Technical Report for the Greens Creek Mine

Juneau, Alaska, USA

NI 43-101 Technical Report on Operations

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1.0 SUMMARY

Hecla Mining Company Limited (Hecla) has prepared a technical report (the Report) on the wholly-owned Greens Creek polymetallic mining operation (the Project) located on Admiralty Island in southeast Alaska, US for itself and Aurizon Mines Ltd. The Report will be used in connection with the preparation of the management information circular to be prepared by Aurizon Mines Ltd. in connection with its special meeting of shareholders to approved a proposed arrangement under the *Business Corporations Act* (British Columbia) with Aurizon Mines Ltd., and may be incorporated by reference in that management information circular.

1.1 Property Description and Location

The Greens Creek Mine is located in the southeastern part of Alaska on Admiralty Island, within the confines of Admiralty Island National Monument (Monument). The mine portal is at an elevation of 920 ft (280 m) above sea level.

Hecla holds a 100% interest in the Greens Creek polymetallic (Au, Ag Cu, Pb, Zn) mining operation through its indirectly-held subsidiaries Hecla Greens Creek Mining Company, Hecla Juneau Mining Company and Hecla Alaska LLC. In this section, the name Hecla is used interchangeably for the parent and subsidiary companies.

Mineral Tenure, Surface Rights, and Royalties

The land comprising the Greens Creek mine, inclusive of all Admiralty Island facilities, consists of both publicly and privately owned land. The Greens Creek Project includes 639 unpatented lode mining claims, 58 unpatented mill site claims, 17 patented lode claims, one patented millsite and other fee lands, notably the Hawk Inlet historic cannery site. There are approximately 9,500 acres (3,844 ha) of unpatented claims and 328 acres (133 ha) of patented claims.

Hecla also holds title to mineral rights on 7,301 acres (2,955 ha) of federal land acquired through a land exchange (the Land Exchange) with the United States Forestry Service (USFS).

Hecla leases parcels from the United States on both the Monument and non-monument lands. Hecla uses other public lands pursuant to special use permits issued by the USFS and leases issued by the State of Alaska. The land exchange confers restricted surface usage rights.

Bristol Bay Resources holds a 2.5% net smelter return (NSR) royalty based on its original 11.2142% interest in the Greens Creek Joint Venture.

The Land Exchange properties are subject to a royalty payable to the USFS that is calculated on the basis of net island receipts (NIR). Net island receipts are equal to revenues from metals extracted from the Land Exchange properties less transportation and treatment charges (e.g., smelting, refining, penalties, assaying) incurred after loading at Admiralty Island. The royalty is 3% of NIR if the average value of the ore during a year is greater than $120 per ton (1994 dollars; ($132/tonne)) of ore, and 0.75% if the value is $120 per ton ($132/tonne) or less. The benchmark of $120 per ton ($132/tonne) is escalated annually by the US gross domestic product until the year 2016, after which time it becomes a fixed rate.

In the opinion of the QPs, mining tenure held by Hecla in the areas for which Mineral Resources and Mineral Reserves are estimated is valid. Hecla holds sufficient surface rights to support mining operations over the underground planned life-of-mine that was developed based on the year-end 2012 Mineral Reserves. Hecla leases parcels from the United States on both the Monument and non-monument lands. Hecla uses other public lands pursuant to special use permits issued by the USFS and leases issued by the State of Alaska.

Environment, Permits, and Social License

The Greens Creek mine is currently regulated by approximately 60 separate permits and approvals issued by various Federal, State and Municipal agencies covering activities at and around the Greens Creek operation. The operation of the mine and associated facilities are authorized in part under a series of leases and other land use authorizations from the USFS and are carried out in accordance with the General Plan of Operations (GPO) approved by the USFS. Certain areas of the mine's operation are also subject to other Federal and State permits and approvals issued by other Federal and State agencies.

An extensive environmental monitoring system is in place and additional monitoring is proposed during mine closure activities. Compliance monitoring is undertaken to verify that the Project operates within permit limitations thereby minimizing impact to the environment during operations and post closure. Monitoring activities include surface, ground, process, and drinking water monitoring, geochemical characterization of tailings, waste rock, and construction rock, geotechnical monitoring of Site 23 and the tailings storage facility (TSF) Pond 7, and biological monitoring of activities during operations and closure.

Hecla has prepared a reclamation and closure plan to address interim, concurrent, final reclamation and post-mining land use of the Greens Creek mine. The reclamation and closure plan and closure cost estimates are submitted to the USFS, the Alaska Department of Natural Resources (ADNR) and the Alaska Department of Environmental Conservation (ADEC). The currently approved closure cost is $29 million, which is funded via sureties.

Hecla holds all required permits for mine operation. The permits are sufficient to ensure that mining activities are conducted within the regulatory framework required by Alaskan State and Federal regulations.

The mine currently holds the appropriate social licenses to operate. Hecla has developed a communities' relations plan to identify and ensure an understanding of the needs of the surrounding communities and to determine appropriate programs for filling those needs. The company monitors socio-economic trends, community perceptions and mining impacts.

The QPs consider that the permits held by Hecla for the Project are sufficient to ensure that mining activities are conducted within the regulatory framework required by Alaskan State and Federal regulations. Hecla has sufficiently addressed the environmental impact of the operation, and subsequent closure and remediation requirements that Mineral Resources and Mineral Reserves can be declared, and that the mine plan is appropriate and achievable. Closure provisions are appropriately considered. Monitoring programs are in place.

1.2 Accessibility, Climate, Local Resources, Infrastructure and Physiography

The mine and concentrator are accessible via passenger ferry originating from Auke Bay, Juneau, to Young Bay on Admiralty Island, and then by private road. A marine terminal is located on the island at Hawk Inlet for supplies and concentrates load-out. Seaplane service is available from the Juneau airport to Hawk Inlet.

The key Project infrastructure consists of the mine, a processing plant, tailings impoundment area, a ship-loading facility, camp facilities and a ferry dock.

Winters are moist, long, but only slightly cold; spring, summer, and fall are cool to mild. Snowfall occurs chiefly from November to March. Mining activity occurs year-round; however, exploration activities are typically conducted over five months, between May to October.

The ecology of Admiralty Island is dominated by temperate rainforest that is primarily made up of Sitka spruce, and western hemlock interspersed with small areas of muskeg.

In the opinion of the qualified persons (QPs), the existing infrastructure, availability of staff, the existing power, water, and communications facilities, the methods whereby goods are transported to the mine, and any planned modifications or supporting studies are sufficiently well-established, or the requirements to establish such, are well understood by Hecla, and can support the current mine plan.

The QPs consider that there is sufficient suitable land available within the mineral tenure held by Hecla for tailings disposal, mine waste disposal, and installations such as the process plant and related mine infrastructure. With the exception of a tailings storage facility expansion, all necessary infrastructure has been built on site and is sufficient for the projected life-of-mine (LOM).

1.3 History

The Greens Creek deposit was discovered by the Pan Sound Joint Venture in 1973. The original joint venture partners included Noranda Exploration, Marietta Resources International, Exhalas Resources Corporation, and Texas Gas Exploration. In 1978, following the involvement of the Bristol Bay Native Corporation, the Pan Sound Joint Venture was dissolved and replaced by the Greens Creek Joint Venture in which Bristol Bay Resources held an interest on behalf of the Native Corporation. Over subsequent years, the makeup of the joint venture partners in the Greens Creek Joint Venture changed, such that by 2008, the partners comprised Hecla, Kennecott Greens Creek Mining Company, and Kennecott Juneau Mining Company. In 2008, Hecla bought out the two Kennecott interests.

1.4 Geology and Mineralization

The Greens Creek deposit displays a range of syngenetic, diagenetic, and epigenetic features that are typical of volcanic-hosted massive sulfide deposits, sedimentary exhalative, and Mississippi Valley-type genetic models.

The Greens Creek polymetallic sulfide deposit occurs within the low-grade metamorphic core of the Admiralty subterrane. Regionally, the major rock types consist of predominantly marine sedimentary, and mafic to ultramafic volcanic and plutonic rocks, which have been subjected to multiple periods of deformation. These deformational episodes have imposed multiple folding of the deposit to create a complex zonal geometry of mineralized zones.

Mineralization occurs discontinuously along the contact between a structural hanging wall of quartz–mica–carbonate phyllites, and a structural footwall of graphitic and calcareous argillite. The sulfide mineralization at Greens Creek is divided into two general types, massive (mineralization in which sulfides exceed 50 volume percent) or white (mineralization in which sulfides are below 50 volume percent), which are further sub-divided into six and three sub-types, respectively.

Greens Creek mineralization is segregated into eight separate mineralized zones, the first seven of which are classed as orebodies with declared Mineral Reserves (East; West; 9A; Northwest West; Southwest; 200 South and associated sub-zones); and the Gallagher Zone, which has Mineral Resources estimated only. The boundaries between the various zones and mineralized areas are defined by faults, shear zones, or changes in the thickness of the mineralized horizon.

The complex structure present at Greens Creek has not allowed detailed metal zonation studies to be completed. In the Central West zone, the thickest orebody, a zonation pattern can be resolved that indicates the orebody has a copper-rich (0.7 to 4% Cu) center sitting on top of the footwall phyllites. Metal zonation continues outwards in order from Fe to Zn, then Zn + Pb, and finally polymetallic-Ag rich against the hanging-wall argillites. Similar zonation patterns have been mapped in the other ore zones, but are incomplete or locally can show contradictory relationships.

Major sulfide minerals are pyrite, sphalerite, galena, and tetrahedrite/tennanite.

A number of prospects have been discovered during ongoing surface and underground exploration efforts in the Greens Creek district and provide upside Project potential.

In the opinion of the QPs, the geological understanding of the settings, lithologies, structural and alteration controls on mineralization and mineralization continuity and geometry in the different zones is sufficient to support estimation of Mineral Resources and Mineral Reserves. The geological knowledge of the area is also considered sufficiently acceptable to reliably inform mine planning. The mineralization style and setting is well understood and can support declaration of Mineral Resources and Mineral Reserves. The QPs concur with the interpretation of a hybrid model style and consider the model and interpreted deposit genesis to be appropriate to support exploration activities.

1.5 Exploration

Work completed prior to Hecla's 100% interest in the project comprised surface reconnaissance exploration, geological and structural mapping, geochemical sampling, airborne, ground and down-hole geophysical surveys, surface and underground drilling, engineering studies and mine development. Mining operations ran from 1989 to 1993, when the mine was placed on care-and-maintenance due to low metal prices. In 1996, the mine re-opened, and has operated continuously since.

Under Hecla's ownership, work has included geological and structural mapping programs, geochemical sampling, ground and down-hole geophysical surveys, surface and underground drilling, engineering studies and mining activities.

The QPs are of the opinion that the exploration programs completed to date are appropriate to the style of the deposit and prospects. Additional exploration has a likelihood of generating further exploration successes particularly down-dip of known orebodies.

1.6 Drilling

A total of 5,541 drill holes (2,722,950 ft or 829,955 m) have been completed over the entire Project area in the period 1975 to 2012. Of these drill holes, 365 (403,279 ft or 122,919 m) are surface holes drilled for exploration or resource development purposes, 3,487 (1,967,811 ft or 599,789 m) are underground resource definition drill holes, which are typically drilled on 50 to 200 ft (15 to 60 m) spaced vertical sections, and 1,689 (351,860 ft or 107,247 m) are underground pre-production drill holes that are drilled on cross- and plan-sections spaced from 20 to 50 ft (15 to 60 m).

All bedrock drilling has been completed using core methods. Surface drill holes collared in unconsolidated sediments utilize reverse circulation (RC) methods until bedrock is encountered (typically less than 100 ft or 60 m), and are then completed using core methods.

Drill core for exploration, in-fill and definition purposes is NQ (1.87in, 47.6mm) in diameter. In some drill holes, the drill core diameter is reduced from HQ (2.50in, 63.5mm) to NQ to BQ (1.44in, 36.5mm) (telescoping) due to problematic ground conditions problems, typically as a result of faulting or ultramafic lithologies. Other hole diameters have been drilled, including NQ/NQTK (2.00in 50.8mm) and BQ/BQTK (1.61in, 40.9mm).

Drill holes are designed to intersect the mineralization as perpendicular as possible; reported mineralized intercepts are typically longer than the true thickness of the mineralization.

The current system of logging employed by Hecla has been used with minor modifications since 1987. Underground drill core is logged for recovery, rock quality description (RQD), lithology, alteration, mineralization, structure and fabric. Surface core is logged for recovery, lithology, alteration, mineralization, structure and fabric.

Core recovery is generally high because of the compact nature of the greenschist-facies metamorphic rocks. Approximately 80% of drilled intervals have core recovery greater than 95%. Poor recovery (less than 50%) occurs in approximately 2% of intervals. Poor recovery is generally localized to heavily faulted areas in the argillite.

The majority of the legacy underground drill collars were surveyed with conventional mine survey equipment by the mine staff. Surface drill collars are currently located using a Trimble Geo XH 600 handheld GPS. Underground drill hole collars are surveyed with conventional mine surveying equipment by Greens Creek staff. All collar locations are recorded in the database utilizing the mine grid coordinate system.

Prior to 1996, down-hole surveys were done by magnetic single-shot cameras, either Sperry-Sun or Well-Nav. Between 1996 and 2000 a combination of Sperry-Sun and

MAXIBOR instruments were used. Since 2008 all surface and underground drill holes have been surveyed using an EZ-Shot system.

A significant number of geotechnical and hydrological drill holes were completed in support of construction and operations of the Greens Creek surface facilities and in support of ongoing mining activity.

In the opinion of the QPs, the quantity and quality of the lithological, geotechnical, collar and down hole survey data collected in the exploration, delineation, underground, and grade control drill programs are sufficient to support the Mineral Resource and Mineral Reserve estimation.

1.7 Sampling and Analysis

Drill core is sampled as half-core by two methods which are dictated by the scope of the drilling. Exploration and definition drilling are sampled on intervals ranging from 1 to 5 ft (0.3–1.5 m) that do not cross lithological boundaries. Barren contacts are sampled through 15 ft (4.6 m) lengths into the hanging wall and footwall, whereas mineralized contacts are sampled through 15 ft (4.6 m) lengths into the hanging wall and 30 ft (9.2 m) lengths into the footwall. Narrower (one 2 ft (0.6 m) followed by one 3 ft (1 m)) sample intervals are placed immediately adjacent to lithological contacts with the thicker 5 ft (1.5 m) intervals filling out the rest of the sampled buffer. Mineralization occurring within veins or as remobilized bands away from contacts are sampled in 5 ft (1.5 m) intervals or less depending on the thickness of mineralization and enclosed by 5 ft (1.5 m) buffer samples. Pre-production and stope drill holes are typically sampled through the majority of the drill hole, with sample intervals ranging from 1 to 5 ft (0.3–1.5 m).

The procedure for measuring specific gravity (SG) of core at Greens Creek relies on the weight in water versus weight in air method. SG measurements are collected on all exploration or definition core that is a mineralized or ore-type lithology as well as the associated buffer samples.

A number of laboratories have been used during the mine and exploration life. These include Bondar Clegg Canada Ltd., Acme Analytical Laboratories Ltd. (Acme), SVL Analytical, McClelland Laboratories Inc, the mine site laboratory, Lakefield Research, Kennecott Utah Copper Labs, CESL, and SGS Canada Inc. Bondar Clegg Canada Ltd. (Bondar Clegg), now part of ALS Chemex Laboratories, obtained ISO 9001 certification in 1998; however its accreditation through the period of use at Greens Creek is not known. Acme was ISO 9001 certified in 1997 and has successfully maintained that certification through the present. SVL Laboratories accreditation through the period of use at Greens Creek is not known. McClelland Laboratories is a metallurgical laboratory with extensive experience in precious metals metallurgy and process, and a good reputation with the local mining industry; however, it is not a certified laboratory. The accreditation of metallurgical laboratories, Lakefield Research, and company laboratories, Kennecott Utah Copper Labs and CESL, are not known. SGS is an ISO 9001 certified laboratory. The Greens Creek mine site laboratory has participated in round robin programs to compare its results to other laboratories intermittently throughout its history, but it is not a certified laboratory.

