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**PMMR  
RESOURCE QUANTITIES  
LYON CO. NEVADA**

PREPARED BY:  
Western Engineering & Surveying Services  
3032 Silver Sage Drive  
Carson City, Nevada

January 15, 2000

Bill Minor, Chief Operating Officer  
PMMR  
716 East Sunbury Street  
P.O. Box 239  
Millerstown, PA 17062

Re: Billy Boy and T&E claims Lyon Co. Nevada, Estimate of Resources

Dear Bill,

We are pleased to announce that we have completed work on your estimate of resources for the PMMR claims in Lyon County, Nevada. Total volumes equal 93,522,358 cubic yards.

As you know this has turned out to be a unique task. Both subcontractors remarked that this was by far the largest projects undertaken by their firms.

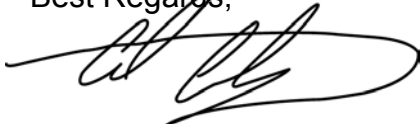
I have attached a copy NAM's S.O.Q. with the report. George Mortimer, owner of Earthwork Quantities unfortunately does not have a standard S.O.Q. As George says, since he is too busy to write one he obviously doesn't need one. We and many other firms in western Nevada can attest to the quality of his work. He is without a doubt the local authority in his field, even writing routines and consulting for the software manufacturer from time to time.

While setting control targets, Dave Winchell found original survey monumentation dating back to the mid 1800's which were set within six inches of their actual position. Quite a feat since all of these points were set by hand and not modern electronic methods. He is submitting this information to BLM for recordation (no charge). Apparently others have tried to locate these in the past to no avail due to the remote area and lack of control. He is persistent.

I have also sent along an article from CE News titled "Aerial Topographic Mapping" you might find this useful in your presentations.

As always, a pleasure working with both you and Joe. Please call if we can be of any further assistance.

Best Regards,



Chuck Armstrong  
Project Engineer

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**PREPARED FOR:  
Precious Minerals Mining and Refining Corporation  
148 Wellington Road South, London  
Ontario, Canada**

**PREPARED BY:  
Western Engineering & Surveying Services  
3032 Silver Sage Drive  
Carson City, Nevada**

## **Executive Summary**

Western Engineering and Surveying Services was contracted by Precious Minerals Mining and Refining Corporation (PMMR) to act as the prime consultants to determine ore quantities located under their Lyon County Nevada Claims. All claims are located with sections 20,21,29 & 23, township 7 north, range 27 east, M.D.B. & M.M.

As the quantity would play a key role in determining PMMR's worth, all work on this project was performed with the highest degree of accuracy attainable within the engineering and surveying fields today. Due to the extensive nature of the mapping and degree of accuracy demanded, this project has taken three months to complete.

We have sub contracted technical work to two independent firms in order to complete this project. North American Aerial Mapping's (NAM) Sparks, Nevada office to provide aerial photogrammetry mapping services. And, Earthwork Quantities of Reno, Nevada to provide computer aided volumetric iterations.

Our final calculations show that 938,522,358 cubic yards of ore lay beneath PMMR's 49 claims within the study site.

The following report provides a narrative of methods used in and the results of our analysis.

# INTRODUCTION

Estimation of earthwork quantities in the engineering and surveying field today, makes extensive use of field survey, aerial photogrammetry, coordinate geometry, computer aided drafting, and iterative mathematics. The following sections provide a brief description of each step in the process of determining earthwork quantities.

## Field Survey

Once a site has been identified the aerial mapping company is given a map of the general area identifying the site. The mapping company will provide surveyors with a map depicting locations along the project boundary and surrounding section corners which will require setting known points (targets). Targets are physically painted on the ground or marked with white nylon X's large enough to be identified by aircraft. Each target is then surveyed to establish its exact location, latitude and longitude.

This project required 12 targets to be set over an area of 3 square miles. Due to the rugged terrain and remoteness of the site, numerous trips to the project site over a one month period were required. Also, research of original survey records at the Bureau of Land Management Offices was required in order to establish known control points within the area.

## Aerial Photogrammetry

After targets have been set, the site is photographed from the air. A series of photographs called strip mosaic is taken. These photos are taken with an overlap of approximately 25%. This overlap will allow for the relief or topographic features to be plotted from the photographs.

Once developed, photos are used to create a topographic map employing stereoscopic and digital terrain modeling techniques. NAM technicians informed our office that this was the largest topographic map (digital file size) that they had produced in their company. This was due to the large area of mountainous terrain and high degree accuracy (2' contour interval) required. As a comparison, topographic maps created in mountainous areas with terrain similar to this site typically are produced with 40' contour intervals. Therefore, twenty times the normal amount of contour lines were required for this map.

