was intersected as the water level measured was drilling induced water. The piezometer record sheet notes depth to water increases, but does not become dry (Kevin McDonnell, Oct. 15/96). It is not clear how was it determined that the hole is dry to depth, if there was always water in it. Inappropriate ground water sampling procedures may result in inaccurate data. Water quality data is used to conduct impact assessment and determine effluent quality standards. Inaccurate groundwater quality data may result in inaccurate impact assessment, unconservative design, and development of inappropriate effluent quality standards.

RERC Recommendation

The RERC recommends that Western Copper provide in Addendum #4, the groundwater sampling methodology including field quality assurance/quality control. This methodology should be consistent with generally accepted sampling practices. The groundwater monitoring system should be shown on a map (Agra, July 21/95). All groundwater quality data should be reviewed to ensure it is appropriate and valid data presented.

SECTION 4 - GEOLOGY, FOUNDATIONS AND GEOTECHNICAL ASSESSMENT

4.2.4 Mineral Resources and Reserves

It was noted in the IEE that there are 14 defined ore zones, however the IEE did not identify their location (Marg Crombie, May 8/95).

RERC Recommendation

The RERC recommends that Western Copper identify in Addendum #4, the location and probable reserves of the remaining 13 ore zones.

4.6 Permafrost

Issue 1

The criteria for removal of thaw unstable material, the methods for identification of thaw unstable material and the proposed mitigation measures are probably adequate to address immediate concerns related to thaw stability. The proponent should identify the procedures for probing for ice-rich permafrost and include this as part of Addendum #4 (Milos Stepanek, Dec. 18/95). Inadequate delineation of permafrost may result in pockets of permafrost going undetected. These pockets may melt and result in stability problems for structures constructed on top of them. The failure of some of these structures may result in loss of contaminants to the environment.

In the Design Criteria and Parameters Report (Oct. 9/98), Western Copper states that thaw unstable soils within the permafrost will be addressed. Prior to construction of the plant facilities, leach pad and confining dike, events pond and waste rock storage area, test holes will be drilled in an approximate 50 metre grid

pattern to bedrock or a maximum depth of 25 metres whichever is shallower. In the test holes, the upper 1.5 metres will be sampled continuously to check for moisture content and suitable soil liner material. Below 1.5 metres, samples will be collected approximately every 1.5 metres or as required by material changes and tested for moisture content. Where the soils are unfrozen or frozen but with a moisture content not greater than 17 percent, construction can proceed without any special foundation treatment. Where there are frozen soils with a moisture content greater than 17 percent within 5 metres of the ground surface, the potentially thaw-unstable soils will be excavated and the excavation backfilled with durable rock. This program and procedures will be described in more detail in the construction quality assurance plan.

RERC Recommendation

The RERC recommends that Western Copper confirm the program and procedures to investigate and remediate thaw unstable soils in Addendum #4. The proposed permafrost delineation program should be extended to include any structures that are to be sited over ice rich ground.

Issue 2:

The Design Criteria and Parameters (Oct. 9/98) report states that permafrost is no deeper than 25 metres. This has yet to be proven. If permafrost extends beyond the 25 metre depth will deeper drilling be conducted to see how deep it actually goes? It is important that the bottom of the permafrost layer be determined. Enhanced heat transfer due to groundwater movement from thawing surficial layers may lead to degradation of permafrost from below as well as the surface down. Permafrost that is very near the freezing point is susceptible to any terrain disturbance and extensive thawing may follow, with accompanying subsidence (Hugh Copland Nov 27/99).

The ground temperatures presented do not indicate the base of frozen ground at any of the five sites instrumented. For permafrost in equilibrium with surface conditions, ground temperature always increases with depth below the zone of annual temperature fluctuation. The data presented do not indicate a gradient of temperature in permafrost at the proposed mine site. The implication is that permafrost has warmed to the melting point and is now degrading. For fine grained soil thawing of pore ice occurs over a small temperature range below 0 degrees C, rather than at 0 degrees C. (C.R. Burn Dec. 13/96)

Western Copper proposed in the Geotechnical Review of Updated Design and Response Strategy for Addendum #4, (May 11/98) that the estimated lateral extent and depth of 'thaw unstable' and permafrost materials in the leach pad foundations will be mapped, together with a detailed description of the drilling program to further delineate these areas. According to the Design Criteria and Parameters report - each area where there are deep soils that are potentially thaw-unstable will require further engineering analysis and/or testing to determine the proper treatment.

RERC Recommendation

The RERC recommends that any new thermistor readings be incorporated into the database. The thermal modelling of the permafrost degradation due to construction of the heap leach facility should be updated, taking into account the concerns raised with previous modelling. This modelling should be tied into the permafrost delineation and remediation program to show that permafrost below the intended excavation depth at the pad will not degrade over time and produce unacceptable differential settlement that could compromise the integrity of the pad liner or any other structure constructed over top deep permafrost.

The RERC recommends that Western copper explain the thermal modelling used to

determine how thawing at depth will occur. The thaw-unstable ground and probability of differential settlement should be discussed further in section 6. 10 Settlement Assessment of Addendum #4.

4.8 Borrow Pit Location

An issue was raised regarding the availability of suitable soil liner material. Insufficient soil liner material may mean that the liner can not be constructed as proposed (Milos Stepanek, July 9/97, Feb 11/99).

RERC Recommendation

The RERC recommends that Western Copper compile all existing data on borrow sources for the soil liner, including relevant properties. This data should be reviewed and evaluated to demonstrate that the borrow source meets the design criteria and that there is sufficient volume of material. This information should be provided in addendum #4.

SECTION 5 - GROUNDWATER CHARACTERISTICS / HYDROGEOLOGY

There is an inadequate delineation of the groundwater regime beneath the heap leach pad site. This means that there is insufficient information to support hydro-geological modelling, impact assessment and the design of the foundation drainage system.

RERC Recommendation

The RERC recommends that in Addendum #4 Western Copper provide data regarding the ground water regime for the heap leach pad site. The data should be accompanied by a comprehensive analysis and discussion of the following:

1. location of regional groundwater table and perched groundwater tables;
- direction of seepage;
- interaction of surface water and groundwater;
- location of groundwater discharge areas;
- variation in groundwater levels;
- permeability of the subsurface materials;
- flow net;
- details on the need for additional studies, their objectives, and when the studies will be done; and
- how the results will be incorporated into modelling and design.

SECTION 6 - HEAP LEAP PAD PLAN AND OPERATION

6.3 Foundation Conditions

The RERC has identified a lack of data and errors and omissions in the site investigation results provided for the area of the proposed heap leach pad. The RERC has also raised questions regarding some of the interpretation of the results of the site investigations. (Milos Stepanek, 18/95, July 9/97; Feb 11/99). Insufficient or deficient data and interpretation may result in an inability to construct as proposed, or inappropriate construction of structures which may end up not performing as designed.

Western Copper had responded to these issues by proposing to provide in Addendum #4 a complete discussion of the results of the investigations, rationale for material properties selection, analyses and use in the geotechnical aspects in the project design. Furthermore, Western Copper recognized the concern with the presence of a glacial fluvial layer under the heap leach pad area: "The geotechnical investigations undertaken on the site have confirmed the presence of a discontinuous sand and gravel unit near the surface. Both the hydrogeological impact assessment and geotechnical design of the heap leach pad will account for this geologic unit. The QA/QC Program and Technical Specifications will be updated and will address materials handling and testing of various geologic units. Materials considered unsuitable within the limits of an excavation shall be removed and wasted as directed by the Engineer. The QA/QC Program will specifically consider materials handling of the discontinuous sand and/or gravel unit."(Summary of Geotechnical Site Investigations - Heap Leach Pad, EBA Engineering Consultants Ltd., May 19/98).

However in the Design Criteria and Parameters report it is stated that: "The geotechnical and hydrogeological properties of the foundation, zoned earthfill, liner, waste rock, ore, drainage layer, and overliner materials have been estimated from drilling and test pitting, site-specific laboratory results, published literature, and professional experience. The following documents form the basis for selecting the principal geotechnical and hydrogeological properties for final design of the leach pad, heap confining embankment, waste rock storage area, events pond dam, and other foundation structures:

> Knight Piesold, Ref, No. 1783/1, May 1995, Report on Preliminary Design ...
>
> ...Knight Piesold, Ref. No. 1784/1 June 1996, Report on 1996 Geotechnical and Hydro geological Site Investigations...

“The complete site-specific test results are not repeated in this report. Table 3.1 at the end of this report provides a list of all materials and interfaces to be considered during design and the principal geotechnical and hydro geological parameters adopted for each. Where available, the range of test results is provided in parentheses. In general where

test data are available, the selected parameters are at or near the lower bound of the test data. In the few exceptions to this, the parameters were selected after considering the variability of the data and experience in similar circumstances." It was with the reports referenced in the Design Criteria report where a number of RERC comments mentioned above were made.

RERC Recommendation

The RERC recommends that Western Copper submit in Addendum #4 a report on the foundation conditions at the heap leach pad which should include but not be limited to the following

10. Review of RERC comments to ensure that all geotechnical issues are addressed in Addendum #4.

11. Compile and present all borehole and test pit logs and all laboratory data including all measured soil and subsurface properties in Addendum #4. The data should be reviewed to correct errors.