Sample preparation and analytical methods have been consistent with the current methods. Methods prior to 1998 are not well documented and thus are not known. Where the documentation of the legacy sample preparation and analytical methodology is not complete, the legacy quality assurance data are more complete and consistent for the life of the Project.

From 2008 through late 2011 all drill core sample preparation was done at Acme locations in Whitehorse, Yukon or Vancouver, British Columbia. In late 2011 a sample preparation laboratory, purchased by Greens Creek but operated by Acme personnel, was established on the Greens Creek site. From late 2011 on, nearly all exploration and definition core samples were prepared for analysis at this facility onsite then shipped to the Acme facility in Vancouver for analysis.

The preparation procedure consists of crushing to 80 % passing 10 mesh, riffle splitting approximately 250 g, then ring pulverizing to 85 % passing 200 mesh. Of the pulverized material 115 to 120 g were sent for analysis, and the remaining 115 to 120 g were stored as a master pulp.

Currently, all mineralized definition and exploration drill core is assayed at Acme for Au, Ag, Pb, Zn, Cu, Fe, and Ba. All mineralized samples are also assayed for a 32 element inductively coupled plasma emission spectroscopy (ICP-ES) assay suite.

The standard assay package employed consists of fire assay for Au and Ag on a 30 g sample. Au is finished by atomic absorption spectroscopy (AA) while Ag is finished by ICP-ES. Gold and Ag are re-assayed by gravimetric finish if the initial fire assay results return values above the upper detection limits. Silver and base metal assays for Pb, Zn, Cu, and Fe are performed using ICP-ES on 1.0 g samples digested in hot aqua regia. Automatic re-analysis is triggered on a smaller sample size if results return above detection limits. Preparation for the 32 element suite involves a 0.25 g sample split digested in an aqua regia solution containing equal parts HCl, HNO_3, and de-ionized H_2O before analysis by ICP-ES.

Analysis for Ba requires that a 0.2 g sample be dissolved in a lithium borate fusion and acid digestion before being analyzed by ICP-ES.

From 2008 onward the onsite laboratory was used as the primary lab for pre-production and in-stope drill core as well as the umpire laboratory for definition and exploration drill core. The standard assay package employed consists of fire assay for Au and Ag and ICP-ES for Pb, Zn, Cu, and Fe.

Previous (pre-2008) operators have used a similar system to the current quality assurance/quality control (QA/QC) methodology. Legacy assaying protocols are typical of those employed in the mining industry and included submission of duplicates, standard reference materials and blanks. Most of the Greens Creek drill holes have been included in a check assay program where SVL Analytical, formerly Silver Valley Laboratories, of Kellogg, Idaho, is the umpire laboratory.

Standards used since 2008 have been sourced from underground bulk samples or drill core and prepared and certified by Hazen Research, Inc. of Golden, Colorado. Check assays (Hecla checks on Acme assays and vice versa) are selected by the project geologist at a rate of approximately one in every 10 to 15 Project samples. Current QA/QC submissions are typical of those employed in the mining industry and include submission of duplicates, standard reference materials and blanks.

The standard reference material inventory, coarse rejects, and returned pulps are secured and kept in locations with restricted access. The core is stored within the original boxes in a remote underground drift designated as a core archive.

Drill hole and production face-sampling data are captured in a structured query language (SQL) database at Greens Creek that utilizes acQuire® software. These data include drill hole collars, down-hole surveys, assays and geological descriptions. Standard database management techniques are utilized that limit access and user rights to ensure data integrity.

The QPs consider that sampling methods are acceptable, meet industry-standard practice, and are acceptable for Mineral Resource and Mineral Reserve estimation and mine planning purposes. The quality of the analytical data is reliable and sample preparation, analysis, and security are generally performed in accordance with exploration best practices and industry standards.

1.8 Data Verification

Regular data verification programs have been undertaken by third-party consultants from 1995 to date on the data collected from the Project.

The QPs consider that as a result of this work, the audit findings acceptably support the geological interpretations and the database quality, and therefore support the use of the data in Mineral Resource and Mineral Reserve estimation, and in mine planning.

1.9 Metallurgical Testwork

Extensive initial testwork programs were conducted at Noranda's Mattagami Lake and Mattabi laboratories in Ontario, Canada, and at Dawson Metallurgical Laboratory in Utah. Composites of various ore types were developed using drill core samples.

Results of these programs allowed the development of the basic Greens Creek lead–zinc flotation flowsheet, with inclusion of a gravity gold circuit. Primary grinding requirements for the white ore types and massive sulfide ore types were developed and use of stage addition for flotation reagents was established, along with collector and modifier recommendations. These programs demonstrated the desirability of a preliminary carbon removal flotation step and of rougher concentrates re-grinding prior to cleaner flotation.

Following mill start-up, a number of refinements have been made to the process and mill design, including construction of a new building primarily devoted to cleaner flotation circuits, a revised gravity circuit utilizing concentrating spirals, concentrate re-grinding and final tabling, and a review of grind sizes to determine if poor flotation recoveries could be addressed by changes to the grinding regime.

Metallurgical testing programs continue to be conducted as required to evaluate possible changes in feed types from new mining areas, proposed changes in processing to improve recoveries and/or concentrate grades and to investigate factors causing lower than desired recoveries and concentrate grades.

Ore blending at the mill stockpile is utilized to maintain reasonably consistent mill feed over periods of a few days.

A simplified net smelter return (NSR) equation was developed using multiple linear regression of data developed from optimized NSR modeling.

Flotation NSR = (0.385(Au oz/ton)*(Au $/oz))+(0.584*(Ag oz/ton)*(Ag $/oz))+(14.1*(%Pb)*(Pb $/lb))+(5.76*(%Zn)*(Zn $/lb))-(1.56*(%Fe))*

This equation only accounts for NSR from flotation. To obtain the NSR from gravity products, the amount of gold recovered in the gravity circuit was compared to the amount of gold in the feed over a 10-year period (January 2001 to December 2010) and a simple equation was built to calculate the amount of gold that will go to the gravity products from the grade of gold in the feed. The NSR for the gravity circuit is the product of the amount of gold in the gravity product, the price of gold, and the percentage of payout for gold in the gravity products.

Gravity NSR = (0.2488(Au oz/ton) - 0.0069)*(Au$/oz)*0.969*

Total NSR = (Flotation NSR) + (Gravity NSR)

The presence of the potentially deleterious elements arsenic, mercury and antimony was noted during initial testing. Over the course of production and marketing since, deleterious element limits set by customers include arsenic, mercury and antimony in lead concentrates; magnesium, arsenic and mercury in zinc concentrates and magnesium, arsenic and mercury in bulk concentrates. Penalties charges have been applied against some shipments from time to time, most commonly for arsenic and mercury content. Other potential deleterious elements have been identified in geological and concentrate analyses, including selenium, fluorine and thallium, but to date, have not been present in high enough concentrations to cause marketing issues.

In the opinion of the QPs, metallurgical testwork and associated analytical procedures were appropriate to the mineralization type, appropriate to establish the optimal processing routes, and were performed using samples that are typical of the mineralization styles found within the Project. Samples selected for testing were representative of the various types and styles of mineralization. Samples were selected from a range of depths within the deposit. Sufficient samples were taken so that tests were performed on sufficient sample mass. As mining progresses deeper and/or new mining zones are identified, additional variability tests are undertaken as required. Testwork results have been confirmed by production data, and since mill construction and start-up, numerous internal and external studies have been performed to investigate metallurgical issues and support mill modifications. Mill process recovery factors are based on production data, and are considered appropriate to support Mineral Resource and Mineral Reserve estimation, and mine planning. Ore hardness, reagent consumptions and process conditions are based on both testwork and production data. Recovery factors vary on a day to day basis depending on the zone, metal grade and mineralization type being processed. These variations are expected to trend to the forecast LOM recovery value for monthly or longer reporting periods.

1.10 Mineral Resource Estimate

Mineralization is segregated into ten unique model zones for both mine planning and resource modeling purposes. These zones are East, West, 9A, Northwest West, Northwest West-Upper, Southwest Bench, 200 South, Deep 200 South, 5250 and Gallagher.

Zones are interpreted by hand on section, then digitized. Shapes are generally drawn around units that are logged as massive or white ore and/or have significant base-metal mineralization. Lithological units such as phyllite and argillite are included in the mineralized shapes if they are mineralized near the contacts with the sulfide zones. For models where structural sub-domains have been used individual perimeters are coded by domain. For models with areas of high-grade metal values (metals zones), which are internal to the overall mineralization envelope, a series of coincident perimeters coded by metal zone are constructed. Thinner zones may be modeled using a two-pass methodology. The first model includes material inside the geologic perimeters or wireframe and the second or waste model is constructed around the mineralization model to address dilution that may be included during the stope designs.

Composite lengths vary from 5 to 12 ft (1.5 to 3.7 m) in length depending upon zone. Drill hole composites are length x density weighted. Grade capping is used to limit the spatial extrapolation of the occasional anomalous, but isolated, precious metal grades.

Three different styles of interpretation are currently in use at Greens Creek, 15 ft. (4.6 m) spaced plan perimeters or polylines, three-dimensional (3D) solid wireframes, or 10 ft (3 m) spaced vertical sections. Each leads to a slightly different style of block model. For stope design, the minimum selective mining unit (SMU) size is 10 ft x 10 ft x 15 ft (3 m x 3 m x 4.6 m) in x, y and z axes respectively. A 20 ft (6 m) model buffer is created around the core mineralized blocks in the instances where the thin, vein-like zones or benches envelope is commonly less than the SMU size.

Block models based on 15 ft (4.6 m) spaced plan perimeters use parent block sizes of 10 ft x 10 ft x 15 ft (3 m x 3 m x 4.6 m) but allow sub-blocking to 3.3 ft x 3.3 ft (1 m x 1 m) in the x and y directions. The buffer models utilize the same approach. Models that utilize this approach are the East, 9A, Northwest West, 200 South, and 5250. The West model also utilizes this approach but minimum sub-blocks are 2 ft x 10 ft x 15 ft (0.6 m x 3 m x 4.6 m).

Block models based on wireframes only use whole blocks (5 ft x 5 ft x 5 ft or 1.5 m x 1.5 m x 1.5 m) which are generated when block centroids lie inside the wireframe. After estimation, but prior to mineral resource tabulation or stope design, blocks (mineralized and buffer) are regularized back to 15 ft (4.6 m) high to meet the minimum mining height of the SMU. Models that utilize this approach are the Northwest West, Northwest West–Upper, Deep 200 South, and Gallagher Zones.

The Southwest Bench model is unique in that it utilizes 10 ft (3 m) spaced vertical section to control block generation. The model use a standard 10 ft x 10 ft x 15 ft (3 m x 3 m x 4.6 m) parent block, but sub-blocking to 5 ft (1.5 m) is allowed in the z direction to accurately account for the thickness of the sub-horizontal mineralized horizon. The buffer model is used to account for the remainder of the material necessary to expand the block back to standard mining heights.

After estimation block models with cells less than the SMU height of 15 ft (4.6 m) are regularized to a height of 15 ft (4.6 m). This process is used on the Northwest West–Upper Plate, Southwest Bench, Deep 200 South and Gallagher models.

Grades are estimated in the block model using the composited drill hole data sets. The variogram provides input to search orientations and anisotropy, and search distance is typically set at 90% of the second structure. Sample selection criteria vary between zones but are typically set as follows: minimum number of composites is five, maximum number 20, maximum number from a single drill hole is two or three, and for some zones an octant criterion is also used. The first estimation pass starts with the original search distance, and then if enough composites are not located, the distances are doubled, and finally if enough composites still cannot be found, the distances are tripled. If reliable variograms can be constructed, models are estimated using ordinary kriging (OK). If the data are too limited in number to construct reliable variograms, an inverse distance (ID) estimator is used.

Models are validated using visual inspection, a comparison of OK or ID and nearest neighbor (NN) distributions, and swath plots.

For Mineral Resource classification purposes, geological continuity is determined qualitatively by inspection of the mineralized envelopes in sections and plans. The general distinction between Inferred and Indicated Mineral Resource classification is whether the level of drilling has sufficient detail to discriminate large scale (>50 ft or >15 m) fold structures, and for major fault offsets (>50 ft or >15 m) to be traceable from section to section. A similar inspection of sections and plans of block grades as compared to nearby composites is used to determine grade continuity.

Large areas (>100 ft^2 or 9.3 m^2) of the block model of near-constant grade without supporting, tightly-spaced drill holes (<50 ft or <15 m) are interpreted as being overly smoothed and are assigned an Inferred classification. In areas that are sparsely drilled, which show localized zones of high-grade precious metals surrounded by lower-grade material in the block model, the high grade areas may be specifically classified as Inferred even though the surrounding area meets all other criteria for an Indicated classification.

Currently all underground Mineral Resources at Greens Creek are classified as Indicated or Inferred Mineral Resources. The Measured Mineral Resource category has only been applied to the surface mill stockpile as its volume and grade have been determined by metallurgical balance based on milling results.

Assessment of reasonable prospects of economic extraction is based on a consideration of three-year trailing average metal prices, set by Hecla corporate staff; consideration of a minimum NSR cut-off; assumptions that the mining method will be overhand cut-and-fill and the minimum mining height and width is 15 ft (4.6 m); blocks are included in a conceptual stope design; and an application of 4% overbreak dilution that is applied to blocks selected as being recoverable from all zones except the East Zone. The 4% dilution factor was not applied to the East zone due to on-going studies which are evaluating options of different mining techniques.

1.11 Mineral Resource Statement

Mineral Resources take into account geologic, mining, processing and economic constraints, and have been defined within a conceptual stope design, and therefore are classified in accordance with the 2005 and 2010 CIM Definition Standards for Mineral Resources and Mineral Reserves and the 2003 CIM Best Practice Guidelines.

The qualified person for the Mineral Resource estimate is Dr Dean McDonald, P.Geo., a Hecla employee. Mineral Resources are reported exclusive of Mineral Reserves, different effective dates, and are reported using variable NSR cut-offs by zone.

Hecla cautions that Mineral Resources that are not Mineral Reserves do not have demonstrated economic viability. Measured and Indicated Mineral Resources are reported in Table 1-1. Inferred Mineral Resources are summarized in Table 1-2.