Vertical accuracy of this map is accepted to be plus or minus one half contour interval (1'), meaning that for any contour on the map, 90% of true ground elevations will be within one foot of the given contour elevation. Horizontal accuracy is accepted as a plus or minus one quarter of a contour interval (6").

## **Coordinate Geometry**

Using coordinate geometry and CAD digitizing techniques, a map of recorded claims, provided by PMMR, is superimposed on the topographic map (attached).

Coordinate geometry refers to locating points on a drawing in the “real world”. Each point on a drawing is assigned a northing and an easting value. These values refer to distances north and east of a known location. In this way we have assured that the claims are laid on the map in correct positions. Once claims have been located on the topographical map, volumes can be calculated.

## **Volumetric Calculations**

Volumetric calculations have been preformed using an engineering program known as Earthworks. The program utilizes a “open end area method” to complete volumes. Basically, the method cuts two slices of an area to be excavated, finds their average area then multiplies this average by the distance between the two sections. Traditionally this method has been calculated by hand with accuracy limited only by the number of sections calculated, the more sections created, the greater the accuracy. Earthworks automatically calculates thousands of sections with minimal (6 inch) separation. Which in effect results in continuous sections, producing accuracy which is only limited by the topographic information provided.

Earthwork’s printouts typically come in the form of a colored map (attached). Various colors represent depths of cut or fill of a project. Each color is referenced by a scale bar to a corresponding depth. In this case all volumes are a cut.

## **Results**

Volumes of deposits under PMMR's Billy Boy and T&E claims have been calculated at 938,522,358 cubic yards. These calculations were made assuming that deposits extend a depth of 800 feet below a point located on Billy Boy Claim #56, with ground elevation of 5800 feet above mean sea level. The 5800' base elevation and 800 foot depth of deposit has been furnished by PMMR, based upon their prior test boreings in the area.

# **ATTACHMENTS**



## **DTM METHODOLOGY**

North American Mapping collected all Planimetric detail and a Digital Terrain Model (DTM) using standard methods of Photogrammetry on Zeiss P-3 First Order Analytical Stereoplotters. The DTM consisted of breaklines on all major topographic structures, and a random grid to create an accurate representation of the terrain for the P.M.M.R. project. The DTM was then used to interpolate a two-foot contour interval using Plus 3's TERRAMODEL surface modeling software. The contour and planimetric files were inserted into a master file and then edited for final map presentation.

North American Mapping (NAM), has been providing the finest in mapping services to Nevada and the Western United States since 1958. NAM has heavily invested in state of the art analytical Stereoplotters, digital computer systems, and aerial mapping camera systems to provide the ultimate in imagery and mapping products. NAM's staff has over 65 years of experience in the field of photogrammetry and offers the expertise and professionalism necessary to meet the rapidly changing technological requirements of the photogrammetric industry.

David W. Gray is the president of North American Mapping with over 20 years of experience working in every aspect of the field of Photogrammetry. David is an expert in Photogrammetric Project Planning, Flight Management, Aero-triangulation, Digital Mapping Techniques, and High Resolution Digital Imagery. He has been a Certified Photogrammetrist with the American Society of Photogrammetry and Remote Sensing, (ASPRS) since 1991. His expertise in the mapping process ranges from countrywide GIS Base Mapping Projects, to the high accuracy requirements of infrastructure and engineering mapping.

Teaming with David, is Steve Gullickson, our Southern Division Manager, and Jeff Crenshaw, our Northern Division Manager. Both have a combined total of 17 years of experience with NAM and are the backbone of project management and accuracy specifications. Steve and Jeff are experts in Digital Mapping Techniques and Quality Control Procedures. Both are members of ASPRS and currently have submitted their applications for Certified Photogrammetrist.

NAM has specialized in high accuracy detail oriented photogrammetric

mapping. With the purchase of a 1999 Carl Zeiss RMK-TOP 6" Aerial Camera System with Forward Motion Compensation and a Gyro Stabilized Mount, NAM has surpassed imagery and the ability to quickly and accurately locate an enormous amount of detailed features for infrastructure mapping. NAM has five Zeiss P-3 First Order Analytical Stereoplotters for superior optics and accuracy in digital mapping. NAM's digital mapping software is ideally suited to individually layer and classify utility and other infrastructure features for easy integration into GIS systems as well as precise output of AutoCAD or Microstation files on CD-ROM. Our Zeiss SCAI Precision Scanner is recognized for its outstanding seven micron resolution and dimensional stability in producing high resolution digital imagery and precise digital orthophotos.

North American Mapping is a precisely engineered organization which can expertly handle every detail of a mapping project with the most advanced equipment available in the photogrammetric industry, and a seasoned expert staff to ensure the optimum in quality, accuracy and client satisfaction.