12. Review and revise as necessary the interpretation of this data to clearly reflect ground conditions at the site and in consideration of RERC comments on previous interpretations.

6.3.2 Hydrogeological Impact Assessment

The RERC has identified concerns with the previous hydrogeological impact assessment done by Western Copper. There was a lack of field data provided to support the assumptions in the model. The effect of permafrost on permeability was not addressed. The attenuation capabilities of the soils were not evaluated and considered in the assessment. A reviewer pointed out that the permeability of the bedrock will be governed by the permeability of the fractured versus unfractured bedrock. The hydrogeological. impact assessment is important to evaluate the consequences of various sized leaks to the environment. It is an important tool in evaluating the long term potential for significant environmental impacts from the heap leach pad. The assessment is also used to establish monitoring well locations, triggers and contingency plans in the event of leaks.

RERC Recommendation

The RERC recommends that a revised hydrogeological impact assessment be done and provided in Addendum #4. This assessment should include but not be limited to the following:

1. A review of RERC members comments on previous hydrogeological impact

assessments;

2. Compilation and presentation of supporting data, including methods used to collect the data;

3. A description of the method of impact assessment that is technically sound and defensible;

4. Consideration of the permafrost under the heap leach pad during various stages of development;

5. All calculations, assumptions, and other information so that the modelling is transparent;

6. An evaluation of the impacts from leaks of different rates, volumes, and duration during different periods of pad development, and considering the different groundwater regimes which may be expected to develop over the life of the development and at abandonment; and

7. A discussion of how the information from the impact assessment will be used in monitoring and contingency planning.

6.4.2 Foundation Drainage

The RERC has concerns with the design and function of the foundation drains under the heap leach pad. These drains are to remove groundwater from below the heap in order to ensure that excessive pore pressures do not develop. Western Copper also proposes to monitor the water quality in these drains, since they may also collect water that has leaked from the heap leach pad. There has been confusion over how the drains can collect both groundwater from below the drains, and water from the heap leach pad above. Western Copper has confirmed that the foundation drainage system is not that of a leak detection system, but that any abnormal flows or changes in water quantity and quality in the foundation drainage to the events pond would imply a leak and it would be prudent to monitor the flow and quality from the foundation drainage system. Previous design criteria for the foundation drains was constructability, however more criteria should have been provided. For example, what will the depth of placement of the foundation drains be - will depth of placement be determined by natural impermeable layers in the substrata (Marg Crombie, 7/96)?

The design of the foundation drainage system is dependant upon a good understanding of the soil layers and permeabilities, groundwater and permafrost regimes under the heap leach pad, which has not been demonstrated to date (Milos Stepanek, July 9/97; Paul Kaplan, Aug. 11/97; Marg Crombie, Feb. 7/96; Kevin McDonnell May 10/96).

RERC Recommendation

The RERC recommends that a revised foundation drainage system plan be provided in Addendum #4. This plan should include, but not be limited to the following:

1. A review of RERC comments regarding foundation drainage for the heap leach pad;

2. An evaluation of the supporting data (soil properties including permeability, water table, topography and soil conditions including permafrost) to define the site specific conditions and how the site specific conditions are considered in the design of the foundation drainage system;

3. Preliminary design including design criteria for the foundation drainage system. The preliminary design of the system should include drawings which indicate the extent and pattern of the proposed foundation drains; and

4. Operating plan for the foundation drainage system, including monitoring and triggers for leak detection and collection.

6.5 Confining Embankment Design

Reviewers have raised issues with the general design concepts and criteria for the confining embankment design, and with the spillway that is proposed to be constructed in the embankment.

With respect to the general design concepts and criteria, a comment was made that since in-heap storage has been eliminated from the operating criteria, the primary purpose of the confining embankment is to provide stability to the leach pile. Has the proponent investigated the minimum embankment height required to provide stability? The thrust of this comment is to understand if the confining embankment needs to be held at a constant elevation with a maximum height of 22 m., or could the embankment be reduced to a minimum height to provide the required mass to demonstrate pile stability. This may result in a decrease in the overall height of the confining embankment and reduce the concern over a major "dam" structure being in place for perpetuity (Paul Kaplan, Apr. 8/99).

The confining embankment is not well specified, and terminology in Section 2.8 (page 18) of the Report on Updated Detailed Design of the Heap Leach Pad and Events Pond (Ref. No. 1785/1) contradicts description on Dwg. No. 1785.206. "Structural random fill" contradicts definitions of "engineered earthfill and rockfill zoned structure". Similarly, "non-frost susceptible random fill" could be any type of material having less than 8%

fines passing No. 200 sieve. This description and soil liner on the upslope side of the dam precludes evaluation of the filter or filters and the drainage blanket (Milos Stepanek July 9/97).

It was commented that the proposed "spine" drain would not adequately drain the toe of the dam embankment (Milos Stepanek Dec 18/95). It was also suggested that a toe berm is needed and rip rap bedding is required beneath the rip rap layers shown in a previous design drawing (Les Sawatsky, Aug. 28/97).

In regards to the spillway, comments were raised regarding the conservativeness of the proposed design capacity of the spillway. In section 2.3 Spillways of the Design Criteria and Parameters report (Oct. 9/98), it is stated that spillways will be sized to pass the peak flow from a 100-yr return period storm with a duration consistent with the local characteristics of the catchment area. In section 10 Closure requirements and Reclamation, 10. 1 Heap Leach Facility, it is stated that spillways will be sized to accommodate a peak flow consistent with a CDSA 'high' consequence category structure (between 1,000-yr return period and Probable Maximum Flood for the project site) with allowances for freeboard. It was suggested that the initial construction of the spillway should be to the criteria for closure so that it is conservative from the beginning, and to eliminate the need to have to go back and re-construct the spillway in the future (Kevin McDonnell, Feb. 10/99). In general, the design capacity of the spillway should be conservative considering the implications of a failure of the spillway and the potential loss of contaminated solutions and materials to the downstream environment.

An issue was raised with some of the design concepts proposed for the spillway. It was proposed that the spillway would be composed of rip rap at steep slopes highly vulnerable to instability (Les Sawatsky, Aug. 28/97). The use of an unprotected HDPE liner for the dam spillway would unlikely meet the stated design objective of ensuring positive erosion control. These liners are usually used as emergency and temporary measures (Milos Stepanek, Dec 18/95).

RERC Recommendation

The RERC recommends that:

1. The minimum height of the embankment be investigated to determine if it can be reduced, and still provide the required mass to demonstrate pile stability;

2. A preliminary design and design criteria be provided for the embankment be provided which should be based on properly identified and specified construction materials. The filter or filters should be designed to prevent internal erosion of fine-grained soils;

3. The design parameters for the spillway be reviewed in light of operational hazard

rating, need to impound water, and the mine post-closure performance; and

4. A revised spillway preliminary design and design criteria be provided.

6.6 Liner System

In the Design Criteria and Parameters report (Oct. 9/98) a general description of the liner system was provided, including permeability criteria. The report proposed that suitable subgrade soil for the liners would be be ripped, disced and recompacted to a total depth of 300 mm. Concerns were raised that due to the thickness of this layer, it may be difficult to achieve the proposed permeability specifications (Milos Stepanek, Feb. 11/99; Paul Kaplan, Apr 8/99).

The thicknesses of the lower and upper soil liners were not identified (Milos Stepanek, Feb. 11/99; Paul Kaplan, Apr. 8/99). Western Copper has noted that laboratory tests and correlations with index properties will confirm that the liner material meets the required permeability criterion of 10^{-8} m/s and these will be described in the CQA manual. Furthermore, in the report Geotechnical Review of Updated Design and Response Strategy for Addendum #4, Western Copper stated that a description of the field and laboratory tests to be performed during fill placement and construction to ensure the achievement of all relevant geotechnical properties will be provided in the addendum #4 text.

The Design Criteria and Parameters report identified the friction angle for the geomembrane soil liner interface as twenty degrees and a reviewer noted that this may be high (Paul Kaplan, Apr 8/99).

RERC Recommendation

The RERC recommends that Western Copper provide in Addendum #4 a preliminary design for the heap leach pad liner that includes but is not limited to the following:

1. A review of RERC comments submitted on the current and previous liner designs to ensure comments are considered in the current design;

2. Design Criteria and preliminary design including soil liner specifications;

3. A construction quality assurance/quality control plan including a description of the field and laboratory tests to be performed during fill placement and construction to ensure the achievement of all relevant geotechnical properties. Field testing should include hydraulic conductivity testing of samples of the compacted soil liner material obtained during construction to verify that the design criteria are being achieved for the full lift thickness; and

4. Stability assessment and a review of the friction angle for the geomembrane soil liner interface.

6.7 Solution Collection System

It is not clear what the present proposal for conveying solutions from the heap to the process plant and/or events pond is. The Design Criteria and Parameters Report (Oct. 9/98) states that solutions will be "conveyed by gravity flow". The previous proposal from Knight Piesold (No. 1785/1, Apr. 23/97) utilized HDPE pipes running beneath the embankment to the process plant and events pond. Several concerns were raised about the long term integrity of this system including, effects of differential settlement, freezing, material life, and decrepitation of graded material over solution collection sumps (Hugh Copland Nov. 27/98, June 11/97; Benoit Godin Aug. 11/97; Bill Slater Aug. 8/97; Paul Kaplan Aug. 11/97).