Table 1-1: Measured and Indicated Mineral Resource Statement 2012

Mineral Resource Classification	Zone	Tons	Gold (Oz/ton)	Silver (Oz/ton)	Lead (%)	Zinc (%)	Gold (Ounces)	Silver (Ounces)	Lead (Tons)	Zinc (Tons)
Measured		—	—	—	—	—	—	—	—	—
Indicated	Gallagher	449,000	0.119	5.9	3.2	7.0	53,400	2,649,000	14,400	31,400
Total Measured and Indicated Mineral Resource		***449,000***	***0.119***	***5.9***	***3.2***	***7.0***	***53,400***	***2,649,000***	***14,400***	***31,400***

Table 1-2: Inferred Mineral Resource Statement

Mineral Resource Classification	Zone	Tons	Gold (Oz/ton)	Silver (Oz/ton)	Lead (%)	Zinc (%)	Gold (Ounces)	Silver (Ounces)	Lead (Tons)	Zinc (Tons)
Inferred	East	1,207,000	0.093	12.6	2.5	7.1	112,300	15,208,000	30,200	85,700
	Northwest West	427,000	0.014	7.1	1.5	3.6	6,000	3,032,000	6,400	15,400
	200S	2,030,000	0.122	11.8	2.5	6.1	247,700	23,954,000	50,800	123,800
	Gallagher	120,000	0.113	5.4	2.9	6.8	13,600	648,000	3,500	8,200
Total Inferred Mineral Resource		***3,784,000***	***0.100***	***11.3***	***2.4***	***6.2***	***379,600***	***42,842,000***	***90,900***	***233,100***

Note to Accompany Mineral Resource Tables

1. The Qualified Person for the Mineral Resource estimates is Dr Dean McDonald, P.Geo., a Hecla employee.
2. Mineral Resources are exclusive of Mineral Reserves and do not have demonstrated economic viability.
3. Mineral Resource block models have a number of database cut-off dates from 2008 to 2012. Metal pricing and NSR cut-off assumption supply dates also vary from 2008 to 2010.
4. Mineral resources have been factored for dilution associated with recovery by a conceptual stope design.
5. Mineral Resources are based on the following metal prices and cut-off assumptions: East Zone: $950/oz Au, $16/oz Ag, $0.80/lb Pb, $0.80/lb Zn, NSR cut-off of $150/t; Northwest West Zone: $650/oz Au, $12.50/oz Ag, $0.80/lb Pb, $0.80/lb Zn, NSR cut-off of $102/t; 200S Zone: $1,400/oz Au, $26.50/oz Ag, $0.85/lb Pb, $0.85/lb Zn, NSR cut-off of $190/t; and Gallagher Zone: $1400/oz Au, $26.50/oz Ag, $0.85/lb Pb, $0.85/lb Zn, NSR cut-off of $190/t.
6. Mineral Resources have the following effective dates: Northwest West, 31 December 2008; East, 31 December 2010; Gallagher and 200S, 31 December, 2012.
7. Reporting units are all US customary, Tons:dry short tons(dst); Au (troy ounces/dst); Ag (troy ounces/dst); Pb and Zn percent (%).

The QPs are of the opinion that Mineral Resources for the Project, which have been estimated using core drill data, appropriately consider relevant modifying factors, have been estimated using industry best practices, and conform to the requirements of CIM (2010).

Factors which may affect the Mineral Resource estimates include metal prices assumptions, changes to stope design parameters, changes to geotechnical and metallurgical recovery assumptions, changes to the assumptions used to generate the NSR cut-off, changes in interpretations of mineralization geometry and continuity of mineralization zones, and changes to the assumptions related to mineral tenure rights associated with the Gallagher zone.

1.12 Mineral Reserve Estimate

Mineral Reserves are estimated for mill stockpiles and the East, West, 9A, Northwest West, Southwest Bench, 200S and 5250 Zones. Underground Probable Mineral Reserves are estimated from Indicated Mineral Resources. Stockpile material at the mill is classified as Measured Mineral Resources and was converted to Proven Mineral Reserves.

Long-hole stoping is considered as the mining method when the mineral resource model shows an orebody with a vertical thickness of at least 35 ft (10.7 m) and strike lengths over 100 ft (30 m). If the orebody geometry or geotechnical constraints preclude the use of long-hole stoping, then overhand cut-and-fill is the mining method used. The cut-and-fill stopes are designed with minimum mining dimensions of 15 ft high by 15 ft wide (4.6 m x 4.6 m), which are the smallest dimensions that can effectively accommodate Hecla's current mining fleet at Greens Creek.

Hecla uses 100% mine recovery for scheduling the life-of-mine Mineral Reserves. A universal dilution factor of 4% is assumed from backfill for both mining methods in all zones. This dilution factor is a global average based on experience. Other waste rock dilution is accounted for in the mine design which includes both mineralized material from the resource model and dilution from the waste or buffer model.

Life-of-mine plans and tabulation of Mineral Reserves is completed using Mine 2-4D® planning software. This software allows for comprehensive three dimensional design, and interface of all development, production and backfilling activities in each zone of the mine. An NSR cut-off is applied to achieve anticipated metallurgical recovery, production goals, and limit marginally economic material. The target NSR cut-off value covers property-wide direct costs distributed on a per-ton basis of production ore and for the 2012 Mineral Reserve estimate this was $190/ton. The exception was the East zone, where the NSR cut-off applied was $150/ton.

1.13 Mineral Reserve Statement

Mineral Reserves, by definition, have taken into account environmental, permitting, legal, title, taxation, socio-economic, marketing and political factors and constraints. The Mineral Reserves are acceptable to support mine planning.

Probable Mineral Reserves were declared for the underground mineralization. The surface stockpile is classified as Proven Mineral Reserves as its volume and grade have been determined by metallurgical balance based on milling results. Mineral Reserves are summarized in Table 1-3.

Mr Bryan Morgen, P.E., a Hecla employee, is the QP for the estimate. Mineral Reserves have an effective date of 31 December, 2012 and are reported using an NSR cut-off of $190/ton for all zones except the East zone, where an NSR cut-off of $150/ton was used.

In the opinion of the QPs, Mineral Reserves for the Project, which have been estimated using channel, core and RC drill data, appropriately consider modifying factors, have been estimated using industry best practices, and conform to the requirements of CIM (2010).

Factors that may affect the Mineral Reserve estimates include: metal price assumptions, the assumptions relating to geotechnical parameters, assumptions that go into defining the NSR cut-off used to constrain Mineral Reserves; maintain appropriate dilution control; mining and metallurgical recovery assumptions; variations to the expected revenue from short-term marketing and sales contracts; and variations to the permitting, operating or social license regime assumptions.

Table 1-3: Mineral Reserve Statement

Classification	Zone	Tons	Gold (Oz/ton)	Silver (Oz/ton)	Lead (%)	Zinc (%)	Gold (Ounces)	Silver (Ounces)	Lead (Tons)	Zinc (Tons)
Proven	East	—	—	—	—	—	—	—	—	—
	West	—	—	—	—	—	—	—	—	—
	9A	—	—	—	—	—	—	—	—	—
	NWW	—	—	—	—	—	—	—	—	—
	SW	—	—	—	—	—	—	—	—	—
	200S	—	—	—	—	—	—	—	—	—
	5250	—	—	—	—	—	—	—	—	—
	Gallagher	—	—	—	—	—	—	—	—	—
	Stockpile	12,000	0.095	9.3	2.7	7.8	1,100	111,600	320	940
Total Proven		***12,000***	***0.095***	***9.3***	***2.7***	***7.8***	***1,100***	***111,600***	***320***	***940***
Probable	East	683,000	0.081	13.0	3.2	7.9	55,300	8,879,000	21,900	54,000
	West	893,000	0.123	10.5	4.2	12.1	109,800	9,377,000	37,500	108,100
	9A	1,549,000	0.089	9.8	3.9	9.8	137,900	15,180,000	60,400	151,800
	NWW	1,753,000	0.114	11.3	3.6	10.4	199,800	19,809,000	63,100	182,300
	SW	131,000	0.105	17.6	2.8	7.9	13,800	2,306,000	3,700	10,300
	200S	684,000	0.137	14.7	2.9	6.7	93,700	10,055,000	19,800	45,800
	5250	2,152,000	0.051	13.4	2.8	7.0	109,800	28,837,000	60,300	150,600
	Gallagher						-	-	-	-
	Stockpile						-	-	-	-
Total Probable		***7,845,000***	***0.092***	***12.0***	***3.4***	***9.0***	***720,100***	***94,443,000***	***266,700***	***702,900***
Total Proven and Probable	East	683,000	0.081	13.0	3.2	7.9	55,300	8,879,000	21,900	54,000
	West	893,000	0.123	10.5	4.2	12.1	109,800	9,377,000	37,500	108,100

Classification	Zone	Tons	Gold (Oz/ton)	Silver (Oz/ton)	Lead (%)	Zinc (%)	Gold (Ounces)	Silver (Ounces)	Lead (Tons)	Zinc (Tons)
	9A	1,549,000	0.089	9.8	3.9	9.8	137,900	15,180,000	60,400	151,800
	NWW	1,753,000	0.114	11.3	3.6	10.4	199,800	19,809,000	63,100	182,300
	SW	131,000	0.105	17.6	2.8	7.9	13,800	2,306,000	3,700	10,300
	200S	684,000	0.137	14.7	2.9	6.7	93,700	10,055,000	19,800	45,800
	5250	2,152,000	0.051	13.4	2.8	7.0	109,800	28,837,000	60,300	150,600
	Gallagher	—	—	—	—	—	—	—	—	—
	Stockpile	12,000	0.095	9.3	2.7	7.8	1,100	111,600	320	940
Grand Total Proven & Probable		***7,857,000***	***0.092***	***12.0***	***3.4***	***9.0***	***721,200***	***94,554,600***	***267,020***	***703,840***

Note to Accompany Mineral Reserve Table

1. The Qualified Person for the Mineral Reserve estimate is Mr Bryan Morgen, P.E., a Hecla employee.
2. Probable Mineral Reserves are contained within Indicated stope designs, and supported by a mine plan. Proven Mineral Reserves are mill stockpiles.
3. Mineral Reserves are based on the following metal prices and cut-off assumptions: East Zone: $950/oz Au, $16/oz Ag, $0.80/lb Pb, $0.80/lb Zn, NSR cut-off of $150/t; all other zones: $1400/oz Au, $26.50/oz Ag, $0.85/lb Pb, $0.85/lb Zn, NSR cut-off of $190/t;
4. Mining methods assumed are long-hole open stoping and cut-and-fill. A universal dilution factor of 4% is assumed from backfill for both mining methods in all zones except the East zone.
5. Mineral Reserves have an effective date of 31 December, 2012.
6. Reporting units are all US customary, Tons: dry short tons (dst); Au: (troy ounces/dst); Ag: (troy ounces/dst); Pb and Zn: percent (%)

1.14 Mining Operations

The underground mine is accessed by a portal on the 920 elevation. The portal (920 Main) is located in the same general area as the mill, ore pad and administration building. The 920 Main is the primary equipment and personnel travel way. A secondary escapeway (the 59 secondary escapeway) offers a secondary egress as necessary. There are several ramp systems used to access the current working headings, which are all fed by primary (through-flow) ventilation. There are currently 12 refuge chambers.

Development and face production activities are performed by a fleet of twin and single boom, drilling jumbos. Blasting is carried out with mobile explosives vehicles utilizing bulk emulsion. Ground support activities are performed with dedicated bolting equipment, and shotcrete is applied as required. Vertical development is typically completed by drop raising wherever possible. When drop raising is not possible, such as with longer raises, a raise-boring crew will normally be mobilized. Approximately 95% of vertical development is attributed to ventilation raises and secondary escapeway raises, and 5% attributed to muck passes.

The mine plan from 2013 forward is designed and scheduled for 2,200 tons per day (1,996 tonnes) or 803,000 tons (728,469 tonnes) per annum. The LOM plan is developed on a month by month basis for 2013 and 2014, and then reported on an annual basis for 2015 through the end of mine life.

Stope design factors in orebody shape, accessibility, mining method and dilution. The design NSR cut off is $190/t.

Two production methods are used, which include overhand cut-and-fill and long-hole stoping. Where overhand cut-and-fill is used, production levels are mined at a minimum dimension of 15 ft wide x 15 ft high (4.6 m x 4.6 m). Upon exhaustion of Mineral Reserves on each individual level, the established access is breasted down, providing re-access to the next extraction level. Long-hole stoping, which accounts for 20% of planned annual production, is used where practicable. Overcut and undercut drives are established at nominal dimensions of 15 ft high x 25 ft (4.6 x 7.6 m) wide, and separated by thicknesses ranging from 35 to 120 ft (10.7 x 36.6 m) vertically. Typical zone level widths range from 200–1,000 ft (61–305 m), with overcut and undercut drive penetration of 100–200 ft (31–62 m) into the ore. Ore zones are drilled and blasted from the overcut or undercut, while extraction occurs via remote mucking on the undercut level. All level layouts are designed as primaries and secondaries, with primary and secondary stopes being similar in size.

In the cut-and-fill excavations, extracted panels are “tight-filled” with a combination of cement and waste, allowing further panel extraction alongside and/or between backfill. The long-hole stopes are filled with paste backfill. This allows the safe extraction of secondary blocks between backfill, while minimizing dilution. Secondary blocks are filled with waste rock from mine development wherever possible.

The ground support strategy developed at the mine uses the concept of rock reinforcement and surface control to construct a stable support arch for the specified excavation geometry.

Conventional underground mining equipment is used to support the underground mining activities. Ore handling is performed with a fleet of underground haulage vehicles and load–haul–dump equipment (LHDs). All ore is trucked out of the mine to the surface mill stockpile, located approximately 450 ft (137 m) from the 920 Portal utilizing the 40 ton (36 tonne) underground haulage fleet. Waste is either trucked out of the mine to the Site 23 waste disposal area located approximately half a mile (0.8 km) from the 920 portal, or is placed in previously mined-out stopes.

Blasting is carried out with the use of mobile explosives vehicles utilizing bulk emulsion.

Greens Creek is considered a dry mine, with annual pumping from operations being in the range of 25 to 50 US gallons per minute (gpm) or 95–190 liters per minute (L/m).

The mining operation is ventilated using an exhausting system with a design capacity of 463,000 cubic feet per minute (or 13,111 cubic meters per minute). There are nine main fans with an operating horsepower (hp) totaling 1,550 hp.

In the opinion of the QPs, underground mine plans are appropriately developed to maximize mining efficiencies, based on the current knowledge of geotechnical, hydrological, mining and processing information on the Project. Production forecasts are achievable with the current equipment and plant, and replacements have been acceptably scheduled. The predicted mine life to 2022 is achievable based on the projected annual production rate and the Mineral Reserves estimated.

1.15 Recovery Methods

The processing plant produces three saleable flotation concentrates and two gravity concentrates. A carbon concentrate is produced as part of the process but is discarded as part of tailings.

A gravity circuit utilizing spiral concentrators and a cleaner table treats a bleed stream from the grinding circuit cyclones. It produces a final gravity concentrate and middlings gravity concentrate. Lead concentrate is produced in a rougher–cleaner circuit with re-grinding of the cleaner feed. The lead concentrate is relatively low grade, at approximately 35% Pb, but carries a large proportion of the Ag in mill feed.

Zinc concentrate is produced in a rougher–cleaner circuit, also with re-grinding, using lead rougher tailings as feed. The Zn concentrate typically contains 50% Zn, which is a normal grade, and considerably less Ag than the Pb concentrate.

Bulk concentrate is produced in a complex circuit which has as feed cleaner tailings from both the Pb and Zn circuits. It is a relatively low-grade Zn concentrate, at 35% Zn, with a smaller amount of Pb and some Ag. Bulk concentrate has a relatively limited market so Pb and Zn concentrates production is preferred over that of bulk.

All three flotation concentrates, as well as the final tailings, are thickened and filtered to approximately 10% moisture. Storage capacity at the mill is limited and all products are hauled to longer-term storage on a daily basis, using highway-type trucks. Concentrates are separately hauled and stored to a storage–load-out facility at Hawk Inlet, approximately eight miles from the mine. At the Hawk Inlet facility they are stored indoors in piles until being loaded periodically into ocean-going ships for transport to a variety of smelters.

Tailings are sent to the surface batch plant as required by the needs of the mine for underground backfill. Remaining tailings are hauled daily to the Tailings Storage Facility approximately seven miles from the mill for final storage.

Reagents are distributed throughout the grinding and flotation circuits by means of head tanks and computerized solenoids for xanthate, copper sulfate, zinc sulfate, 3418A and MIBC reagents. Sodium cyanide, sulfuric acid, hydrogen peroxide and non-ionic and anionic flocculants are added by positive displacement pumps (Pulsafeeder, Liquid Metronics, Micro or Moyno).

The mill requires approximately 4.8 MW of power to operate at full capacity.

The mine has now been operational for a 24-year period, and continuously operational for the last 17 years, and has current contracts in place for concentrate sales, doré refining, concentrate transportation, metals hedging and other goods and services required to operate an underground mine. Hecla has agreements at typical Pb and Zn concentrates industry benchmark terms for metal payables, treatment charges and refining charges for concentrates produced from the Greens Creek mine. These custom smelters are located in Canada, Japan, Korea and China. Greens Creek concentrates are higher in precious metals content, but lower in Pb and Zn content than typical Pb, Zn and bulk concentrates.

Hecla has had concentrate sales contracts in place since the beginning of operations in 1989 and these contracts are typical sales contracts in the industry. New contracts are negotiated at the end of their terms. For all of Hecla's sales contracts, the title and risk of ownership of the concentrates transfers either at the load port or discharge port.

The QPs are of the opinion that the current process facilities are appropriate for the mineralization styles in the underground operations, and the existing plant design will support the current life-of-mine plan. Hecla is able to market the gravity products, Pb, Zn, and bulk concentrates produced from the Project. The terms contained within existing sales contracts are typical and consistent with standard industry practice, and are similar to contracts for the supply of doré, precious metals and base metal concentrates elsewhere in the world. Imperial Smelting Furnaces (ISFs) are being phased out which can affect long-term marketing of bulk concentrates. Hecla has existing contracts in place and relationships with other buyers for such concentrates, and it is a reasonable expectation that the bulk concentrates will be able to continue to be marketed. Metal prices are set by Hecla management and are appropriate to the commodity and mine life projections.

1.16 Infrastructure

The major infrastructure areas supporting operations at Greens Creek include the 920/860 Area, Site 23, Hawk Inlet, tailings area, the Young Bay dock, 13 miles (21 km) of connecting roadways, a power-intertie connecting to the Juneau area power grid, and various pipelines and outfalls for wastewater and storm water conveyance.

The 920 Area is located adjacent to the main portal at the 920 ft elevation or approximately eight road miles (13 km) from the tidewater facilities located at Hawk Inlet. Located at the 920 Area are the mill, power-house, mill and water treatment plants, surface-maintenance shop, main warehouse, administrative offices, and fuel storage tanks. The 860 Area, which is immediately adjacent to the 920 Area, has additional office buildings, assay laboratory, and core-logging facilities. Site 23, which is adjacent to the 860 Area or approximately 0.2 miles (0.3 km) from the 920 Area, is the current active waste rock storage facility.

The tailings area includes all the tailings produced to-date which has not been backfilled underground. There is additional permitted capacity for several years of production needs, storm water ponds, water-treatment plant and fully permitted Alaska Pollutant Discharge Elimination System (APDES) discharge facilities. Additional tailings storage space will be required toward the end of the planned mine life. A request for an expansion of the TSF was made to the USFS in 2010, with the intent to have the permitting process completed a few years prior to reaching capacity at the existing facility. A Record of Decision is expected from the USFS in 2013, which will state whether the proposed expansion is approved, or whether a new TSF at a different location will be approved.

Support facilities at Hawk Inlet include core storage, concentrate storage and shipping, barge port facilities, warehouse, waste and potable water treatment, fuel storage, and camp housing.

The Young Bay facilities consist solely of a boat dock for the regular crew transport boat that runs twice daily from Auke Bay, near Juneau, and a small generator to power lights.

Mine roads link the Young Bay site, the Hawk Inlet site, and the mine/mill site.

The Greens Creek Mine is allowed by permit to withdraw 700 gpm (2,650 L/m) of fresh water from Greens Creek. This provides the fresh water to the mine, mill, 920 and 860 Areas, including the mine and potable water system, with approximately 520 gpm (1,968 L/m) of fresh water being available for mill use. However, the mill requires approximately 1,600 gpm (6,057 L/m) of total water to operate. The difference between the fresh water and total water required for the mill is made up using recycled water. Some process recycle water is taken directly from the tailings thickener overflow, with the balance supplied by treated mill discharge water.

The mine's electrical power needs are met by utilizing a combination of two major sources. The primary source is onsite diesel-powered generation. This system includes two separate power-houses that contain nine generating units. The on-site generators include a mixture of reciprocating and turbine generators. The secondary source is from purchased power generated by the local Juneau power utility. This power is generated by hydro and only available to Greens Creek when lake levels are above predetermined limits. The Juneau power grid is connected to the Greens Creek grid by an undersea cable and a 13 mile (21 km) 69 kV aerial power line.

Fuel is delivered on a bimonthly basis and is necessary if the mine is required to operate the diesel generators to supply power to the site. If power is being supplied from the local utility, fuel usage drops dramatically and is delivered as necessary to fuel the mobile equipment.

In the opinion of the QPs, the existing infrastructure required to support mining activities is sufficient for the current LOM plan.

1.17 Capital Costs

Total LOM remaining capital costs are estimated at $316.6 M.

Future capital costs are estimated based on expected sustaining capital requirements of the mine. Development costs are estimated based on past experience and are adjusted for any future anticipated changes in factors that would affect cost and the amount of development. The timing of equipment replacement and rebuilds are based on replacement and rebuild schedules, and the anticipated cost is based on actual experience. In the later years of the LOM, costs are estimated for estimated equipment required to sustain production.

1.18 Operating Costs

Total LOM operating costs are anticipated to be $154.94/ton ($170.79/tonne) milled.

The operating costs included in the LOM are derived from the 2013 budget for the near-term and adjusted for factors regarding expected cost changes in the later years. The budget is built using various cost inputs including operating experience, quotes from various service providers, anticipated personnel changes, and changes in production.

Fuel and power costs are variable by year, averaging about 6% each of total production costs in 2012, but ranging from 4–13% each in the last five years. A key driver of the cost fluctuation is the unpredictable availability of less expensive hydroelectric power to the site. When precipitation in southeastern Alaska is low, and hydroelectric power is unavailable or reduced, the mine must generate electricity on-site using diesel generators.

1.19 Financial Analysis

The results of the economic analysis to support Mineral Reserves represent forward-looking information that is subject to a number of known and unknown risks, uncertainties and other factors that may cause actual results to differ materially from those presented here.

Forward-looking statements in this Report include, but are not limited to, statements with respect to future metal prices and concentrate sales contracts, the estimation of Mineral Reserves and Mineral Resources, the realization of Mineral Reserve estimates, the timing and amount of estimated future production, costs of production, capital expenditures, costs and timing of the development of new ore zones, permitting time lines for the tailings storage expansion, requirements for additional capital, government regulation of mining operations, environmental risks, unanticipated reclamation expenses, title disputes or claims and limitations on insurance coverage.

Additional risk can come from actual results of current reclamation activities; conclusions of economic evaluations; changes in Project parameters as mine and process plans continue to be refined, possible variations in ore reserves, grade or recovery rates; geotechnical considerations during mining; failure of plant, equipment or processes to operate as anticipated; shipping delays and regulations; accidents, labor disputes and other risks of the mining industry; and delays in obtaining governmental approvals.

To support declaration of Mineral Reserves, Hecla prepared an economic analysis to confirm that the economics based on the Mineral Reserves could repay life-of-mine operating and capital costs. The Project was evaluated on an after-tax, project stand-alone, 100% equity-financed basis at the Project level, using three-year trailing average metal prices and a 5% discount rate. Results of this assessment indicated positive Project economics until the end of mine life, and supported Mineral Reserve declaration.

Sensitivity analysis was performed on the base case net cash flow. Mineral Reserve estimates are most sensitive to variations in metal price, less sensitive to changes in metal grade and recoveries, and least sensitive to fluctuations in operating and capital costs.

As a producing issuer, Hecla's financial evaluation has been performed to support Mineral Reserve declaration. The QPs have reviewed the financial analysis and confirm that the Project has positive economics until the end of mine life, which supports Mineral Reserve declaration. The QPs note that there is some upside for the Project if some or all of the Inferred Mineral Resources estimated for the Project can be upgraded to higher confidence Mineral Resource categories and eventually to Mineral Reserves.

1.20 Conclusions

In the opinion of the QPs, the Project that is outlined in this Report has met its objectives. Mineral Resources and Mineral Reserves have been estimated for the Project, a mine has been constructed, mining and milling operations are performing as expected, and reconciliation between mine production and the mineral resource model is acceptable. This indicates the data supporting the Mineral Resource and Mineral Reserve estimates were appropriately collected, evaluated and estimated, and the original Project objective of identifying mineralization that could support mining operations has been achieved.

Project opportunities were identified as the potential for discovery of additional mineralization that may support upgrade to Mineral Resources, conversion potential of existing or updated Mineral Resource estimates to Mineral Reserves, changes to mining methods that may allow increased production at lower mining costs, changes to process plant methodologies that may result in increased efficiencies or recoveries or reductions to processing costs.

Project risks include potential loss of access travel ways, ventilation limitations that may be imposed as a result of changes to the mine plan; uncontrolled dilution; fluctuations in mining costs; fluctuations in environmental compliance costs due to changes to regulatory requirements, changes to existing smelter terms, conditions, and agreements; project metal price assumptions.

1.21 Recommendations

The QPs have reviewed the information on the Greens Creek mining operation and have no meaningful recommendations to make for further work.

2.0 INTRODUCTION

2.1 Terms of Reference

Hecla has prepared a technical report (the Report) on the wholly-owned Greens Creek polymetallic mining operation (the Project) located on Admiralty Island in southeast Alaska, US (Figure 2-1 and Figure 2-2) for itself and Aurizon Mines Ltd.

The Report will be used in connection with the preparation of the management information circular to be prepared by Aurizon Mines Ltd. in connection with its special meeting of shareholders to approve a proposed arrangement under the *Business Corporations Act* (British Columbia) with Aurizon Mines Ltd. and may be incorporated by reference in that management information circular.

Hecla holds a 100% interest in the Greeks Creek polymetallic (Au, Ag Cu, Pb, Zn) mining operation through its indirectly-held subsidiary companies Hecla Greens Creek Mining Company, Hecla Juneau Mining Company and Hecla Alaska LLC (see Section 4.2). In this Report, the name Hecla is used interchangeably for the parent and subsidiary companies.

2.2 Qualified Persons

The following serve as the qualified persons for this Technical Report as defined in National Instrument 43-101, Standards of Disclosure for Mineral Projects:

- Dr. Dean McDonald, PhD, P.Geo: Vice President of Exploration, Hecla Mining Company;
- Mr. Bryan Morgen, P.E. Senior Mine Engineer, Hecla Greens Creek Mining Company; and
- Mr. Bill Hancock, RM SME, Principal, Argo Consulting LLC.

2.3 Site Visits and Scope of Personal Inspection

QPs have either visited site on the dates indicated below, or are full-time employees at the mine.

Dr. McDonald has visited the Project on a number of occasions, most recently on 11 December, 2012. During his site visits, he has inspected drill core, visited and inspected surface outcrops, drill platforms and sample cutting and logging areas; discussed geology and mineralization with Project staff; reviewed geological interpretations with staff; reviewed modeling efforts; audited and reviewed on-site data including reviews of quarterly and annual budgets; visited the underground workings, and viewed the locations of key infrastructure.

Figure 2-1: Project Location Plan

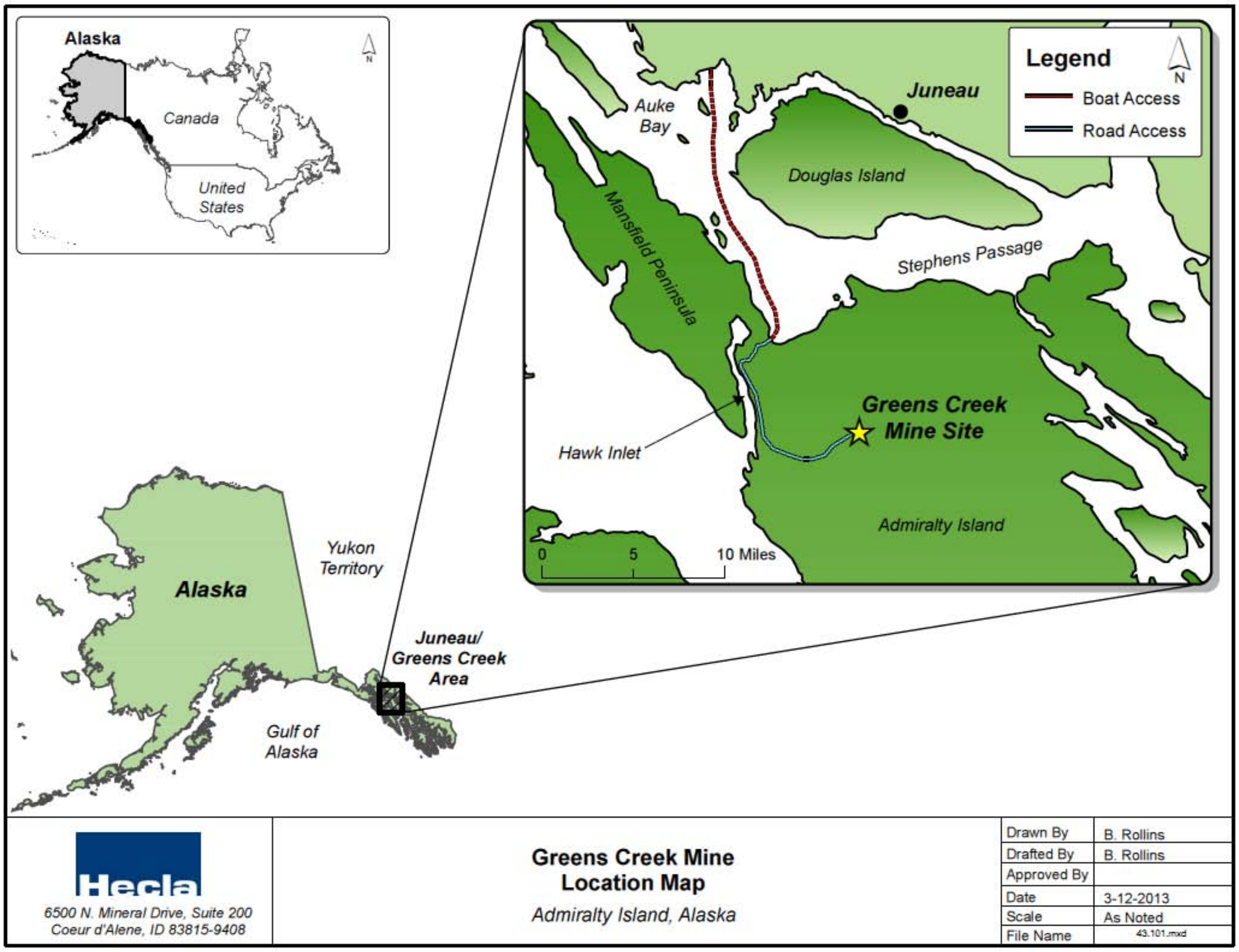
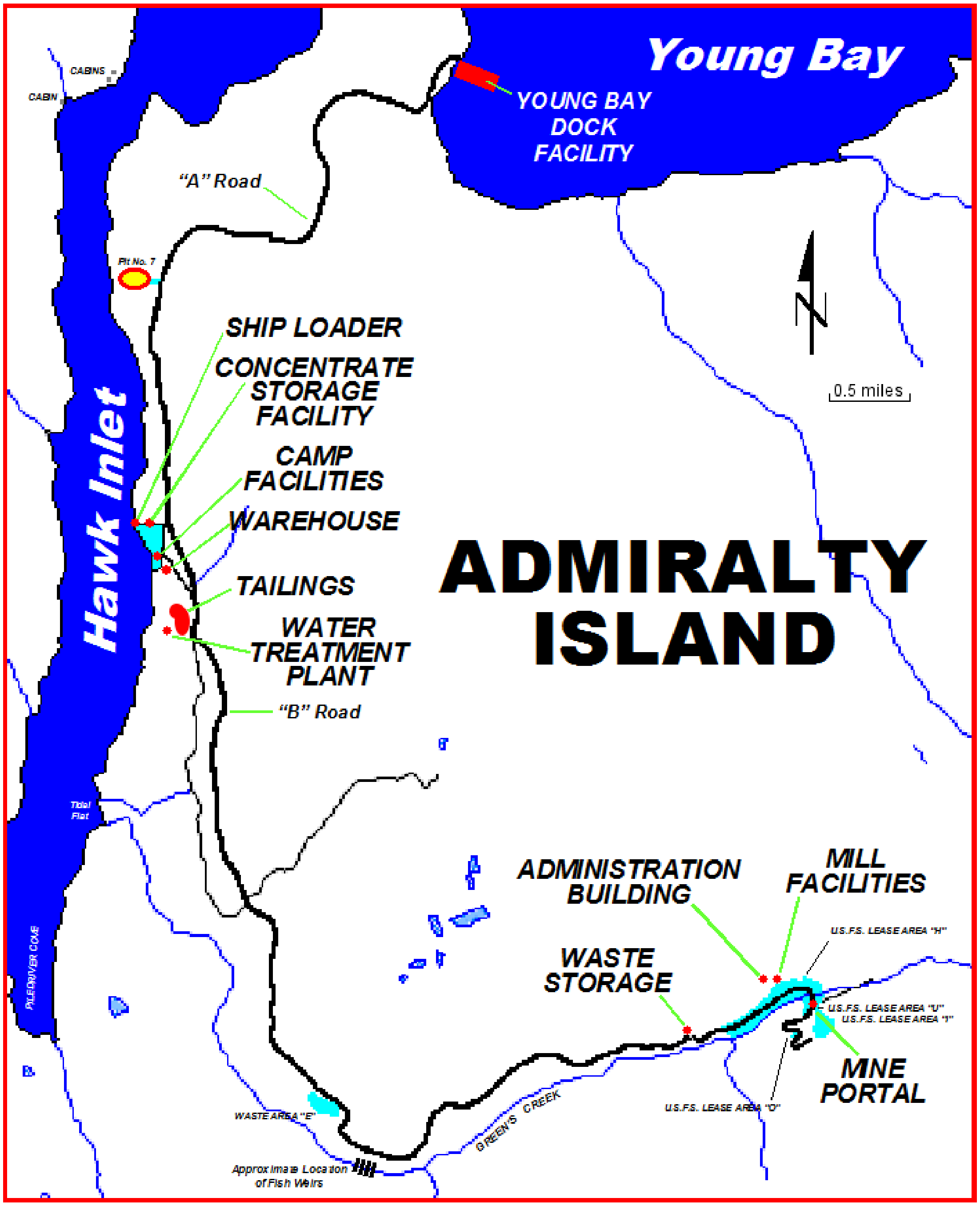