RERC Recommendation

The RERC recommends that Western Copper submit in Addendum #4 a report on the solution collection system which should include but not be limited to the following:

1. A review of RERC comments regarding the solution collection system to ensure comments are considered in the preliminary design;

2. Design criteria and preliminary designs of the solution collection system between the heap leach pad, process plant and events pond; and

3. The design should discuss the long term integrity of the system considering it will be required to function for a considerable length of time following decommissioning so that fluids do not become impounded behind the confining embankment.

6.8 Ore and Heap

No details were provided about how the liner, solution management piping and foundation drains would be tied in between different phases. The steps proposed to ensure that the ingress of surface water, and the prevention of excess sediment loads are inadequately described (Milos Stepanek Feb. 11/99, July 9/97; Yodit Johnson Mar. 26/99). The diversion channels are to be designed to pass the peak flow from a 100-year return period. This will not be sufficient considering the operational hazard rating and the post-closure period. (Milos Stepanek Feb. 11/99; Les Sawatsky Feb. 15/99; Yodit Johnson Mar. 26/99; Kevin McDonnell Feb. 10/99).

The Design Criteria & Parameters report (Oct. 9/98) states that the pad could be expanded beyond its present capacity by increasing height or moving to the west. The potential environmental impacts from the expansion, and proposed mitigation of the impacts were not identified or assessed (Kevin McDonnell, Feb. 10/99).

The solution application rate has decreased from 1,137 m^3/hr previously proposed to 540 m^3/hr in the Design Criteria & Parameters report (Oct. 9/98). It is not clear if any other parameters have changed such as concentration of the leachate or proposed leaching times. The Beattie report of 1996 stated that a higher flow-rate with a lower acid concentration may be the optimum for leaching. A different application rate will have implications for water balance and the leachate concentration must be taken into account when doing contaminant modelling (Hugh Copland, Feb. 8/99).

It had been recommended that Western Copper commit that no frozen ore will be placed on the pad, and no ore will be placed on frozen ore in the pad.

RERC Recommendation

The RERC recommends that Addendum #4 include:

1. Preliminary designs for the tie-ins for liner, solution management, and foundation drains;

- A description of measures that will prevent influx of surface water into the upper edge of pad expansion and how the increased sediment load will be handled. The design parameter for the diversion structures should be re-assessed to reflect the post-abandonment period;

- Western Copper should clarify the scope of the project including plans for expansion. The potential environmental impacts and necessary mitigation should be identified. If the project proceeds, then any future changes to the project that have not been previously assessed will require an environmental assessment.

- A discussion on how the change in solution application rate may affect other design criteria;

- Criteria for the loading of unfrozen ore and loading onto unfrozen ore.

6.9 Stability Assessment

The RERC has identified a number of concerns with the stability assessment of the heap and confining embankment.

The Design Criteria and Parameters report (Oct. 9/98) states the confining embankment is to be designed to withstand the appropriate minimum criteria for design earthquakes as outlined in the Canadian Dam Association Dam Safety Guidelines. A concern was raised that utilizing a pseudostatic analysis per Hynes-Griffin and Franklin (1984) is not applicable for the heap foundation conditions unless the potential of the ice-rich foundation material to liquify in the long term is carefully examined.

In previous stability calculations the relatively high factors of safety against sliding reported for the pad can be classified as optimistic and possibly biassed. The approach used ignored the well documented effects of pore pressure generated from the thaw consolidation theory developed by Morgenstern and Nixon. The case histories of the adverse impact of thawing ground on stability had been ignored. Similarly, structures with PVC or HDPE liners are susceptible to small deformations and a reduction in shear strength parameters could be imprudent (Milos Stepanek, Feb. 11/99).

Thermal modelling of the heap presented a case where the sides of the pile froze during the winter to a depth of 4-5 metres. The development of ice lenses in the heap perimeter during the winter could be a concern if spring thawing leads to instability of the sides and possible damage to the liner from localized failures (Marg Crombie, May 8/95).

RERC Recommendation

The RERC recommends that Western Copper include in Addendum #4 a re-evaluation of the stability of the heap and confining embankment. This should include but not be limited to the following:

- An earthquake acceleration with at least a 1000 year return period (if a probabilistic analysis is applicable) be considered for all structures. It is not recommended to implement the proposed seismic coefficients unless the liquefaction potential of some of the ice-rich foundation materials is carefully examined. If liquefaction is probable, then alternative analysis to the pseudostatic method should be used;

- Stability assessment should incorporate the possibility of increased pore pressures due to thawing of ice rich foundation materials; and

- The heap design should ensure that any localized instabilities due to the formation of ice lenses in the heap perimeter will not damage liner components.

6.10 Settlement Assessment

The amount of settlement due to thawing of foundation materials at depth is a concern

because of the effect on the integrity of the liner system and piping. Preliminary designs predicted three metres of settlement under some portions of the heap. This was revised to a maximum settlement of approximately 1.2 metres (Knight Piesold, 1785/1, April 23/97). The Design Criteria & Parameters report (Oct. 9/98) states liner settlement will be due to pad vertical loads. The concern of differential settlement under the heap has not been addressed. Settlements in excess of 200 mm may render the berms separating cells inoperative (Milos Stepanek, July 9/97).

RERC Recommendation

The RERC recommends that the issue of settlement due to both vertical loading and thawing of ice rich foundation material be re-evaluated. This should include but not be limited to:

- An assessment of how differential and unequal thaw settlements will affect the integrity of the liner, leak detection, solution collection, and foundation piping and connections;

- An evaluation of the adequate characterization of existing subsurface conditions and any assumptions made due to a paucity of foundation information. How will additional information collected during the permafrost delineation program be incorporated into the design of the heap?

- Criteria to determine when thaw unstable foundation materials will be considered too deep to be effectively excavated but may remain as a design hazard should be defined; and

- Procedures to ensure liner and piping integrity will be maintained.

SECTION 7 - EVENTS AND SEDIMENT PONDS DESIGN

7.2 General Concepts and Design Criteria

RERC members have noted several issues with respect to the design criteria for the events pond (see also section 12.5 regarding sizing criteria for solution storage from heap draindown). The criteria for pond spillways to pass the 100 year return period flood given in the Design Criteria and Parameters report (Oct. 9/98) may not be adequate for the operational hazard rating and mine closure (Milos Stepanek, Feb. 11/99).

The Design Criteria and Parameters report states the pond is to be designed to withstand the appropriate minimum criteria for design earthquakes as outlined in the Canadian Dam Association Dam Safety Guidelines. A concern was raised that utilizing a pseudostatic analysis as per Hynes-Griffin and Franklin (1984) is not applicable for the events pond foundation conditions unless the potential of the ice-rich foundation material to liquify in the long term is carefully examined. Similarly, structures with PVC or HDPE liners are susceptible to small deformations and a reduction in shear strength parameters could be imprudent (Milos Stepanek, Feb. 11/99).

Previous designs identified that the maximum head on the outer liner of the events pond would not exceed one metre, however one metre maximum head was not identified as a criteria nor was it indicated how this will be achieved (Marg Crombie Feb. 7/96).

It is proposed to temporarily store water in the events pond during the summer and fall seasons. However the design basis for the events pond (sec. 4.1) does not account for this volume. Shouldn't this volume, or a specified maximum volume, be included in the design basis for the events pond (Kevin McDonnell, Feb. 10/99, pg. 2)?

RERC Recommendations

The RERC recommends that the design criteria for the events pond be re-evaluated taking into account RERC members comments. Addendum #4 should include but not be limited to:

5. Design criteria and preliminary design for the events and sediments ponds, incluindg the spillways;

6. Consideration of the operational hazards and long term closure requirements;

7. An earthquake acceleration with at least a 1000 year return period (if a probabilistic analysis is applicable) be considered for all structures. It is not recommended to implement the proposed seismic coefficients unless the liquefaction potential of some of the ice-rich foundation materials is carefully examined. If liquefaction is probable, then alternative analysis to the pseudostatic method should be used; ang

8. Leakage calculations for the events pond should include all pertinent parameters used including head on the lower liner and a description of how the head will be maintained at this level.

7.3 Foundation Conditions

Foundation conditions under the events pond have been assumed to be similar to those under the heap leach pad. Very little specific sub-surface data is available for the area under the events pond, what little there is indicates interbedded organic silts and sands overlying interbedded sands and gravels all resting on relatively ice rich glacial till. The effects of differential settlement on the events pond confining embankment have not been evaluated. There is no discussion or design parameters for construction of the confining embankment.

RERC Recommendation

All the issues and recommendations concerning the heap leach pad foundation conditions are applicable to the events pond and should be reviewed. Ice rich substrata is probably more widespread in the area of the events pond and the responses to concerns should reflect the greater uncertainty in this area. Details should be supplied concerning the construction materials and techniques for the pond confining embankment.

7.4 Liner System

The proposed liner system for the events pond is to be placed on prepared subgrade or random fill. A concern has been raised that this may not provide enough protection against puncture to the lower HDPE liner and the rate of leakage from the pond will be increased (Milos Stepanek, Feb. 11/99). Other concerns have been raised about details concerning the construction of the pond. These related to previous designs and included details about anchoring of the outlet spillway channel to the liner, welded connections between primary and secondary liners, and LDRS details (Les Sawatsky, Dec. 4/95).