Figure 2-2: Mine Layout Plan



Mr. Bryan Morgen has worked at the Greens Creek mine site for six years. His QP scope of personal inspection of the site has been undertaken as part of his role as a Senior Mine Engineer at Greens Creek. Mr. Morgen has inspected the underground workings on numerous occasions and is familiar with the key site infrastructure. He reviewed has on-site data, including the current mine plan, production plan, and underground mine layout plans.

Mr. Bill Hancock last visited site on 31 October, 2012. During the site visit, he toured and inspected the process facilities and discussed reagent usage with Hecla staff.

2.4 Effective Dates

The following effective dates pertain to database closure and supporting assumptions for block modeling efforts:

- East zone: 2010
- West zone: 1 September, 2010
- 9A zone: 1 March 2010
- Northwest West zone: 31 December, 2008 (Mineral Resources); 1 April, 2012 (Mineral Reserves);
- Southwest zone: 2005
- 200S zone: 30 March 2010
- 5250 zone: 21 July, 2011
- Gallagher zone: 31 October, 2012
- Stockpile: 31 December, 2012

The following effective dates pertain to Mineral Resource estimation:

- East zone: 31 December, 2010
- West zone: 31 December, 2012
- 9A zone: 31 December, 2012
- Northwest West zone: 31 December, 2008 (Mineral Resources); 31 December, 2012 (Mineral Reserves);
- Southwest zone: 31 December, 2012
- 200S zone: 31 December, 2012
- 5250 zone: 31 December, 2012

- Gallagher zone: 31 December, 2012
- Stockpile: 31 December, 2012.

Mineral Reserve estimates have an effective date of 31 December 2012

The financial analysis that supports the Mineral Reserves was effective 31 December, 2012.

The overall Report effective date is taken to be 31 December, 2012, based on the date of the Mineral Reserve estimates.

2.5 Information Sources and References

Hecla has used reports prepared by Hecla staff in support of United States Securities and Exchange Commission (SEC) filings, and internal company spreadsheets and reports in support of this Report.

Hecla has also used the information and references cited in Section 27 as the basis for the Report. Additional information on the operations was provided to the QPs from other Hecla employees in specialist discipline areas.

Hecla is reporting the Proven and Probable Mineral Reserves, and Measured, Indicated, and Inferred Mineral Resources in Sections 14 and 15 using the definitions and categories set out in the Canadian Institute of Mining, Metallurgy, and Petroleum 2010 Definition Standards for Mineral Resources and Mineral Reserves (2010 CIM Definition Standards).

All measurement units used in this Report are United States customary units, and currency is expressed in US dollars unless stated otherwise. All figures have been prepared by Hecla unless otherwise noted.

2.6 Previous Technical Reports

Hecla has not previously filed a technical report on the Greens Creek Project.

2.7 Cautionary Statement on Forward-Looking Information

This Technical Report contains forward-looking statements within the meaning of the U.S. Securities Act of 1933 and the U.S. Securities Exchange Act of 1934 (and the equivalent under Canadian securities laws), that are intended to be covered by the safe harbor created by such sections. Such forward-looking statements include, without limitation, statements regarding the Company's expectation of the Greens Creek Mine and its expansions, including estimated capital requirements, expected production, cash costs and rates of return; mineral reserve and resource estimates; estimates of silver, lead and zinc grades; and other statements that are not historical facts. We have tried to identify these forward-looking statements by using words such as "may," "might", "will," "expect," "anticipate," "believe," "could," "intend," "plan," "estimate" and similar expressions. Forward-looking statements address activities, events or developments that Hecla Mining Company expects or anticipates will or may occur in the future, and are based on information currently available. Although Hecla management believes that its expectations are based on reasonable assumptions, it can give no assurance that these expectations will prove correct. Important factors that could cause actual results to differ materially from those in the forward-looking statements include, among others, risks that Hecla's exploration and property advancement efforts will not be successful; risks relating to fluctuations in the price of silver, lead and zinc; the inherently hazardous nature of mining-related activities; uncertainties concerning reserve and resource estimates; uncertainties relating to obtaining approvals and permits from governmental regulatory authorities; and availability and timing of capital for financing exploration and development activities, including uncertainty of being able to raise capital on favorable terms or at all; as well as those factors discussed in Hecla's filings with the U.S. Securities and SEC including Hecla's latest Annual Report on Form 10-K and its other SEC filings (and Canadian filings) including, without limitation, its latest Quarterly Report on Form 10-Q. Hecla does not intend to publicly update any forward-looking statements, whether as a result of new information, future events, or otherwise, except as may be required under applicable securities laws.

2.8 Currency

All dollar amounts in this Technical Report are expressed in US dollars, unless otherwise indicated.

3.0 RELIANCE ON OTHER EXPERTS

This section is not relevant to the Report as it was prepared without reliance on other experts. The Report has been prepared using the reports and documents, as noted in Section 27 “References”. The authors do not disclaim any responsibility for this Report.

4.0 PROPERTY DESCRIPTION AND LOCATION

The Greens Creek Mine is located on Admiralty Island, approximately 18 miles (29 km) to the southwest of Juneau, Alaska. The property location is displayed in Figure 2-1.

The mine is 100% owned and operated by Hecla subsidiaries (refer to Section 4.2).

The mine coordinates in UTM North American Datum of 1983 (NAD 83) Zone 8V are:

- US Survey Feet
  - Northing: 21121755.473
  - Easting : 1710158.573
- Meters
  - Northing: 6437923.944
  - Easting: 521257.376.

4.1 Property and Title in Alaska

Information included in the following subsections is summarized from Alaska Department of Natural Resources (2009), Alaska Division of Mining, Land and Water (2012), Bureau of Land Management (2011a, 2011b, 2012), and the Alaska Department of Revenue (2012).

4.1.1 Mineral Tenure

Mineral tenure can be held either under Alaskan State law, or under Federal permits.

Federal Mineral Titles

Alaska is one of the 19 US states where there are federally-administered lands that allow for staking of mining claims.

There are three basic types of minerals on Federal lands:

- Locatable (subject to the General Mining Law of 1872, as amended);
- Leasable (subject to the various Mineral Leasing Acts);
- Saleable (subject to mineral materials disposed of under the Materials Act of 1947, as amended).

The General Mining Law of May 10, 1872, as amended (30 U.S.C. §§ 22-54 and §§ 611-615) is the major Federal law governing locatable minerals. The General Mining

Law allows for the enactment of State laws governing location and recording of mining claims and sites that are consistent with Federal law.

The Bureau of Land Management (BLM) manages the surface of public lands and the USFS manages the surface of National Forest System lands. The BLM is responsible for the subsurface on both public lands and National Forest System lands.

Mining claims may not be located on lands that have been:

- Designated by Congress as part of the National Wilderness Preservation System;
- Designated as a wild portion of a Wild and Scenic River;
- Withdrawn by Congress for study as a Wild and Scenic River.

Areas also withdrawn from location of mining claims include National Parks, National Monuments, Native American reservations, most reclamation projects, military reservations, scientific testing areas, most wildlife protection areas (such as Federal wildlife refuges), and lands withdrawn from mineral entry for other reasons.

Claim and Entry Types

Two main claim types can be granted, lode mining and placer mining claims.

Federal lode mining claims are defined by the BLM as:

Deposits subject to lode claims include classic veins or lodes having well-defined boundaries. They also include other rock in- place bearing valuable minerals and may be broad zones of mineralized rock. Examples include quartz or other veins bearing gold or other metallic minerals and large volume, but low-grade disseminated gold deposits. Descriptions are by meters and bounds surveys beginning at the discovery point on the claim and including a reference to natural objects or permanent monuments. Federal statute limits their size to a maximum of 1,500 feet in length, and a maximum width of 600 feet (300 feet on either side of the vein). The end lines of the lode claim must be parallel to qualify for underground extralateral rights. Extralateral rights involve the rights to minerals that extend at depth beyond the vertical boundaries of the claim.

The boundaries of a claim based on staking and located after January 1, 1985, shall run in the four cardinal directions unless the claim is a fractional claim or the commissioner determines that staking in compliance with this paragraph is impractical because of local topography or because of the location of other claims; a claim established in this manner may be known as a non-MTRSC (meridian, township, range, section and claim) location.

Federal placer mining claims are defined by the BLM as:

Including all forms of deposit, excepting veins of quartz, or other rock in-place. In other words every deposit, not located with a lode claim, should be appropriated by a placer location. Placer claims, where practicable, are located by legal subdivision (aliquot part and complete lots). The maximum size is 20 acres per locator, and the maximum for an association placer is 160 acres for 8 or more locators. The maximum size in Alaska is 40 acres. The maximum size for a corporation is 20 acres per claim. Corporations may not locate association placers unless they are in association with other locators or corporations as co-locators.

Federal lode and placer mining claims are administered by the BLM under the 1872 General Mining Law. After physically staking the boundaries with six posts a minimum of 1 m tall, new claims are filed with the local county and with the BLM.

Maintenance requirements are based on the assessment year which begins September 1, at noon, and ends the following September 1, at noon. An annual $140 maintenance fee per claim is required to be filed or postmarked (if mailed) on or before September 1 of the year preceding an assessment year. These BLM fees are increased from time to time.

Claimants who perform assessment work must spend a minimum of $100 in labor or improvements on each claim, and record evidence of such with the BLM by December 30 of the calendar year in which the assessment year ended. Assessment work includes, but is not limited to, drilling, excavations, driving shafts and tunnels, sampling (geochemical or bulk), road construction on or for the benefit of the mining claim; and geological, geochemical, and geophysical surveys.

In addition to these claim types, there are kinds of two mineral entry claim.

Mill site entries are defined by the BLM as:

A mill site must be located on non-mineral land. Its purpose is to either (1) support a lode or placer mining claim operation or (2) support itself independent of any particular claim. A mill site must include the erection of a mill or reduction works and/or may include other uses reasonably incident to the support of a mining operation. Descriptions of mill sites are by metes and bounds surveys or legal subdivision. The maximum size of a mill site is 5 acres.

Tunnel sites are defined by the BLM as:

A tunnel site is where a tunnel is run to develop a vein or lode. It may also be used for the discovery of unknown veins or lodes. To stake a tunnel site, two stakes are placed up to 3,000 feet apart on the line of the proposed tunnel. Recordation is the same as a lode claim. An individual may locate lode claims to cover any or all blind (not known to exist) veins or lodes intersected by the tunnel. The maximum distance these lode claims may exist is 1,500 feet on either side of the centerline of the tunnel. This, in essence, gives the mining claimant the right to prospect an area 3,000 feet wide and

3,000 feet long. Any mining claim located for a blind lode discovered while driving a tunnel relates back in time to the date of the location of the tunnel site.

Federal Lode and Placer Patented Mining Claims

A patented claim is one for which the federal government has passed title to the claimant, making it private land. A person may mine and remove minerals from a mining claim without a patent; however, a mineral patent gives the owner title to the minerals, surface and other resources (timber, vegetative). Mineral patents can be issued for lode claims and placer claims.

Patenting requires the claimant to demonstrate the existence of a valuable mineral deposit. In addition the applicant needs to:

- Survey, if required, subsequent to location;
  - Survey application requires initial fee of $750 plus $300 for each additional claim;
  - Approved survey plat and notice of intent to patent posted on claim.
- File patent application in BLM State Office accompanied by fees - $250 service charge (1 claim) and $50 for each additional claim;
- Provide evidence of title and citizenship;
- Provide statement of expenditures and improvements;
- Have BLM approval notice published in newspaper;
- Provide proofs of posting and publications, and corroborated statements.

Under current law, if all requirements have been satisfied, the applicant can purchase a lode claim at $5 per acre ($12 per ha) and placer claims for $2.50 an acre ($6.18 per ha).

Federal Conditions of Use

Activities that ordinarily result in no or negligible disturbance of the public lands or resources are termed “casual use.” In general, the operator may engage in casual use activities without consulting, notifying or seeking approval from the BLM.

For exploration activity greater than casual use and which causes surface disturbance of five acres (2 ha) or less of public lands; the operator must file a complete notice with the responsible BLM field office. Notice is for exploration only and only 1,000 tons (907 tonnes) may be removed for testing.

A Plan of Operations is required for surface disturbance greater than casual use, unless the activity qualifies for a Notice filing. Surface disturbance greater than casual use on certain special category lands always requires the operator to file a Plan of Operations and receive approval from the federal agency that administers the land (i.e. BLM, the USFS).

An applicant for a plan of operations must pay a processing fee, and/or for a mineral examination on a case-by-case basis.

Anyone proposing to prospect for or mine locatable minerals that might cause disturbance of surface resources is required to file a “Notice of Intention to Operate” with the local USFS office or BLM. If the Federal Agency determines that such operations will cause a significant disturbance to the environment, the operator must submit a proposed Plan of Operations, from which the impacts of the operations will be assessed. The Plan of Operations must describe such things as the type of operation proposed and how it will be conducted; proposed roads or access routes and means of transportation; and the time period during which the proposed activities will take place. The Plan of Operations must also indicate the measures to be taken to rehabilitate areas where mining activities have been completed. An operator shall also be required to furnish a bond commensurate with the expected cost of rehabilitation.