RERC Recommendation

Consideration should be given to the construction of a soil liner below the HDPE liner for the events pond. The RERC recommends that appropriate mitigation be identified in Addendum #4 for further assessment. Comments on the construction details previously raised should be reviewed to determine if they are applicable to the new design for the events pond.

7.6 Sediment Control Ponds

The criterion to remove "fine silt sizes for events up to a 10 year return period 24 hour duration storm" requires additional definition. What size of fine silt sizes shall be removed during the design flood? Does the sediment removal criterion apply to peak flow during the 10 year 24 hour flood or the mean flow during the 10 year 24 hour flood. (Les Sawatsky, Feb. 15/99; Yodit Johnson, March 26/99).

RERC Recommendation

Clarify the sizing of the sediment control ponds to remove suspended sediments during the specified precipitation events.

SECTION 9 - MINE WASTE ROCK STORAGE AREA

9.2 Waste Characterization

Concerns have been raised with the inputs used in modelling projected water quality from the waste rock dump. Water quality of the dump runoff was chosen to be equivalent to that of treated raffinate (Initial Environmental Evaluation, Vol. 4, s 5.4.2). No metal leaching tests were done on any waste rock, only on samples of ore. The proponent has assumed that using values for treated raffinate represents the worst case scenario. Modelling accuracy is also compounded by the lack of longer term background water quality data (Benoit Godin Aug. 8/95, Dec. 14/95, Les Sawatsky Feb. 15/99, Yodit Johnson Mar. 26/99).

Estimates of nitrogen loading from the use of mine explosives has also been called into question. Specifically the NO_3 / NH_3 ratios used in the calculation of loading were based on Fording Coal data (Pommen, 1983) in which a ratio of 15:1 is used. Limited data for the Yukon indicates that this ratio could be much lower (Benoit Godin Aug. 8/95).

RERC Recommendation

It is recommended that the water quality modelling from the waste dump be re-examined. Justification that input parameters represent realistic numbers should be presented. Not only metals but residues from explosives should be examined. Concentrations at various stations along the affected drainages should be provided. Contingencies in case water quality is worse than predicted should be discussed, including discharge criteria and treatment methods during operations and post-operational.

9.3 Site Geotechnical and Hydrogeological Characteristics

Issue 1: Foundation Conditions

It is generally agreed that foundation conditions of the waste rock site and waste rock sediment control pond are difficult to deal with due to various surficial units ranging from organics, fine silt and sand to decomposed bedrock all complicated by the presence of warm permafrost throughout. If foundation conditions are poorly understood, and unless conservative values are used in the design of the waste dump to account for the uncertainties, the possibility that the dump may fail is increased. Reviewers have expressed concerns that with the limited foundation information, the proponent has not used sufficiently conservative design parameters for the waste dump. Specifically some of the index properties for the foundation materials (eg. friction angles) have been called into question.

Many questions regarding the extent, depth, and thermal modelling of the thawing of the

permafrost have been raised. These include thickness of permafrost, how the depth and rate of thaw were calculated, what the temperature of the base of the waste dump will be over time, and what the degradation of the permafrost may look like. The delineation, handling, and long term behavioural modelling of the permafrost under the dump is a key consideration in the dump design (Milos Stepanek Feb.11/99, Dec. 18/95, Aug. 2/95; Kevin McDonnell Feb. 10/99, May 10/96; Hugh Copland Aug. 7/97, Nov. 27/98, Aug. 7/97, C.R. Burn, Dec./96).

RERC Recommendation

It is recommended that all foundation characteristics be re-examined and justification be provided for the material properties that have been selected to represent the foundation in any stability calculations. It is important that the properties of any material that may remain in the dump foundation be characterised. The extent and nature of the permafrost under the dump and in beneath the sediment control pond should be well documented as well as the modelling used to determine permafrost behaviour over the long term. Reviewers comments regarding foundation conditions and permafrost should all be examined to ensure they are addressed.

Issue 2: Hydrogeological Conditions

Concerns have been brought forward that the hydrogeological conditions beneath the waste rock dump site are poorly understood. Water quality data from wells in the waste rock area are lacking, water table levels are not reported, and the flow regime beneath the waste rock dump has not been defined. The impact of disturbing the permafrost in the waste rock area on the hydrogeology beneath the dump has not been examined. Increased subsurface flow of water due to permafrost melting may also have an impact on the rate of permafrost degradation from below. It is difficult to model the effects of possible groundwater contamination due to the waste dump when there is no baseline water quality data. Monitoring requirements, triggers, and contingencies in the event of contamination will also depend on baseline considerations. The presence of near surface groundwater will also have a bearing on the physical stability calculations required for the waste dump (Milos Stepanek Feb. 11/99, Dec. 18/95; Benoit Godin Aug. 8/95, Dec. 14/95; Dan Cornett Jan. 6/96; Hugh Copland Aug. 7/97, Sept. 13/96).

RERC Recommendation

All available data on the hydrogeological regime beneath the waste rock dump should be compiled including any new information on groundwater levels and water quality that have not been presented previously. Expected changes in the groundwater flows or quality once construction on the dump has commenced and on completion of the dump should be outlined. How the groundwater regime and changes to it have an impact on dissipation of pore pressures and thereby dump stability should be discussed.

9.5 Design of Mine Waste Rock Storage Area

Issue 1: Stability analysis

Assumptions used in the stability analysis done on the waste dump are believed to be optimistic and not based on the actual field conditions that are expected. In particular the index properties of the foundation and dump materials themselves may be too high and not based on any material testing done specific to this site. Thaw induced pore pressures have not been adequately accounted for. The method of analysis used (Hynes, Griffin, and Franklin, 1984) may not be appropriate for the foundation conditions encountered on site (Yodit Johnson, March 26/99; Milos Stepanek Feb. 11/99 July 9/97, Dec. 18/97).

RERC Recommendation

It is recommended that the stability analysis be re-evaluated including all the input parameters. Assumptions must be based on data specific to the site or if these are unknown then conservatism must be built in to account for possible adverse conditions encountered in the dump foundation. The method of analysis should be shown to be appropriate for the situation. The stability analysis should be done for the various critical stages of dump construction to show the dump will remain stable at all times.

Issue 2: Water Management

Questions have been raised regarding the design of ditches for foundation drainage prior to and after dump construction (Hugh Copland Sept. 13/96; Yodit Johnson March 26/99; Milos Stepanek Feb. 11/99, July 9/97, Dec. 18/97).

RERC Recommendation

The drainage ditch design criteria should be specified, including but not limited to specifications for construction, rock fill, sizing, contingencies for differential settlement.

Issue 3: Conforming to British Columbia "Investigation and Design of Mine Dumps, Interim Guidelines

The Design Criteria and Parameters Report (Oct. 98) states that the design of the dumps will conform to the British Columbia Investigation and Design of Mine Dumps Interim Guidelines (1991). Reviewers have raised concerns that some of the preliminary information presented in the Design Criteria and Parameters report does not conform to these guidelines. These include, inappropriate use of Canadian Dam Safety Association (CDSA) classifications applied to a waste dump, and inappropriate reduction of ground acceleration values when foundation conditions are susceptible to liquefaction.

RERC Recommendation

If the British Columbia Investigation and Design of Mine Dumps Interim Guidelines are to be used for the design of the waste dump, the dump design must clearly demonstrate that the procedures discussed in the Guidelines are followed. This includes: descriptions of properties and testing of foundation, overburden and waste rock; description of foundation preparation; proper classification of the dump; application of the appropriate stability analysis; methods of surface water control; and dump construction methods.

Issue 4: Contingencies if Design Criteria Not Met

Reviewers have been concerned that some of the design criteria specified will not be met because of the adverse conditions. No contingency plans have been presented. (Kevin McDonnell Oct. 15/96, Hugh Copland Sept. 13/96)

RERC Recommendaton

Contingency plans should be documented where there is a likelihood that the design criteria may not be able to be met.

9.6 Construction Methodology and Sequencing

Issue 1: Construction and Monitoring

Many questions have been raised concerning the construction and monitoring of the waste dump. Beginning with the criteria for removal and/or the remediation of thaw unstable materials in the dump foundation, through to the operational dump monitoring, the observational approach used, criteria for placing or not placing material into the buffer zone, and monitoring to ensure the dump is stable during reclamation and closure. Specific questions have been directed towards the monitoring methods and locations and remediation of "localized instabilities" (Hugh Copland, Aug. 7/97; Kevin McDonnell Oct. 15/97; Yodit Johnson, Mar. 26/99; Milos Stepanek Feb. 11/99, July 9/97, Dec. 18/97).

RERC Recommendation

Western Copper should re-examine all reviewers comments with regard to construction and monitoring of the dump. Western Copper should confirm whether they be following the British Columbia "Operation and Monitoring of Mine Dumps, Interim Guidelines" (May 1991).

Issue 2: Dump Failure

The proponent has not fully analysed the consequences of any dump failure. The consequences of any dump failure will weigh heavily on the design parameters used for the siting and construction of the dump. Where the risks or consequences of dump failure are high the classification and design of the dump must be conservative enough to reflect this.

RERC Recommendation

Western Copper should discuss possible dump failure mechanisms, run out distances, the risks involved, effects on the environment and mine operations, and remediation plans in case of possible failures. The preliminary design of the waste dump should reflect the results of this evaluation.

SECTION 12 - WATER MANAGEMENT PLANS

12.5 Heap Leach Pad Solution and Water Management

Issue 1: Solution Storage and Sizing of Events Ponds

Western Copper had originally proposed to provide solution storage at all times during the operations for 100% draindown of solution from the heap plus water from extreme spring hydrological events that may drain into the heap or events pond.

Western Copper revised this proposal in the Design Criteria and Parameters Report, (Oct. 9, 1998). It is now proposed that during the first year of operation, the events pond will be able to contain 100% of the total potential heap draindown volume. During subsequent years of operation, Western Copper proposes to allow for containment of only 48 hours of draindown at the full rate of solution application (540 m^3/hr). No rationale or analysis of the environmental and technical factors which support the adequacy of the current proposal was provided.

The inability to provide 100% solution storage and lack of rationale means that the risk of a loss of process solution to the environment from an operational upset either can not be evaluated with certainty, or could be conservatively assumed to be high.

The discharge of untreated solution to Williams Creek and eventually to the Yukon River may result in significant impacts to the aquatic resources of both systems. The severity of the impacts depends on various factors such as the volume of solution released, the form and concentration of contaminants in the solution, the rate of release, when the solutions were released, and the potential receptors. In general, untreated solution from the heap leach pad will be very toxic to aquatic and terrestrial animals as the solution will be very acidic and contain high levels of metals. The potential environmental impacts from a loss of a certain minimal volume of untreated solution from the heap leach pad to the environment can be assumed to be significant.

The recommendations from the RERC review of this proposal ranged from the need to provide 100 % draindown storage capacity, to the need to demonstrate that any less a storage containment capacity be shown to be as conservative as 100% draindown containment.

The Department has reviewed the proposal and advice from the RERC and responds with the following recommendations to Western Copper.

DIAND Recommendations:

5. It is DIAND's preference that Western Copper provide design criteria and preliminary designs to demonstrate 100% draindown storage capacity at all times of the project life. This capacity should include the ability to handle extreme precipitation events. DIAND believes that 100% draindown storage capacity at all times of the project life, including the ability to handle extreme precipitation events, will mitigate the potential for significant environmental impacts from a loss of storage solutions in the event that the heap has to be drained down.

6. If Western Copper choses to proceed with a design criteria of less than 100% draindown storage capacity, then the risks of a loss of contaminated solution as a result of not having 100% draindown storage capacity should be shown to be equivalent to the risk of such a loss when 100% draindown storage is in place. In addition, the potential environmental impacts from a 100% draindown should be shown to be insignificant. Failure to demonstrate this will result in a Environmental Assessment and Review Process Guidelines Order determination that the potential adverse environmental effects from this component of the project are either unknown, significant or unacceptable.

7. If Western Copper choses to proceed with a design criteria of less than 100% draindown storage capacity, then the following points should be considered in the supporting analysis. There may be other issues which need to be considered as well, and it is Western Copper's responsibility as the project proponent to identify them and provide the appropriate analysis.

   - An evaluation of the water balance model and assessment of the confidence in the input parameters (hydrology, flowrates, ore moisture contents).
   - Consideration of the temporary storage of make-up water;
   - Likelihood of extreme hydrological events occurring and implications to solution management.
   - List and discuss likelihood of events that would lead to primary solution management system failure.
   - Evaluate the time required to bring backup systems online and the risk that primary system failure would affect backup systems.
   - Evaluate the time required to repair various problems to primary system that may occur singly or together.
   - List and discuss likelihood of events that would lead to backup system failure.
   - Evaluate the likelihood of overtopping of available storage.
   - Discuss what contingency measures would be taken if overtopping was imminent.
   - Complete an evaluation of the environmental impacts from system

solution loss.

The discussion should include:

- A full description of operational redundancies built into the systems.
- How operational changes to the project (ie. flowrate adjustments) might affect the water balance.
- Monitoring and how additional hydrological data gathered with time will be incorporated into the solution management plan.
- How some of the operational inputs (ie. ore moisture content) will be verified during operations.
- Provide justification for inputs into the environmental impact assessment (ie. leach solution chemistry and quantities).
- Extend the complete risk assessment analysis to include the detoxification stage of the operation.
- Explain how all the above factors justify providing reduced storage capacity from the original proposal.

Western Copper should consider the above points and provide a response in Addendum #4 regarding solution storage capacity for draindown from the heap leach pad. This information will be assessed to determine if the potential environmental impacts from this project component will be adequately mitigated.

Issue 2: Ore moisture

The run of mine ore moisture contents that were presented were quite different from those provided in previous submissions (initial moisture: 4%, leaching moisture: 25%, residual moisture: 16%). The difference between leaching and residual moisture content is a critical component in the water balance calculation and any small changes in this number has a very large impact on the amount of solution in the heap (Hugh Copland, Feb. 8/99; Yodit Johnson, Jun. 10/99).

RERC Recommendation

The RERC recommends that Western Copper review the ore moisture contents that have been presented previously and confirm the numbers. The results of testing or other information to support the ore moisture content projections should also be provided, as well as a statistical analysis of the data.

12.10 WASTE WATER MANAGEMENT PLANS

Problems have been identified with previous proposals of the water treatment system. For example, an issue was raised regarding the transfer of waste water from the events

pond to the waste rock sediment pond, and location and design criteria for a polishing pond. Clarification has also been requested of the design and operation criteria for the system.

RERC Recommendation

The RERC recommends that Western Copper provide in Addendum #4 a waste water treatment plan. This plan should include, but not be limited to the following:

1. Review of RERC comments;

2. Design criteria and preliminary design for the waste water treatment system; and

3. Operating criteria.

SECTION 13 - ABANDONMENT AND RECLAMATION

13.2.3 CONCEPTUAL CLOSURE MEASURES

Western Copper's conceptual abandonment and restoration plan for the spent ore in the heap is to rinse and neutralize the spent ore, cap the heap to minimize infiltration, and if necessary collect and treat any seepage from the heap until such time as the effluent quality is acceptable for discharge without treatment. Effluent treatment will involve collecting seepage, routing it to a treatment plant, pH adjustment and flocculation to generate a heavy metal sludge. The sludge will either be disposed off-site or on-site pending further assessment of the sludge characteristics.

Western Copper notes that: "While the long-term objective is to achieve "walk-away" closure condition, it is realized at this time that further testing and investigation would be required to demonstrate that "walk-away" closure can be achieved. At this time, therefore, an active care system must be proposed until further work can be completed.". Western Copper proposes to conduct studies during operations to determine the best way to rinse, neutralize and decommission the heap.

Information provided by Western Copper of the testing of the spent ore indicates that it could be on the order of decades after the mine has been closed, before the leachate from the spent ore is of acceptable quality to be discharged to the environment without treatment. While covering the heap will reduce infiltration, there will always be some infiltration through the spent ore, and this infiltration will be contaminated and will require treatment before discharge. Furthermore all the components of the heap such as the diversion dikes, embankment, solution collection system, foundation drainage system, spillway, liner system, and the effluent treatment system will have to be monitored and maintained until it can be demonstrated that the facility can be left as is, where is, and the company can 'walk away'. It is not clear if the structures as designed will last for the period of time it may take before the site can be abandoned.

There are potential environmental impacts from having to maintain a heap leach pad and associated structures in 'active care' mode for an unknown but potentially long period of time. Structures degrade and fail over time. The impacts from small spills and leaks magnify over time as the loading of contaminants to the environment increases. Companies may change ownership, or close and default on their obligations and government ends up assuming responsibility for reclaiming a site. The potential for major storms, earthquakes, floods, or other such abnormal events increases with time, and these major events may cause structures to fail. The information provided by Western Copper has not adequately demonstrated that the potential environmental impacts from an 'active care' abandonment scenario are adequately mitigated.

Other issues were raised regarding the conceptual abandonment and restoration plan. Testing indicated the potential for ore degradation and precipitate formation. This may

result in problems such as blockage of solution collection pipes, development of low permeability areas in the heap and the subsequent impounding of waters in the heap which the heap is not designed for.

While the effluent treatment system at abandonment calls for a collection pond, no further information was provided such as it's location or design criteria. It is not clear for example, how the collection pond will fit in with the gravity drainage pipeline, effluent treatment plant and events pond. It is not clear if sizing of the collection pond will be sufficient to handle peak expected flows.

It is proposed to operate the water treatment plant remotely from Carmacks. Questions were raised whether this was appropriate considering the potential for upsets and the discharge of contaminated solution to the downstream environment before personnel could mobilize to the mine site.

It was also noted that little detail was provided in the Conceptual Closure and Reclamation Plan regarding actions to be done during suspended operations.

RERC Recommendation

DIAND recommends that Western Copper Holdings Limited identify a method for detoxifying the spent ore and leachate from the heap, such that it can be left in a 'walk away' situation. The method of detoxification should be supported by data and modelling from testwork, and a discussion of how long it will take to detoxify the heap.

DIAND advises Western Copper Holdings Limited that its' proposal to conduct further detoxification study during operations and have a fall back of 'active care' has many risks and unknowns, and it will be a difficult task for Western Copper Holdings Limited to demonstrate that the potentially adverse impacts from this proposal are insignificant or mitigable with known technology. If Western Copper Holdings Limited wishes to pursue this concept, then Western Copper Holdings Limited will need to support it with a rigorous and thorough discussion of the potential environmental effects, mitigation and residual effects, as well as any risks and uncertainties associated with the 'active care' scenario.