There are no fees associated with processing notices of intent or plans of operations needed for locatable minerals. A bond is required for a plan of operations, in an amount that would be adequate to reclaim the surface resources. In addition, the USFS may require an applicant to submit environmental information and may authorize an applicant to prepare an environmental assessment.

State Mineral Titles

State-owned lands cover an area larger than the entire State of California, and most of these lands are open to mining under a location system which is a modem version of the Federal mining law.

Legislation relating to mining claims was enacted in 2000 as Senate Bill 175. State mining claims in Alaska use the meridian, township, range, section and claim (MTRSC) format. Two sizes of claim can be staked, quarter section (~160 acres or 65 ha), and quarter–quarter section (~40 acres or 16 ha). Claims require posting of corners, as the corner posts define the actual claim location and mineral rights acquired. Typically such locators are defined using global positioning system (GPS) instruments.

Annual rental payments for a mining claim, leasehold location, or mining lease are based on the number of years since the concession was first located. Claims that were located before 31 August 1989 have that date as their commencement date for fee payment purposes.

Rental payments are required as follows:

- For all traditional mining claims and quarter–quarter section MTRSC locations, the annual rental amount is $35/year for the first five years, $70/year for the second five years and $170/year thereafter;
- For all quarter section MTRSC locations, the annual rental amount is $140/year for the first five years, $280/year for the second five years and $680/year thereafter;
- For all leases, the annual rent is $0.88/acre ($2.17/ha) per year for the first five years, $1.75/acre ($4.32/ha) for the second five years, and $4.25/acre ($10.50/ha) per year thereafter.

There is also a minimum labor requirement for each mining claim. Under Alaska legislation, "labor" includes geological, geochemical, geophysical, and airborne surveys conducted by qualified experts and verified by a detailed report lodged with the appropriate Alaskan authorities. Included as labor is such work as drilling, excavations, driving shafts and tunnels, sampling (geochemical or bulk), road construction on or for the benefit of the mining claim, in addition to the

Commitments are:

- $100 per claim, leasehold location, or lease if the claim, leasehold location, or lease is a quarter–quarter section MTRSC claim, leasehold location, or lease;
- $400 for each quarter section;
- $100 for each partial or whole 40 acres (16 ha) of each mining claim, leasehold location, or lease not established using the MTRSC system.

If more work is performed than required to meet minimum commitments, then an application can be made to have the excess applied against the following year, or for as many as four years. There is provision for a cash payment to be made in lieu of work expenditure.

At any time in the exploration or production process, a claimholder may convert the mining claim to a mining lease. Mining leases have the same rental and production royalty rates do mineral claims, and require annual claim filing and recordation. Each lease title defines specific rights of control and tenure for that lease that may otherwise be open to conflict with third party claimants or other multiple use users of the State land.

A mining lease shall be for any period up to 55 years, and is renewable if requirements for the lease remain satisfied.

Minerals on State lands cannot be patented.

4.1.2 Surface Rights

Federal Lands

Of the total area of Alaska, 60% (222 million acres or 89.8 million ha) is classed as Federal lands. The USFS and BLM manage about 98 million acres (39.7 million ha) (20 and 78 million acres (8.1 million and 31.6 million ha) respectively) for multiple use purposes including timber production, fish and wildlife, recreation, water and mining.

Mineral tenure holders do not have surface rights, but do have the rights to concurrent use of land to the extent necessary for the prospecting for, extraction of, or basic processing of mineral deposits once necessary permits have been obtained. Requirements for BLM land vary from those for USFS-administered lands.

State Lands

When Alaska became a state in 1959, the federal government granted the new state 28% ownership of its total area. Approximately 103,350,000 acres (41.8 million ha) were selected under three types of grants:

- Community (400,000 acres or 162,000 ha);
- National Forest Community (400,000 acres or 162,000 ha);
- General (102,550,000 acres or 41.5 million ha).

Additional territorial grants, for schools, university and mental health trust lands; totaling 1.2 million acres (486,000 ha) were confirmed with statehood.

Mineral tenure holders do not have surface rights, but do have the rights to concurrent use of land to the extent necessary for the prospecting for, extraction of, or basic processing of mineral deposits.

Where surface rights are held by a third-party other than the State, appropriate compensation must be negotiated with the owner.

Alaska Native Claims Settlement Acts Lands

In 1971 Congress passed the Alaska Native Claims Settlement Act (ANSCA). This law granted 44 million acres (17.8 million ha) and $1 billion to village and native corporations created under the act. Generally, ANSCA gave Native selections priority over state land selections. Native lands are private lands. Thirteen regional corporations were created for the distribution of ANSCA land and money. Twelve of those shared in selection of 16 million acres (6.5 million ha), the 13th corporation, based in Seattle, received a cash settlement only. A total of 224 village corporations, of 25 or more residents, shared 26 million acres (10.5 million ha). The remaining acres, which include historical sites and existing native-owned lands, were allocated to a land pool to provide land to small villages of less than 25 people.

Agreements and compensation for land access and infrastructure construction must be separately negotiated with ANSCA holders.

4.1.3 Water Rights

The Alaska Water Use Act defines water rights as:

A water right is a legal right to use surface or groundwater under the Alaska Water Use Act (AS 46.15). A water right allows a specific amount of water from a specific water source to be diverted, impounded, or withdrawn for a specific use. When a water right is granted, it becomes appurtenant to the land where the water is being used for as long as the water is used. If the land is sold, the water right transfers with the land to the new owner, unless the Department of Natural Resources approves its separation from the land. In Alaska, because water wherever it naturally occurs is a common property resource, landowners do not have automatic rights to groundwater or surface water.

4.1.4 Permits and Environmental

Permits issued by federal agencies constitute “federal actions.” Any major federal action requires review under the National Environmental Protection Act (NEPA). A number of agencies can be involved in the review, at both the Federal and State levels. Other agencies are involved for specialist areas, such as transport of explosives, communication licenses, and landing strips for aircraft.

Typically, for larger metalliferous projects in Alaska, agencies involved in the permitting process can include:

- Bureau of Land Management (BLM);
- Federal Aviation Administration (FAA);
- United States Forest Service (USFS);
- National Marine Fisheries Service (NMFS);
- U.S. Coast Guard;
- U.S. Army Corps of Engineers (USACE);
- Environmental Protection Agency (EPA);
- Bureau of Alcohol, Tobacco, and Firearms (BATF);

- Federal Communications Commission (FCC);
- U.S. Department of Homeland Security;
- U.S. Department of Transportation (DoT);
- Mine Safety and Health Administration (MSHA);
- Alaska Department of Natural Resources (ADNR);
- Alaska Department of Environmental Conservation (ADEC);
- Alaska Department of Fish and Game (ADFG).

The federal agency with the predominant federal permit is usually designated the lead for the NEPA process. During the permitting process, the agencies identified as requiring input into the process will review the proposed Project, evaluate impacts associated with each facet of the Project, consider alternatives, identify compliance conditions, and ultimately decide whether or not to issue the requested permits.

Upon completion of the NEPA process, a Record of Decision is prepared that supports issuance of the permit for the preferred alternative for the Project, describes the conditions of the decision to issue the permit, and explains the basis for the decision. The state permitting process typically is not finalized until the NEPA process is completed. Each federal and state permit has compliance stipulations requiring review and possibly negotiation by the applicant and appropriate agency.

Reclamation

The US Mining Laws, specifically 43 CFR 3809 on the federal level, define the reclamation standards for mines operated since 1981. An Alaskan State law regulates the reclamation procedures on private, state, and federal lands for mines operated since mid-October 1991. The Department of Natural Resources and Division of Water and Mining issued the reclamation requirements. Briefly, requirements are that all mined land be returned to a stable state, that post-mining erosion be minimized, and that the potential for natural re-vegetation be enhanced. Before a mining permit can be issued, the mining company must first submit a plan for reclamation.

An approved reclamation plan from the appropriate Alaskan regulatory authority is required prior to mining operations commencement. An individual financial assurance is normally required, although for certain mining operations, the State will allow a bonding pool. However, a mining operation may not be allowed to participate in the bonding pool if the mining operation will chemically process ore, or has the potential to generate acid.

The Alaskan Commissioner determines the amount of the financial assurance needed after consideration of the reasonable and probable costs of reclamation for that operation. There are a number of methods of meeting the financial assurance requirements, including a surety bond, letter of credit, certificate of deposit, a corporate guarantee that meets the financial tests set in regulation by the commissioner, or payments and deposits into a specified trust fund. Typically companies establish a fund under the Alaskan "Trust Fund for Reclamation, Closure & Post-Closure Obligations", such that the amount in the fund is sufficient to generate adequate cash flow to cover all reclamation, closure, and post-closure costs.

4.1.5 Royalties

A mining license tax (MLT) is payable on all production from State, Federal or private lands. This tax is on a net profits basis with a no-tax grace period for the first 3.5 years from when a mine goes into production. If annual net income is less than $40,000, there is no MLT. If annual net income is between $40,000 and $100,000 the MLT rate is 5%. If annual net income is above $100,000, the MLT rate is 7%.

Applying to State lands only, there is also a 3% production royalty that is calculated on the same net profits basis as the mining license tax. This production royalty is payable on all State land production and does not include the 3.5 year grace period. Failure to file and pay this royalty will result in loss of claims.

No Federal taxes are currently levied; however, royalties are payable by Hecla to the Federal Government in certain instances (see Section 4.3).

4.1.6 Taxation

Mining projects in Alaska are typically subject to the following major taxes:

- Federal Income Tax = 35% subject to an Alternative Minimum Tax of 20%
- Alaska State Income Tax = 9.4% subject an Alternative Minimum Tax of 18% of Apportioned Federal Alternative Minimum Tax
- Alaska State Mining License Tax = 7% of taxable mining income

4.2 Project Ownership

The Pan Sound Joint Venture, formed in 1973, consisted of joint venture partners Noranda Exploration (29.73%), Marietta Resources International (29.73%), Exhalas Resources Corporation (29.73%), and Texas Gas Exploration (10.81%). Under the Pan Sound Joint Venture, the first mineral claims were staked over the Big Sore vegetation and geochemical anomaly.

Bristol Bay Resources (Bristol), a company held by the Bristol Bay Native Corporation, joined the original partners in 1976.

In 1978, the Pan Sound Joint Venture was dissolved, and the Greens Creek Joint Venture created, with the same partners holding the interests in the Greens Creek Joint Venture.

Bristol sold its 11.2% interest in 1988 to Noranda and Hawk Inlet Company, with a half interest sold to each party. Bristol retained a 2.5% NSR royalty on its 11.2% share as part of the sale.

In 1982, Anaconda Minerals bought Marietta's interest and, in 1986, Amselco (a unit of BP Minerals) purchased both Anaconda's and Noranda's interests, subsequently selling off a portion to Hecla in 1987.

Texas Gas changed its name to CSX Alaska Mining Company, Inc. (CSX) in 1987. Following the merger of British Petroleum and Sohio, Kennecott Minerals (Kennecott) acquired Amselco in 1987.

The three remaining joint venture partners, Kennecott, Hecla, and CSX, bought out Exhalas Resources Corporation in 1993. Kennecott Minerals bought out CSX in 1994, and CSX changed its name to Kennecott Juneau Mining Company (KJMC). At that time, the ownership was Kennecott Greens Creek Mining Company (KGCMC) with a 57.75% interest, KJMC with a 12.52% interest and Hecla with an interest of 29.73%.

In 1994, the Greens Creek Joint Venture agreement was restated in order to resolve certain issues between the Joint Venture participants.

KGCMC operated the mine up to 2008 with Hecla maintaining its 29.73% interest. On April 6, 2008, Hecla Mining Company completed its transaction to acquire KGCMC's 57.75% and KJMC's 12.52% interests in the Joint Venture (the Kennecott subsidiaries which held the remaining 70.27% interest in the Greens Creek mine). As a result, Hecla subsidiaries now hold 100% of the Greens Creek Joint Venture.

The current ownership structure is illustrated in Figure 4-1.

4.3 Mineral Tenure

The Project core claims at Big Sore are held in the name of Hecla Greens Creek Mining Company, a wholly-owned Hecla subsidiary.

Figure 4-2 is a layout plan showing the breakdown of the various land holdings in the greater Project area. Table 4-1 and Table 4-2 present a summary of the Hecla ground holdings. Details of the unpatented claims are included in Appendix A. The holding obligations are summarized in Table 4-3. The annual maintenance fees of US$125 per claim required to hold the unpatented mining claims have been paid annually to the US

Bureau of Land Management, and the required annual filing fees have been paid to Juneau Recording District, State of Alasks. The claims have been properly maintained and are in good standing. Hecla owns the patented mining and millsite claims and fee parcels, and pays the assessed property taxes, which payments are current as of the date of this report.