The RERC recommends that Western Copper prepare a revised conceptual abandonment and restoration plan and submit it as part of Addendum #4. This Plan should include but not be limited to the following considerations:

1. A review of RERC comments submitted on Abandonment and Restoration;

2. Discussion of methods of testing done on the spent ore;

3. Presentation of all data generated from the tests;

4. Interpretation of test results, geochemical modelling, and discussion of the feasibility of detoxification of the spent ore, including an estimation of how long it will take to detoxify the heap and implications of precipitate formation and ore decrepitation.

5. Details of leaching, rinsing and detoxification procedures including volumes, scheduling, duration, and factors which determine when rinsing and detoxfication will cease.

6. Design criteria and preliminary design for the closure treatment system.

7. Discharge effluent quality which will protect the aquatic resources of the receiving environment, and sludge disposal.

8. Covering, contouring and revegetation plans, including an assessment of the potential for gully erosion of the low permeable cover on slopes, and how this will be mitigated.

9. Response plans to spills and treatment upsets.

10. A discussion of the risks and uncertainties associated with the conceptual plan, including a technical evaluation of the conservativeness of the design criteria, a technical evaluation of the operational life of the structures that will be required, a detailed evaluation of possible failure modes, contingencies that will be in place, and a evaluation of any risks or uncertainties.

11. A discussion of how the conservativeness of the design for structures to remain operational during abandonment, (i.e.events and sediment ponds, water conveyance structures, etc.) takes into consideration, among other things, the longest period of time that these facilities may need to be operational, the remoteness of the site, lack of onsite personnel after mineral recovery stops, and the potential environmental impacts if these structures were to fail.

12. Sizing of all water retaining and conveying structures, the conservativeness of which considers the risks and implications of failures, remoteness of the site, operational life of the structures and other factors which influence the design criteria for these structures.

13. A discussion of how the company will ensure that sufficient security will be in place at all times during operation and abandonment so that there will be sufficient funds available to complete any studies, stabilize the site, cover the costs for consultants and contractors, and conduct complete abandonment and

reclamation in the event that the company defaults on it's obligations.

14. Description of ongoing or planned studies, objectives, scheduling, how the results of studies will be incorporated into the Plan, and reporting back to regulatory agencies.

15. Temporary closure plan including the duration of temporary closure before it is considered to be permanent and final reclamation measures are to be implemented.

16. Conceptual monitoring and maintenance plan.

SECTION 15 - MONITORING PROGRAMS

15.4 OPERATIONAL MONITORING PROGRAMS

The RERC has identified concerns with the groundwater monitoring program and triggers and action plans to be implemented in the event that monitoring indicates that the groundwater is being contaminated. Monitoring locations, frequencies and triggers and action plans are dependant upon accurate hydrogeological modelling. Issues and recommendations have been presented earlier in this report regarding hydrogeological conditions and modelling.

RERC Recommendation

The RERC recommends that in Addendum #4 Western Copper submit a revised operational monitoring program. Western Copper should review RERC comments regarding previous monitoring proposals, triggers and action plans. An updated and revised hydrogeological model should be considered when revising the operational monitoring program. Triggers and action plans should be developed in consideration of baseline water quality, and protection of aquatic and terrestrial life. This plan should identify what constitutes an acceptable leakage rate, and a rationale to support the rate that considers expected leakage rates, permeability of underlying materials, and proximity to groundwater among other factors.

APPENDIX 1 - CORRESPONDENCE LIST

Mar. 26/99 **Review of Western Copper Holdings Ltd., Carmacks Copper Project Design Criteria and Parameters Report**, Yodit Johnson, Water Resources Division, DIAND.

Feb. 23/99 **Western Copper Holdings Limited - Carmacks Copper Project - Status of Review and Revised Abandonment and Restoration Plan**, Ian Church, Environment Directorate, DIAND.

Feb. 15/99 **Review of Design Criteria and Parameters Report by Sitka Corp**., Les Sawatsky, Golder Associates Ltd.

Feb. 11/99 **Review of Design Criteria and Parameters Report**, Milos Stepanek, Geo-engineering (M.S.T.) Ltd.

Feb. 10/99 **Kevin McDonnell's comments on Western Copper's Design Criteria Report**, Kevin McDonnell, Environment Directorate, DIAND.

Feb. 8/99 **Western Copper Design Criteria Report and Heap Leach Facility Water Balance Reports**, Hugh Copland, Minerals Division, DIAND.

Jan. 19/99 **Western Copper Design Criteria and Water Balance**, Benoit Godin, Environmental Protection, Environment Canada.

Dec. 24/98 No subject header, but responding to Dec. 4/98 letter from Dale Corman, Terry Sewell, DIAND.

Dec. 4/98 **Western Copper Holdings Limited - Carmacks Copper Project - Project Design Criteria**, F. Dale Corman, Western Copper Holdings Limited.

Dec. 4/98 **Western Copper Holdings Limited - Heap Leach Facility Water Balance - Design Memorandum CCL-CC4,** Clearwater Consultants

Nov. 27/98 **Carmacks Copper Design Criteria and Parameters Report**, Hugh Copland, Mineral Resources Division, DIAND.

Oct. 9/98 **Design Criteria and Parameters (W37.1)**, Sitka Corp.

Sept. 29/98 No subject header, but regarding roadwork and archaeological assessment, Dale Corman, Western Copper Holdings Limited.

Sept. 9/98 RERC Meeting.

Sept. 8/98 **New Access Road To Carmacks Copper Project - Heritage Resource**

Concerns, Ruth Gotthardt, Heritage Branch, Government of Yukon.

Sept. 7/98 **Western Copper Holdings Limited - Carmacks Copper Project - Project Update**, Dale Corman, Western Copper Holdings Limited.

Jul. 27/98 RERC site visit to Carmacks Copper Project site.

Jul 27/98 **Western Copper/Carmacks Copper Project**, Ruth Gotthardt, Heritage Branch, Government of Yukon.

Jun. 9/98 **Revised Site Hydrology - Williams Creek Project**, Bill Slater, Water Resources Division, DIAND.

Jun. 2/98 **Western Copper Holdings Limited - Carmacks Copper Project - Revised Site Hydrology**, J.R. Janowicz, Water Resources Division, DIAND.

May 19/98 **Western Copper Holdings Limited, Carmacks Copper Project, EBA Geotechnical Test Results and Geotechnical Investigation Summary**, Dan Cornett, Access Mining Consultants Ltd., with attachments:

- **Western Copper Holdings Limited Carmacks Copper Project Summary of Geotechnical Site Investigations - Heap Leach Pad**, Knight Piesold Ltd.; and
- **Submission of Testpit & Laboratory Test Results - Heap Leach Pad Area Carmacks Copper Project - NW of Carmacks, Yukon**.

May 11/98 **Western Copper Holdings Limited - Carmacks Copper Project - Geotechnical Review of Updated Design and Response Strategy For Addendum #4**, Dan Cornett, Access Mining Consultants Ltd., with attachment:

- **Carmacks Copper Project Geotechnical Review of Updated Design and Response Strategy for Addendum #4**, Knight Piesold Ltd.

May, ?/98 *Preliminary Review - Addendum #4, Water Balance Issues*

Apr. 28/98 **Western Copper Holdings Ltd. - Carmacks Copper Project - Revised Site Hydrology**, Dan Cornett, Access Mining Consultants Ltd., with attachment

- **Carmacks Copper Project - Revisions to Site Hydrology - Response to RERC Design Memorandum CCL-CC2A**, Peter S. McCreath, Clearwater Consultants Ltd.

Apr. 20/98 **Western Copper - Hydrology Report, Clearwater Consultants**, Bill Slater,

Water Resources Division, DIAND, with attachment:

- **Western Copper Holdings Limited - Carmacks Copper Project - Site Hydrology Revisions**, J.R. Janowicz, Water Resources Division, DIAND.

Apr. 4/98 **Review of "Carmacks Copper Project - Site Hydrology" by Clearwater Consultants, dated March 12, 1998**, Les Sawatsky, AGRA Earth and Environmental.

Mar. 13/98 **Western Copper Holdings Limited - Carmacks Copper Project - Site Hydrology Revisions - Draft Design Memorandum CCL-CC2 Clearwater Consultants**, Dan Cornett, Access Mining Consultants Ltd., with attachment:

- **Carmacks Copper Project - Site Hydrology Revisions, Draft Design Memorandum CCL-CC2**, Peter S. McCreath, Clearwater Consultants Ltd.

Feb. 17/98 RERC Meeting with attachment:

- **Carmacks Copper - Spent Ore Leaching Test**, Benoit Godin, Environmental Protection, Environment Canada.

Feb. 3/98 **Carmacks Copper Project Draft Table of Contents - Addendum #4**, Dan Cornett, Access Mining Consultants Ltd.

Dec. 23/97 Meeting between DIAND officials and Western Copper and Access Mining Consultants.

Dec. 9/97 **Western Copper Holdings Ltd. - Carmacks Copper Project**, Terry Sewell, DIAND.

Dec. 4/97 **Carmacks Copper Project - Addendum #4**, Kirstie Simpson, Environment Directorate, DIAND.

Nov. 28/97 **Western Copper Holdings Limited ("Western Copper") - Carmacks Copper Project - Status of Project Screening**, Dale Corman, Western Copper Holdings Limited.

Nov. 14/97 RERC Meeting.

Oct. 6/97 **Carmacks Copper Project - Closure**, Benoit Godin, Environmental Protection, Environment Canada.

Oct. 2/97 RERC Meeting.

Sept. 30/97 **Western Copper Holdings Limited - Carmacks Copper Project**, Russel Blackjack/Eddie Skookum, Little Salmon/Carmacks First Nations.

Sept. 29/97 **Western Copper Holdings Limited ("Western Copper") - Carmacks Copper Project - Project Screening**, Dale Corman, Western Copper Holdings Limited.

Sept. 155/97 No subject header, but regarding outstanding issues and next steps, Marg Crombie, Environment Directorate, DIAND.

Aug. 31/97 **Independent Water Balance Analysis Carmacks Copper Project Western Copper Holdings**, Les Sawatsky, AGRA Earth & Environmental.

Aug. 28/97 **Review of Documents Prepared for by Western Copper Holdings Limited in Support of Addendum No. 4 - Carmacks Copper Project**, Gary Beckstead, AGRA Earth & Environmental with attachment:

- **Review of Documents Prepared for by Western Copper Holdings Limited in Support of Addendum No. 4 - Carmacks Copper Project**, Les Sawatsky, AGRA Earth & Environmental.

Aug. 27/97 **Concerns of LS/CFN, in regards to Western Copper**, Russel Blackjack/Eddie Skookum, Little Salmon/Carmacks First Nations.

Aug. 11/97 **Western Copper, Pre-addendum #4 documents**, Benoit Godin, Environmental Protection, Environment Canada.

Aug. 11/97 **Review of Additional Documents Carmacks Copper Project Western Copper Holdings Limited**, Paul Kaplan, AGRA Earth & Environmental.

Aug. 8/97 **Summary of Renewable Resources requests for mitigation**, Scott Herron, Renewable Resources, Government of Yukon

Aug. 8/97 **Western Copper, Carmacks Copper Project - Conceptual Closure and Reclamation Plan**, Scott Herron, Renewable Resources, Government of Yukon.

Aug. 8/97 **Review of Western Copper Submissions**, Bill Slater, Water Resources Division, DIAND.

Aug. 7/97 **Western Copper Report Review**, Hugh Copland, Mineral Resources Division, DIAND

Aug. 1/97 **Western Copper - Updated Heap Leach Pad Design**, Bill Slater, Water

Resources Division, DIAND.

Aug. 1/97 **Carmacks Copper Project**, Ruth Gotthardt, Heritage Branch, Government of Yukon.

July 18/97 **Review of Addendums To Carmacks Copper Project (3 Latest Reports)**, Diane Brent, Department of Economic Development, Government of Yukon.

Jul. 18/97 **Western Copper Holdings Limited ("Western") - Carmacks Copper Project - Conceptual Closure and Reclamation Plan, dated June 30, 1997**, Dan Cornett, Access Mining Consultants Ltd.

Jul. 11/97 RERC Site Visit.

Jul. 9/97 **Carmacks Copper Project**, Milos Stepanek, Geo-engineering (M.S.T.) Ltd.

Jul. 8/97 **Overview Assessment of Phase III Documentation Submitted by Western Copper Holdings Limited for Carmacks Copper Project**, Les Sawatsky, AGRA Earth & Environmental Ltd.

Jul. 4/97 **Carmacks Copper Project**, Dan Cornett, Access Mining Consultants Ltd. with attachments:

- **Technical Issues Response Document**, June 30, 1997, Western Copper Holdings Limited;
- **Waste Rock Storage Area Evaluation and Detailed Design Report**, June 30, 1997, Western Copper Holdings Limited; and
- **Conceptual Closure and Reclamation Plan**, June 30, 1997, Western Copper Holdings Limited.

Jun. 11/97 **Western Copper - Review of Reports: Evaluation of Mineralogy of a Sample of Carmacks Acid Leach Residue; Pilot Scale Column Testing of the Williams Creek Oxide Deposit; 1996 Geotechnical and Hysrogeological site Investigations (1784/1); Updated Detailed Design of the Heap Leach Pad and Events Pond (1785/1)**, Hugh Copland, Mineral Resources Division, DIAND.

Jul. 2/97 **Western Copper Holdings Ltd. Carmacks Copper Project**, Eddie Skookum, Little Salmon Carmacks First Nations.

Jun. 6/97 **Issue/Action Summary**, Bill Slater, Water Resources Division, DIAND.

Jun. 3/97 **Western Copper (Issue/Action Summary) - Comments**, Benoit Godin, Environmental Protection, Environment Canada.

May 30/97 **Western Copper Issue/Action Summary (dated 05/08/97)**, Hugh Copland, Mineral Resources Division, DIAND.

May 28/97 RERC Meeting.

May 21/97 **Western Copper Holdings Limited - Carmacks Copper Project - Issue/Action Summary**, Marg Crombie, Environment Directorate, DIAND.

May 13/97 **Western Copper Holdings Limited - Carmacks Copper Project - Issue/Action Summary**, Dale Corman, Western Copper Holdings Limited.

May 8/97 **Carmacks Copper Project**, Gregg Jilson, Access Mining Consultants Ltd. with attachment:

- **Report on Updated Detailed Design of the Heap Leach Pad and Events Pond (Ref. No. 785/1)**, Knight Piesold Ltd.

May 7/97 **Carmacks Copper Project**, Gregg Jilson, Access Mining Consultants Limited with attachment:

- **1996 Geotechnical and Hydrogeological Site Investigations, Report 1784/1,** Knight Piesold;
- **Report on Evaluation of Mineralogy of a Sample of Carmacks Acid Leach Residue**, Dr. R. Lawrence;
- **Report on Pilot Scale Column Testing of the Williams Creek Oxide Deposit**, Dr. M. Beattie.

Apr. 28/97 **Western Copper Holdings Limted - Carmacks Copper Project - Issue/Action Summary**, Dan Cornett, Access Mining Consultants Ltd. with attachment:

- **Western Copper Holdings Limited Carmacks Copper Project Issue/Action Summary, Draft for Review and Discussion Only**.

Mar. 4/97 **Revised Heap Leach Pad Liner Design**, Marg Crombie, Environment Directorate, DIAND.

Feb. 19/97 RERC Technical Sub-group meeting summary minutes.

Feb. 13/97 **February 6, 1997 - Western Copper Letter**, Kelvin Leary, Renewable Resources, Government of Yukon.

Feb. 6/97 **Western Copper Holdings Limited - Carmacks Copper Project - Revised Heap Leach Pad Liner Design**, Dale Corman, Western Copper Holdings Limited with attachement:

- **Carmacks Copper Project Heap Leach Pad Updated Design Criteria**, B. Borntraeger, B.S. Brown, Knight Piesold Ltd.

Nov. 4/96 **Key Points from Meeting - Western Copper and Detoxification of Heap**, Kevin McDonnell, Environment Directorate, DIAND.

Oct. 31/96 **Carmack Copper**, Tony Wachmann, Kilborn Engineering Pacific Ltd. with attachment:

- **Conceptual Heap Leach Pad Closure and Reclamation Plan**.

Feb. 6/96 **Carmacks Copper Pilot Plant Testing**, Hugh Copland, Mineral Resources Division, DIAND.

Dec. 13/96 **Review of Western Copper Proposal Permafrost Aspects**, C.R. Burn

Oct. 28/96 **Mine Reclamation**, Kevin McDonnell, Environment Directorate, DIAND with attachment:

- **Brodie Report - Initial Review Western Copper - Carmacks Copper Project - Mine Reclamation Plan**, Dan Cornett, Water Resources Division, DIAND with attachment:

- **Initial Review Western Copper - Carmacks Copper Project Mine Reclamation Plan**, M.J. Brodie

Oct. 15/96 **Draft #2, Addendum #4, Western Copper**, Kevin Mcdonnell, Environment Directorate, DIAND.

Oct. 10/96 **Carmack Copper**, Tony Wachmann, Kilborn Engineering Pacific Ltd. with attachment:

- **Heap Leach Pad Confining Embankment Storage Volume to EL. 799m by DTM & VAD**.

Oct. 9/96 **LDRS Discussion Paper and Fisheries Resources**, Gail Faulkner, Habitat & Enhancement Branch, Department of Fisheries and Oceans

Oct. 8/96 **Carmacks copper Project IEE Addendum #4 2nd Draft**, Tony Wachmann, Kilborn Engineering Pacific Ltd.

Oct. 4/96 **Western Copper Addendum #4**, Bill Slater, Water Resources Division, DIAND

Sept. 27/96 Untitled, notes on conceptual Abandonment and restoration, Kevin McDonnell, Environment Directorate, DIAND.

Sept. 26/96 Records of Discussion: Michael Li, Erik Olin, Kevin McDonnell, Environment Directorate, DIAND.

Sept. 20/96 **Preliminary Review - Addendum #4, Water Balance Issues**, Bill Slater, Water Resources Division, DIAND.