Figure 4-1: Ownership Structure, Greens Creek Mining Operations

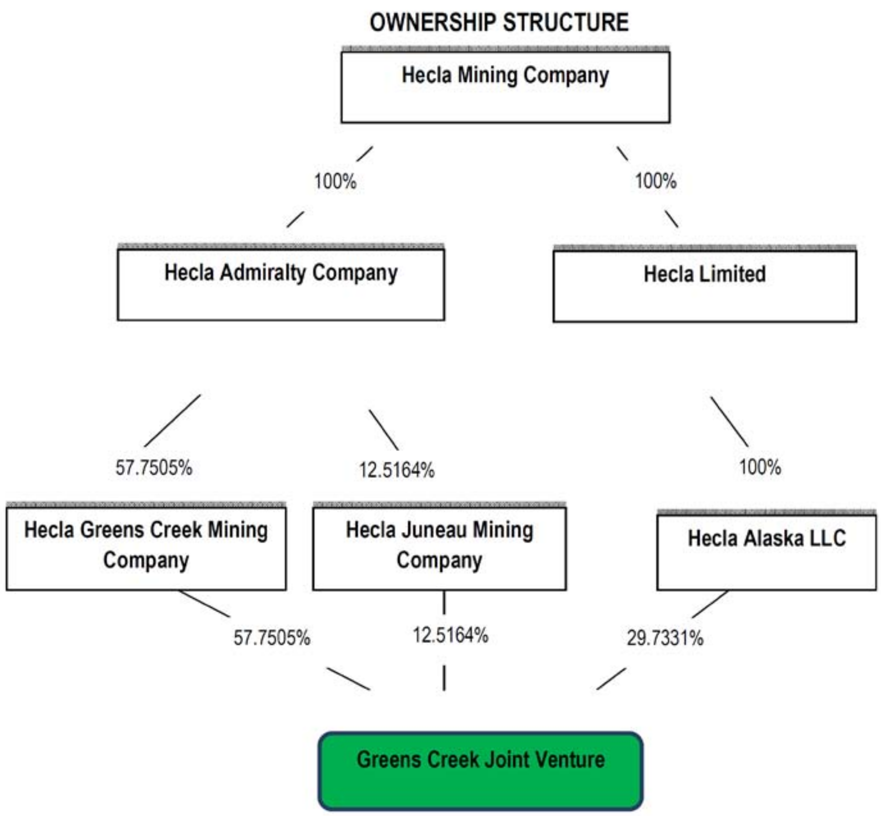


Figure 4-2: Project and Regional Land Holdings Layout Plan

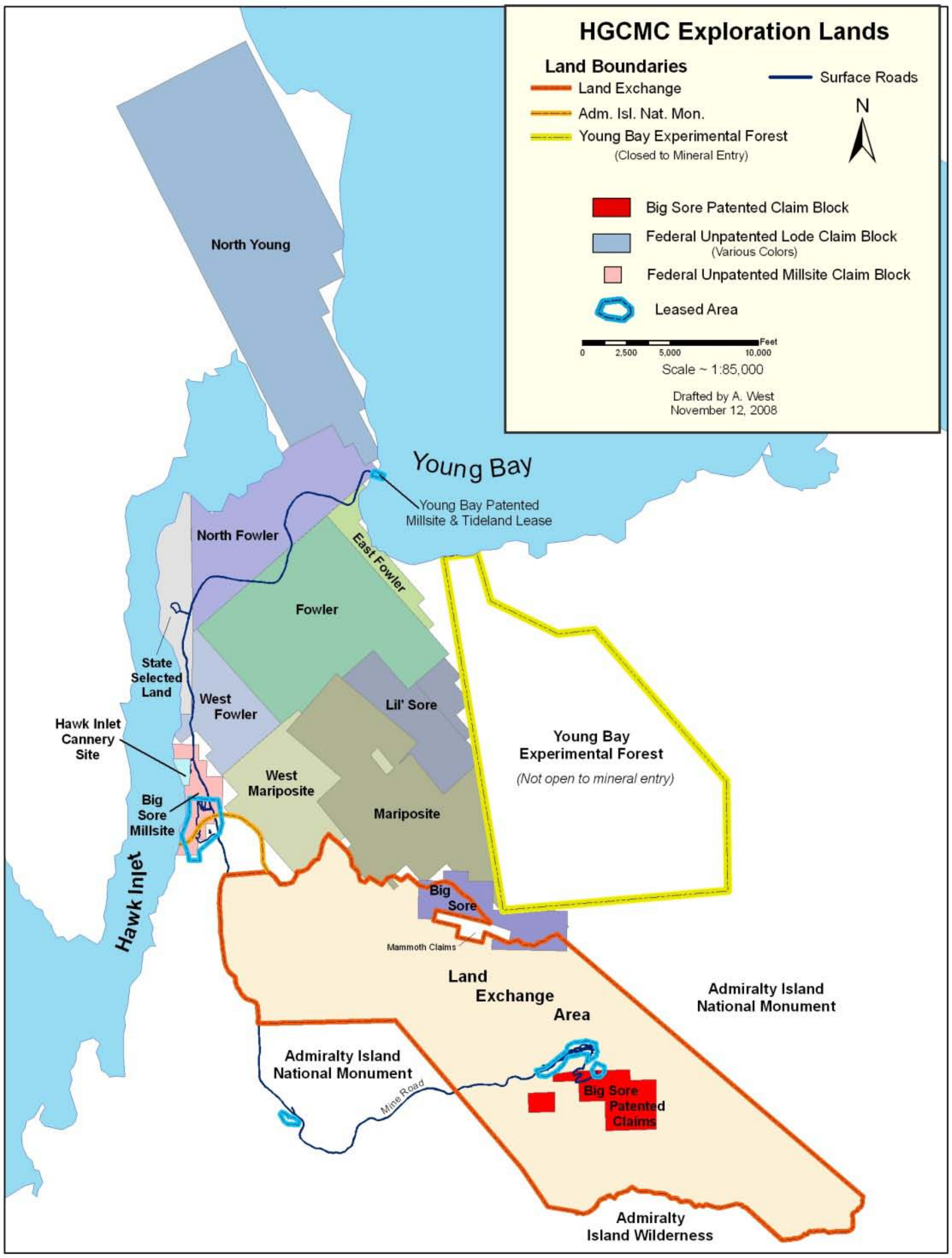


Table 4-1: Summary, Patented Claims, and Mill Sites

Claim Names	Number	BLM Serial No. or Survey No. or ADL No.	Type	Acreage
Patented Claims				
Big Sore #s 902, 903, 904, 905, 906, 1006, 1007 and Big Sore #1305	8	Mineral patent Surveys: MS2402, MS2515	Patented surface and subsurface ("fee simple") lode mining claims	155.366 (62.874 ha)
Big Sore #s 1002, 1003, 1004, 1005, 1106, 1107; Big Sore #1105, 1207; and Big Sore #1304	9	Mineral Patent Surveys: MS2402, MS2515, MS2516	Patented lode	171.825 (69.535 ha)
Patented Millsite				
Young No. 1 millsite	1	Mineral Patent Survey: MS2514	Patented millsite, patented (surface) in Dec. 1992	0.6151 (0.2489 ha)

Table 4-2: Summary, Land Exchange, and Other Fee Properties

Property Name	Number	BLM Serial No. or Survey No. or ADL No.	Type	Acreage
Exchange lands (Greens Creek Land Exchange Act of 1995)	N/A	Pat. No. 50-98-0434; U.S. Survey No. 11840, Alaska	Sub-surface mineral estate, surface considered AINM non-wilderness for mining development purposes	7,301.48 acres (2,954.80 ha)
Hawk Inlet Cannery site	1	U.S. Survey No. 793		16.83 acres (6.81 ha)
Hawk Inlet Cannery site tidelands	1	Alaska Tidelands Survey No. 57/ Serial No. 63-1523		21.019 acres (8.5 ha)
Exchange lands (Greens Creek Land Exchange Act of 1995)	N/A	Pat. No. 50-98-0434; U.S. Survey No. 11840, Alaska	Sub-surface mineral estate, surface considered AINM non-wilderness for mining development purposes	7,301.48 acres (2,954.80 ha)
Hawk Inlet Cannery site	1	U.S. Survey No. 793		16.83 acres (6.81 ha)
Hawk Inlet Cannery site tidelands	1	Alaska Tidelands Survey No. 57/ Serial No. 63-1523		21.019 acres (8.5 ha)

Table 4-3: Summary, Claims Holding Obligations

Names	Number	Type	Acreage	Holding Costs	Royalties	Comments
Big Sore #'s 902, 903, 904, 905, 906, 1006, 1007 (MS 2402) and Big Sore # 1305 (MS 2515)	8	patented surface and sub-surface ('fee simple') Federal lode mining claims	155.366 (62.874 ha)	property taxes	none	within Exchange Lands; represents so-called "perfected" claims in the immediate mine area (core claims with valid discoveries **as of** 12/1/78)
Big Sore #'s 1002, 1003, 1004, 1005, 1106, 1107 (MS 2402); Big Sore # 1105, 1207 (MS 2516); and Big Sore # 1304 (MS 2515)	9	patented sub-surface Federal lode mining claims	171.825 (69.535 ha)	property taxes	none	within Exchange Lands; represent so-called "unperfected" claims in the immediate mine area (core claims with valid discoveries made **after** 12/1/78)
Young No. 1 Millsite	1	Federal millsite claim, fully patented (surface) in Dec. 1992	0.6151 (0.2489 ha)	property taxes	none	outside of AINM within standard Tongass National Forest lands; claim provides a site for Young Bay dock and parking facility
Big Sore 1321-1324, 1421-1424, 1521-1524, 1623-1627, 1723-1728, 1824-1827	27	unpatented Federal lode mining claims	claimed acreage, @ 20 acres/claim, is 540 acres (219 ha); valid acreage is **much less**	$125/year/claim BLM rental fees, plus filing/recording fees	none	Mariposite Ridge area (abutting the Mammoth claims) within Tongass National Forest lands but overlapping **into** AINM; a portion of this claim block is invalid
Mariposite 1-77, 79-87, 100-114	101	unpatented Federal lode mining claims	claimed acreage, @ 20 acres/claim, is 2,020 acres (817 ha); because of overlaps actual valid acreage will be l**ess**	$125/year/claim BLM rental fees, plus filing/recording fees	none	multiple groups staked in 80's; on Tongass Nat'l Forest lands; portions may be invalid due to overlaps, especially with Lil Sore block
West Mariposite 115-123, 128-156, 159-165, 168-171	49	unpatented Federal lode mining claims	claimed acreage, @ 20 acres/claim, is 980 acres (397 ha); because of overlaps actual valid acreage will be l**ess**	$125/year/claim BLM rental fees, plus filing/recording fees	none	staked in 1996; on Tongass Nat'l Forest land:
Lil' Sore 1-40	40	unpatented	claimed acreage, @ 20	$125/year/claim BLM	none	staked in early 80's; on

Names	Number	Type	Acreage	Holding Costs	Royalties	Comments
		Federal lode mining claims	acres/claim, is 800 acres (324 ha); because of overlaps actual valid acreage will be less	rental fees, plus filing/recording fees		Tongass Nat'l Forest lands; overlaps well into administratively defined Exper. Forest
Lil Sore 41-48	8	unpatented Federal lode mining claims	claimed acreage, @ 20 acres/claim, is 160 acres (65 ha); because of overlaps actual valid acreage will be less	$125/year/claim BLM rental fees, plus filing/recording fees	none	staked in 1996; on Tongass Nat'l Forest land; borders Lil' Sore block to W, Fowler block to N, Young Bay Experimental Forest to E
Fowler 543-558, 643-658, 743-758, 843-858, 943-958, 1043-1047, 1143-1147	90	unpatented Federal lode mining claims	claimed acreage, @ 20 acres/claim, is 1,800 acres (728 ha); because of overlaps actual valid acreage will be less	$125/year/claim BLM rental fees, plus filing/recording fees	none	staked in 1985; on Tongass Nat'l Forest land; bordered by West Fowler, North Fowler, & East Fowler; Lil Sore and Mariposite blocks to S
North Fowler 41, 141-149, 226-246, 250-251, 336-358, 363, 436-461	83	unpatented Federal lode mining claims	claimed acreage, @ 20 acres/claim, is 1,660 acres (672 ha); because of overlaps actual valid acreage will be less	$125/year/claim BLM rental fees, plus filing/recording fees	none	93 claims staked in 1996; on Tongass Nat'l Forest land; 10 claims were declared Null and Void Ab Initio (and portions of 12 others) by BLM in February 1997 (State Selected Land)
West Fowler 559-561, 659-664, 759-767, 859-865, 959-966	33	unpatented Federal lode mining claims	claimed acreage, @ 20 acres/claim, is 660 acres (267 ha); because of overlaps actual valid acreage will be less	$125/year/claim BLM rental fees, plus filing/recording fees	none	staked in 1996; on Tongass Nat'l Forest land; 7 claims abandoned in April 1997 that overlapped new millsites claims, 1 declared Null and Void Ab Initio (and portions of 10 others) by BLM in February 1997 (State Selected Land)
East Fowler 538-542, 641-642, 741-742, 841-842, 941-942, 1042	14	unpatented Federal lode mining claims	claimed acreage, @ 20 acres/claim, is 280 acres (113 ha); because of overlaps actual valid acreage will be less	$125/year/claim BLM rental fees, plus filing/recording fees	none	41 claims staked in 1996; on Tongass Nat'l Forest land;

Names	Number	Type	Acreage	Holding Costs	Royalties	Comments
Big Sore Mill site Nos. 798, 802-803, 899-902, 904-907, 996, 1001-1010, 1096-1097, 1103-1108, 1202-1205, 1505-1508, 1509-1511, 1514, 1516-1517, 1610-1614, 1710-1718	58	unpatented Federal mill site mining claims	claimed acreage, @ 5 acres/claim, is 290 acres (117 ha)	$125/year/claim BLM rental fees, plus filing/recording fees	none	25 were re-staked in Fall 1993; on Tongass Nat'l Forest land; covers main tailings area; 33 sites to the north and east were re-staked in May 2002 (originally staked in Fall 1996)
HIP 010, 020, 030, 040, and 050	5	Alaska State Prospecting Sites	claimed acreage is 800 acres (324 ha) (1/4 section, 160 acres, per pros. site), 'valid' acreage is roughly 1/2 that due to shoreline	no rentals, no fees, no filings required **until land tentatively approved,** costs thereafter would be same as the state tideland claims	3% net income production royalty	staked in Feb 1996; on State selected lands along E side of Hawk Inlet, **status in limbo**; no development allowed until state selections are tentatively approved (has not happened as of Sept, 2005)
Hawk Inlet Cannery site	1	fee simple land (US survey 783) owned by KGCMC	16.83 acres (6.81 ha)	property taxes	NA	acquired from Bristol Resources, Inc.
Hawk Inlet Cannery site tidelands	1	Alaska Tidelands Survey No. 57	21.019 acres (8.50 ha)	property taxes	NA	acquired from Bristol Resources, Inc.
Exchange Lands (Greens Creek Land Exchange Act of 1996)	NA	sub-surface mineral estate, surface remains AINM non-wilderness	7,301 acres (2,955 ha)	none	3% net island receipts (NIR) production royalty; 3/4% NIR when NIR value is less than $120/ton ore	Completed in 1998; no surface mining allowed; 100 year expiration of conveyance
North Young Bay #'s 1106-1120, 1206-1220, 1306-1320, 1406-1420, 1506-1520, 1606-1620, 1706-1720, 1806-1820, 1906-1920, 2008-2020, 2111-2120, 2212-2220, 2312-2320, 2412-2420, 2512-2520, 2613-25-15,	199	unpatented Federal lode mining claims	claimed acreage, @ 20 acres/claim, is 3,980 acres (1,611 ha); because of overlaps actual valid acreage will be l**ess**	$125/year/claim BLM rental fees, plus filing/recording fees	none	staked in Sept 2008 on Tongass Nat'l Forest land north of the Young Bay dock, on east side of the Mansfield Peninsula.

Names	Number	Type	Acreage	Holding Costs	Royalties	Comments
2713-2714						
727 total unpatented and patented claims and mill sites, state prospecting sites and tideland claims; including Exch. Lands, **approximately 19,300 acres** (7,810 ha) encompassed			approximate total direct holding costs, excluding property taxes, are **$87,750 plus approx $1720** in recording costs			***** excluding Forest Service leases and State tideland leases (approx. 113 acres (46 ha) total) ****** AINM is Admiralty Island National Monument

The Greens Creek property includes 639 unpatented lode mining claims, 58 unpatented millsite claims, 17 patented lode claims, one patented millsite and other fee lands, notably the Hawk Inlet historic cannery site. Hecla also holds title to mineral rights on 7,301 acres (2,955 ha) of Federal land acquired through a land exchange with the USFS.

4.3.1 Patented and Unpatented Claims

The patented lode claims, containing approximately 327 acres (132 ha), are located in Sections 4, 8, 9 and 10, Township 44 South, Range 66 East, Copper River Meridian, Juneau Recording District, Alaska. The 0.62 acre (0.25 ha) millsite claim is located in Section 1, Township 43 South, Range 65 East.

The unpatented lode and millsite mining claims are situated in Sections 10-11, 13-15, 22-26, 35-36, Township 42 South, Range 65 East, Sections 1-3, 10-15, and 22-26, Township 43 South, Range 65 East, and Sections 7, 17-20, 22, 23, 26 and 29-33, Township 43 South, Range 66 East, Copper River Meridian. The unpatented lode and millsite claims encompass approximately 9,500 acres (3,844 ha).

4.3.2 Leasehold Lands

Greens Creek leases parcels from the United States on both the Monument and non-monument lands. It uses other public lands pursuant to special use permits issued by the USFS and leases issued by the State of Alaska. Some areas within the Monument required for the road right-of-way, mine portal and millsite access, campsite, mine waste area and a tailings impoundment are governed by USFS leases. Alaska National Interest Lands Conservation Act (ANILCA) is the legal basis for these leases and others which may be required.

4.3.3 Land Exchange Properties

Pursuant to “The Federal Greens Creek Land Exchange Act of 1995” (Pub. L. 104-123 April 1, 1996), 7,301 acres (2,955 ha) of mineral lands (subsurface estate and certain restricted surface use rights) surrounding the core group of 17 patented claims were conveyed to the Greens Creek Joint Venture in exchange for $1.0 million of private lands purchased by the Venture and a royalty on mineral production from the Land Exchange properties. Previously patented claims, including associated extralateral rights, are not subject to the royalty. The property extents are approximately from Section 23, Township 42 South, Range 65 East, to Section 32, Township 44 South, Range 66 East.