Sept. 13/96 **Preliminary Review - Addendum #4**, Kevin McDonnell, Environment Directorate, DIAND.

Aug. 14/96 **Report on Detailed Design (Ref. No. 1784/2**), Knight Piesold Consulting Engineers.

Aug. 7/96 **Western Copper Holdings Limited - Carmacks Copper Project, Yukon Addendum No. 4 to the Initial Environmental Evaluation (IEE)**, Dale Corman, Western Copper Holdings Limited.

Jun. 7/96 **Report on 1996 Geotechnical and Hydrogeological Site Investigations (Ref. No. 1784/1)**, Knight Piesold Consulting Engineers

May 10/96 **Bill Slater, Water Resources Division's Comments on Action Plan**, Kevin McDonnell, Environment Directorate, DIAND with attachment:

- **Water Resources Division's Comments on Action Plan**, Bill Slater, Water Resources Division, DIAND.

May 10/96 **Response/Proposed Action Plan**, Marg Crombie, Environment Directorate, DIAND, with attachment:

- **Action Plan and Schedule**.

Apr. 23/96 **Report On Updated Design of the Heap Leach Pad and Events Pond, (Ref. No. 1785/1**), Knight Piesold Consulting Engineers

Mar 11/96 **Request For Timelines**, Kevin McDonnell, Environment Directorate, DIAND, with attachment:

- **Timelines**

Feb. 22/96 **Follow-up to February 13 and 14 Meetings**, Marg Crombie, Environment Directorate, DIAND.

Feb. 7/96 **IEE Addendum #3 and EARP Review**, Marg Crombie, Environment Directorate, DIAND with attachment:

- **List of Issues**.

Jan 17/96 **Draft Study Plan Outline**, Kevin McDonnell, Environment Directorate, DIAND with attachment:

- **Study Plan Outline**.

Dec. 19/95 **Addendum No. 3 Review of Specific Components of Western Copper Holdings Limited's Carmacks Copper Project Near Williams Creek**, Les Sawatsky, AGRA Earth & Environmental.

Dec. 18/95 **Carmacks Copper Project Review of Geotechnical Aspects of IEE Addendum No. 3,** Milos Stepanek, Geo-Engineering (MST) Ltd.

Dec. 14/95 **Western Copper Addendum No. 3**, Hugh Copland, Mineral Resources Division, DIAND.

Dec. 14/95 **Carmacks Copper Addendum #3 - Comments**, Benoit Godin, Environmental Protection, Environment Canada.

Dec. 7/95 **Carmacks Copper Project: Status of Review and Additional Concerns**, Marg Crombie, Environment Directorate, DIAND.

Dec. 7/95 **Western Copper IEE Addendum #3**, Kelvin Leary, Renewable Resources, Government of Yukon.

Dec. 4/95 **Review of Specific Components of Western Copper Holdings Limited's Carmack Copper Project near Williams Creek**, Les Sawatsky, AGRA Earth & Environmental.

Nov. 29/95 **Carmacks Copper - ABA and Ammonia Analysis**, Benoit Godin, Environmental Protection, Environment Canada.

Nov. 8/95 Addendum No. 3, Updated Spill Contingency and Emergency Response Plan, Reclamation and Closure Plans and responses to comments on Addendum No. 2 submitted by Western Copper Holdings Limited.

Oct. 24/95 **September 19, 1995 letter and Resolutions from September 29 Meeting**, Marg Crombie, Environment Directorate, DIAND

Oct. 17/95 **Section 7 - Revised Conceptual Reclamation and Closure Plan**, Western Copper Holdings Limited.

Oct. 12/95 **Follow-up to September 29 Meeting**, Marg Crombie, Environment Directorate, DIAND, with attachment:

- **Resolutions from Meeting**

Sept. 29/95 RERC technical sub-group meeting with Western Copper Holdings Limited.

Sept. 19/95 **Report on Outstanding Issues**, Marg Crombie, Environment Directorate, DIAND, Marg Crombie, Environment Directorate, DIAND with attachment:

- **Issues and Responses**

Sept. 15/95 **Carmacks Copper Project Addendum**, Hallam Knight Piesold Ltd.

Aug. 29/95 **Scope of Work Outline**, Knight Piesold Ltd.

Aug. 14/95 **Response To Concerns of DIAND's heap leach consultant in relation to IEE Addendum**, Hallam Knight Piesold Ltd.

Aug. 9/95 **Response to Comments by Agra Earth & Environmental Ltd. on Heap Leach Pad Design and GeoEngineering on Heap Leach Pad Design**, Knight Piesold Ltd.

Aug. 9/95 **Response to Geo-Engineering (MST) Ltd. Comments On The Carmacks Copper IEE**, Hallam Knight Piesold.

Aug. 8/95 Letter from Western Copper Holdings Limited regarding estimated haul quantities of materials that will be transported to and from the Carmacks Copper project during operations.

Aug. 8/95 Western Copper Holdings Limited submits partial response to DIAND's consultants reports.

Aug. 2/95 DIAND's Heap leach and geotechnical consultants reports sent to Western Copper Holdings Limited.

Jul. 21/95 Draft water licence application submitted to DIAND

Jul. 20/95 DIAND meeting with Western Copper.

Jun. 28/95	Revised Timelines, Chair, RERC.
Jun. 27/95	**Initial Environmental Evaluation Addendum**, Hallam Knight Piesold Ltd.
May 30/95	**Timing for EARP Review of Carmacks Copper Project**, Marg Crombie, Environment Directorate, DIAND.
May 8/95	**Initial Environmental Evaluation (IEE)**, Marg Crombie, Environment Directorate, DIAND.
May 1/95	**Report on Preliminary Design, Vol. I and II**, Knight Piesold Ltd.
Mar. 24/95	**Reclamation Schedule**, Western Copper Holdings Limited.
Mar. 2/95	DIAND and Western Copper Holdings Limited Meeting.
Feb. 23/95	**Leach Pad, Site Selection Criteria**, Ken McNaughton, Western Copper Holdings Limited.
Feb. 21/95	RERC technical sub-group and DIAND consultants meeting with Western Copper Holdings Ltd.
Feb. 14/95	**Additional Geotechnical Investigations**, Knight Piesold Ltd.
Feb. 8/95	Western Copper Holdings Limited submits letter report regarding feasibility of heap leach pad site.
Feb. 8/95	RERC meeting with Yukon Electric Co. Ltd. (YECL) and Western Copper Holdings Limited. YECL presentation of Initial Environmental Evaluation for transmission line.
Feb. 6/95	DIAND's heap leach consultant report sent to Western Copper Holdings Limited.
Jan. 12/95	**Carmacks Copper Addendum #3 - Erratum**, Benoit Godin, Environmental Protection, Environment Canada.
Jan. 12/95	**Western Copper Holdings - Carmacks Copper Project - IEE Addendum No. 3**, Dan Cornett, Water Resources Division, DIAND.
Jan. 9/95	DIAND's geotechnical consultant report sent to Western Copper Holdings Ltd.
Nov. 23/94	RERC meeting and submission of **Addendum to Volume I - Biophysical Assessment of the Williams Creek Mine Site**, Western Copper Holdings Limited.

Nov. 18/94	Letter from Environment Directorate to Public informing them of availability of IEE for review and comment.
Oct. /94	**Environmental Mitigation and Impact Assessment, Vol. IV**, Hallam Knight Piesold Ltd.
Oct. /94	Feasbility Study, Western Copper Holdings Limited.
Oct. 6/94	DIAND consultants site visit to Williams Creek property.
Jul. 19/94	RERC site visit to Williams Creek property.
Mar. 23/94	RERC meeting.
Feb. 7/94	**Review of Carmacks Copper Project Heap Leach Pad Site**, Hallam Knight Piesold Ltd.
Jan. '94	**Biophysical Assessment of the Williams Creek Mine Site**, **Vol. I**, P.a. Harder and Associates Ltd.
Jan. '94	**Community Profiles and Socio-Economic Assessment, Vol. II**, Hallam Knight Piesold Ltd.
Jan. '94	Archaeological Impact Assessment, Vol. III, Antiquus Archaeological Consultants Ltd., January 1994
Mar. 23/93	**Proposal for Funding to Operate A Solvent Extraction Pilot Plant for Williams Creek Oxide Ore**, Western Copper Holdings Limited.
Aug. 4/92	Letter from Environment Directorate, DIAND, regarding information deficiencies in pilot heap leach proposal and baseline study.
Jul. '92	**Initial Assessment of Aquatic Resources in Williams Creek**, P.A. Harder & Associates Ltd.
Jul. 10/92	RERC meeting, presentation of Heap Leach Pilot proposal.
Feb. 22/92	DIAND provided Western Copper with Information Guidelines.
Feb. 21/92	**Surface Waters Baseline Data Collection** Methods, J. Gibson, Gibson & Associates.
Aug. 29/91	Yukon Archaeologist submitted required Archaeological Baseline Studies.

Aug. 29/91	RERC tour of the Williams Creek property.
Aug. 22/91	RERC meeting. Initial presentation and submission of the project overview.
Aug. 14/91	Western Copper Holdings submitted Preliminary Report to RERC.
May 22/91	Initial submission prepared by Archer Cathro & Associates and Silver Standard Resources Inc. for Western Copper Holdings Ltd. and Thermal Exploration Company submitted to the Regional Environmental Review Committee.