The Land Exchange properties conveyed are subject to:

(i) Restrictive covenants limiting surface use; and

(ii) A future interest held by the United States which pertains to the Land Exchange properties, the core claims and other Greens Creek properties.

The future interest vests with the United States upon the earlier of

(iii) Abandonment of the properties;

(iv) January 1, 2045 (absent good faith mineral exploration, production or reclamation); or

(v) January 1, 2095.

Hecla is currently exploring, but not mining, on such Federal lands.

4.4 Surface Rights and Property Agreements

The land comprising the Greens Creek mine, inclusive of all Admiralty Island facilities, consists of both publicly- and privately-owned land. It owns land on Admiralty Island both as a result of patenting mining and millsite claims and through transfer of private lands in the historic cannery area from its predecessor.

As noted in Section 4.3.2, Hecla leases parcels from the United States on both the Monument and non-monument lands. Hecla uses other public lands pursuant to special use permits issued by the USFS and leases issued by the State of Alaska.

Additionally, Hecla holds subsurface and restricted surface use rights under the Land Exchange.

4.4.1 USFS Agreement

Kennecott and the USFS began discussing the possibility of the existence of extralateral rights at Greens Creek in about 1990. In 1994, Kennecott prepared a comprehensive geologic and legal analysis of extralateral rights at the Greens Creek mine based upon the geologic information then available. Based upon that analysis, the USFS agreed that extralateral rights exist with respect to the Big Sore claims.

At Greens Creek, underground mining has progressed outside of the vertical boundaries of the mining claims under the extralateral rights. Hecla and predecessor companies have also conducted underground exploration beyond the mining claims' vertical boundaries.

In addition to the right to mine inherent in the Big Sore claims and the extralateral rights acknowledged by the USFS, Kennecott was granted mining rights pursuant to US Patent No. 50-98-0434 (AA-80626; the Patent) and the associated Agreement dated December 14, 1994 between Kennecott and the United States (the Patent

Agreement). Hecla is also bound by these agreements and granted rights, and each of these rights carries with it somewhat different mining or possessory rights.

First, as it has done historically, Hecla can mine each and every deposit of ore found within the vertical boundaries of the Big Sore claims based upon the intraliminal rights that are inherent to every mining claim. Second, to the extent extralateral rights associated with the Big Sore claims can be demonstrated to exist, Hecla can mine “down dip” on a vein outside of the vertical boundaries of the claims. As long as Hecla stays within such vertical planes, there is no limit how far down dip it can mine. And third, pursuant to the Patent and the Patent Agreement, Hecla is permitted to mine a specified area (the Agreement Area) outside of the vertical boundaries of the Big Sore claims even where no extralateral rights can be shown to exist.

To the extent Hecla mines pursuant to its intraliminal rights, i.e., the right inherent in the Big Sore claims, it is not obligated to make any royalty payment to the Federal Government. Likewise, to the extent Hecla mines pursuant to extralateral rights, i.e., down dip on a vein within vertical planes drawn through the end line of a claim that has extralateral rights, it is not obligated to make any royalty payment to the Federal Government.

When Hecla mines a mineral deposit located outside of the Big Sore claims where it cannot demonstrate extralateral rights, it must mine pursuant to the Patent and the Patent Agreement. The Patent and the Patent Agreement carry with them the obligation to pay a royalty to the Federal Government (the Federal Royalty, see Section 4.3). In addition, the area that can be mined is geographically limited to the Agreement Area.

From the statutory language of the General Mining Law, courts have established a number of requirements that must be met in order to obtain extralateral rights:

- The deposit involved must be a “lode” or a “vein”;
- The deposit must “apex” within the claim boundaries;
- The deposit must “dip”, and not be horizontal;
- The deposit must be “continuous”; and
- The deposit can only be pursued beyond the vertical boundaries of the side lines of a claim within planes parallel to the end lines of the claim.

These definitions of what constitute the basis for extralateral rights are being reviewed in relation to known mineralization, in particular the Gallagher zone, which is adjacent to and appears to extend into, the Land Exchange boundaries. Hecla is currently exploring the relationships of the Greens Creek orebodies to the Gallagher zone, and evaluating the influence of a major structural boundary, the Gallagher fault, on mineralization continuity. If extralateral rights across the Gallagher fault are not established, then the Gallagher zone would be subject to a royalty to the US Government.

4.5 Royalties and Encumbrances

Bristol Resources holds a 2.5% net smelter return royalty based on 11.2142% of the Greens Creek Joint Venture. This royalty is the sole responsibility of the Hecla Juneau Mining Company ownership interest (12.5164%; refer to Figure 4-1 for the ownership interest breakdown).

The royalty was payable once a calculated "capital recovery amount" of $26.5 million was recouped. The capital recovery amount is based on a percent of the capital investment related to the original feasibility study, the original purchase price of Bristol's ownership share, and interest accumulated for a four-year period. Earnings applied to capital recovery were essentially calculated based on 11.2142% of net income before non-cash charges and income tax.

The NSR value used in the Bristol Resources royalty is calculated as follows:

- Net proceeds from smelter;
- Less on-island concentrate transportation, storage, and ship loading costs;
- Less severance taxes.

Under the Land Exchange, production from new discoveries on the exchanged lands will be subject to Federal royalties included in the Land Exchange Agreement. The royalty is only due on production from Mineral Reserves that are not part of Greens Creek's extralateral rights. Thus far, there has been no production, and no payments of the royalty have been triggered.

The Land Exchange properties are subject to a royalty payable to the USFS that is calculated on the basis of net island receipts (NIR). Net island receipts are equal to revenues from metals extracted from the Land Exchange properties less transportation and treatment charges (e.g., smelting, refining, penalties, assaying) incurred after loading at Admiralty Island.

The Net Islands Receipt royalty is 3% if the average value of the ore during a year is greater than $120 per ton ($132/tonne) of ore, and 0.75% if the value is $120 per ton ($132/tonne) or less. The benchmark of $120 per ton ($132/tonne) is adjusted annually according to the US Gross Domestic Product (GDP) Implicit Price Deflator until the year 2016, and at December 31, 2012, was at approximately $167 per ton ($184/tonne) when applying the latest GDP Implicit Price Deflator. Under the terms of the Land Exchange Agreement, the NIR will continue be adjusted annually until

20 years after operations commenced, meaning annual adjustments will continue until 2016, and after 2016, the rate will be fixed.

4.6 First Nations

Hecla complies with all state and federal employment laws, which identify Native Alaskans as a protected minority classification. No other specific regulations regarding indigenous peoples apply to the Project.

4.7 Permits

Permitting considerations for the Project are discussed in Section 20.

4.8 Environmental Liabilities

The environmental status of the Project is discussed in Section 20.

4.9 Social License

The social license considerations for the Project are discussed in Section 20.

4.10 Comments on Property Description and Location

In the opinion of the QPs, the information discussed in this section supports the declaration of Mineral Resources and Mineral Reserves, based on the following:

- The Project is wholly-owned by an indirectly held Hecla subsidiary;
- Information provided by Hecla land tenure experts supports that the mining tenure held is valid and is sufficient to support declaration of Mineral Resources and Mineral Reserves;
- Hecla holds sufficient surface rights in the Project area to support the mining operations, including access and power line easements;
- Royalties are payable on the Bristol and USFS Land Exchange lands; no royalty payment has yet been triggered on USFS lands;
- Hecla holds the appropriate permits under local, State and Federal laws to allow mining operations;
- The appropriate environmental permits have been granted for Project operation;
- At the effective date of this Report, environmental liabilities are limited to those that would be expected to be associated with an operating base metals mine where

production occurs from underground sources, including roads, site infrastructure, waste dumps and disposal facilities;

- Hecla is not aware of any significant environmental, social or permitting issues that would prevent continued exploitation of the deposit;
- To the extent known, there are no other significant factors and risks that may affect access, title, or the right or ability to perform work on the property.

5.0 ACCESSIBILITY, CLIMATE, LOCAL RESOURCES, INFRASTRUCTURE, AND PHYSIOGRAPHY

5.1 Accessibility

The majority of the area of Admiralty Island is part of the Admiralty Island National Monument, which covers an area of more than 955,000 acres (3,860 km²). The mine and plant site are located approximately five miles (8 km) up the Greens Creek valley with the mines' camp located at Hawk Inlet (refer to Figure 4-2).

The mine site is situated partly within the Admiralty Island National Monument and completely within the municipal boundaries of the City and Borough of Juneau.

Greens Creek employees are shuttled by ferry boat, which travels twice daily from Auke Bay, Juneau to Young's Bay dock on Admiralty Island. Air transport is also available, for hire, through Ward Air originating at the Juneau airport and landing at the dock at Hawk Inlet camp. A number of helicopter services are also available for hire and may, with proper clearance, land at two landing pads; one at Hawk Inlet camp and the second at the mine site in the Greens Creek valley.

Freight services operate via weekly scheduled barge with service originating in Seattle, Washington and subsequent connections to Juneau. Once on Admiralty Island, buses are used to transport passengers along an improved dirt and gravel road from Young's Bay dock to the Hawk Inlet camp or to the Greens Creek mine.

5.2 Climate

Admiralty Island is a temperate rainforest featuring a cool temperate climate milder than its latitude may suggest, due to the influence of the Pacific Ocean. Winters are moist, long but only slightly cold: temperatures drop to 20º F (−6.7º C) in January, and highs are frequently above freezing. Spring, summer, and fall are cool to mild, with average highs peaking in July at 65º F (18.3º C).

Annual snowfall on Admiralty Island averages 98 inches (213 cm) and occurs chiefly from November to March. Precipitation occurs year-round, ranging from 55 inches (1,400 mm) to 90 inches (2,290 mm) annually. The months of May and June are the driest while September and October are the wettest.

Admiralty Island's monthly temperature, precipitation and snowfall are summarized in Table 5-1.

Table 5-1: Climate Summary Table

Month	Average Maximum Temp (ºF)	Average Maximum Temp (ºC)	Average Minimum Temp (ºF)	Average Minimum Temp (ºC)	Average Total Precipitation (in.)	Average Total Precipitation (mm)	Average Total Snowfall (in.)	Average Total Snowfall (mm)
January	29	-1.7	18.2	-7.7	4.26	108	26.8	681
February	34.2	1.2	23	-5	3.92	100	19.6	498
March	38.7	3.7	26.6	-3	3.48	88	14.4	366
April	47.5	8.6	32.4	0.2	2.93	74	2.8	71
May	55.3	12.9	39.2	4	3.53	90	—	—
June	61.6	16.4	45.3	7.4	3.13	80	—	—
July	64	17.8	48.4	9.1	4.29	109	—	—
August	62.7	17.1	47.6	8.7	5.34	136	—	—
September	56	13.3	43.2	6.2	7.21	183	—	—
October	47	8.3	36.9	2.7	7.86	200	1.1	28
November	37.7	3.2	28.5	-1.9	5.43	138	11.7	297
December	32.5	0.3	23.4	-4.8	5.09	129	21.8	554
Annual	**47.2**	**8.4**	**34.4**	**1.3**	**56.47**	**1,434**	**98.4**	**2,499**

Mining activity occurs year-round.

Surface exploration at Greens Creek operates at elevations ranging from sea level to 3,300 feet (1,005 m). Weather is highly variable, ranging from sunny to week-long periods of low clouds and fog and because of this, exploration activities are conducted over five months; between May to October.

5.3 Local Resources and Infrastructure

Juneau is the closest large city. Operating supplies are shipped via weekly barge service from Juneau and Seattle in Washington State.

Project infrastructure and the infrastructure layout are discussed in Section 18 of the Report.

5.4 Physiography

Mine facility elevations range from the concentrate shipping facility, which is at sea level, to the 1350-adit at an elevation of 1,350 ft (412 m) above sea level . The mill and main mine portal are located at an elevation of 920 ft (280 m).

The ecology of Admiralty Island is dominated by temperate rainforest that is primarily made up of Sitka spruce, and western hemlock interspersed with small areas of muskeg. The timberline is typically at an elevation of 2,000 to 2,500 ft (610 m to 762 m). Above the timberline the forest gradually changes to alpine-tundra with rock outcrops and permanent and semi-permanent snow fields.

5.5 Comments on Accessibility, Climate, Local Resources, Infrastructure, and Physiography

In the opinion of the QPs:

- There is sufficient suitable land available within the mineral tenure held by Hecla for tailings disposal, mine waste disposal, and installations such as the process plant and related mine infrastructure. With the exception of a planned tailings storage facility expansion, all necessary infrastructure has been built on site and is sufficient for the projected LOM plan.
- A review of the existing power and water sources, manpower availability, and transport options indicate that there are reasonable expectations that sufficient labor and infrastructure will continue to be available to support declaration of Mineral Resources, Mineral Reserves, and the proposed LOM plan.

6.0 HISTORY

Information in this section is based on a summary prepared by West (2010) on the exploration history of the Greens Creek deposit, and updated for the period between 2001 and February 2013 by Hecla staff.

Work completed to February 2013 is presented in Table 6-1. The localities discussed in Table 6-1 are indicated in Figure 6-1. Mineralization was discovered at the "Big Sore" copper sub-crop in 1974. Mining operations commenced in 1989 but closed in 1993 due to low metal prices. In 1996, the mine was re-opened and production has continued to date.

Hecla obtained a 100% interest in the Project in 2008. Mine production from 1989 to 2012 is summarized in Table 6-2 in US customary units and in Table 6-3 in metric units. An overall life-of-mine summary is included as Table 6-4.

Table 6-1: Exploration Summary

Year	Operator	Work Completed/Company	Comment
1973	Pan Sound Joint Venture, a consortium vehicle of partners Noranda Exploration (29.73%), Marietta Resources (29.73%), Exhalas Resources (29.73%), and Texas Gas Exploration (10.81%)	Stream sediment sampling	Identified a zinc and copper anomaly associated with Cliff Creek, but no claims were pegged.
1974		Air reconnaissance inspection	Identified a large ferricrete zone that was vegetation free, the “Big Sore”; claims staking.
1974–1975		Additional stream sediment sampling, soil and rock sampling, Crone shoot-back electromagnetic (CEM) geophysical survey, surface magnetometer survey, geological mapping, trenching and blasting and drilling of three core holes	PS0001 (first surface drill hole) intersects a wide zone of mineralization at Big Sore.
1976	Noranda assumed operatorship of the Pan Sound Joint Venture	Geochemical sampling, CEM and magnetic surveys, geological mapping at Big Sore, core (five holes) and Winkie (AQ size; eight holes) drilling	First-time mineral resource estimate.
1977		22 holes totaling 8,810 ft (2,685 m) were completed at Big Sore, Killer Creek and Gallagher Creek. Additional soil sampling was undertaken over extensions to these areas, as was a CEM survey. Soil surveys, CEM and magnetic geophysical surveys, and geologic mapping were also carried out on the Zinc Creek and Mariposite Ridge prospects	
1978	Pan Sound Joint Venture was dissolved		Greens Creek Joint Venture formed in its place to accommodate the involvement of the Bristol Bay Native Corporation.
1978	Greens Creek Joint Venture	Exploration drift was started; a total of 24 underground drill stations were established, from which 50 core holes were collared. Environmental baseline studies commenced	By November 1979, 4,190 ft (1,277 m) of drift and a 219 ft (67 m) raise had been completed.
1980		33 core holes were completed and an Environmental Impact Assessment commissioned	The Alaska National Interest Land Conservation Act was passed, under which the Admiralty Island National Monument was created. The Greens Creek deposit and mineral tenure, although within the national monument zone, were excluded from the wilderness classification of the remainder of the national monument area. Section 504 of ANILCA allowed for exploration on previously located, unpatented claims that fell within three-quarters of a mile of Greens Creek, providing that exploration ceased in five years and any claims not “perfected” reverted to national monument status.

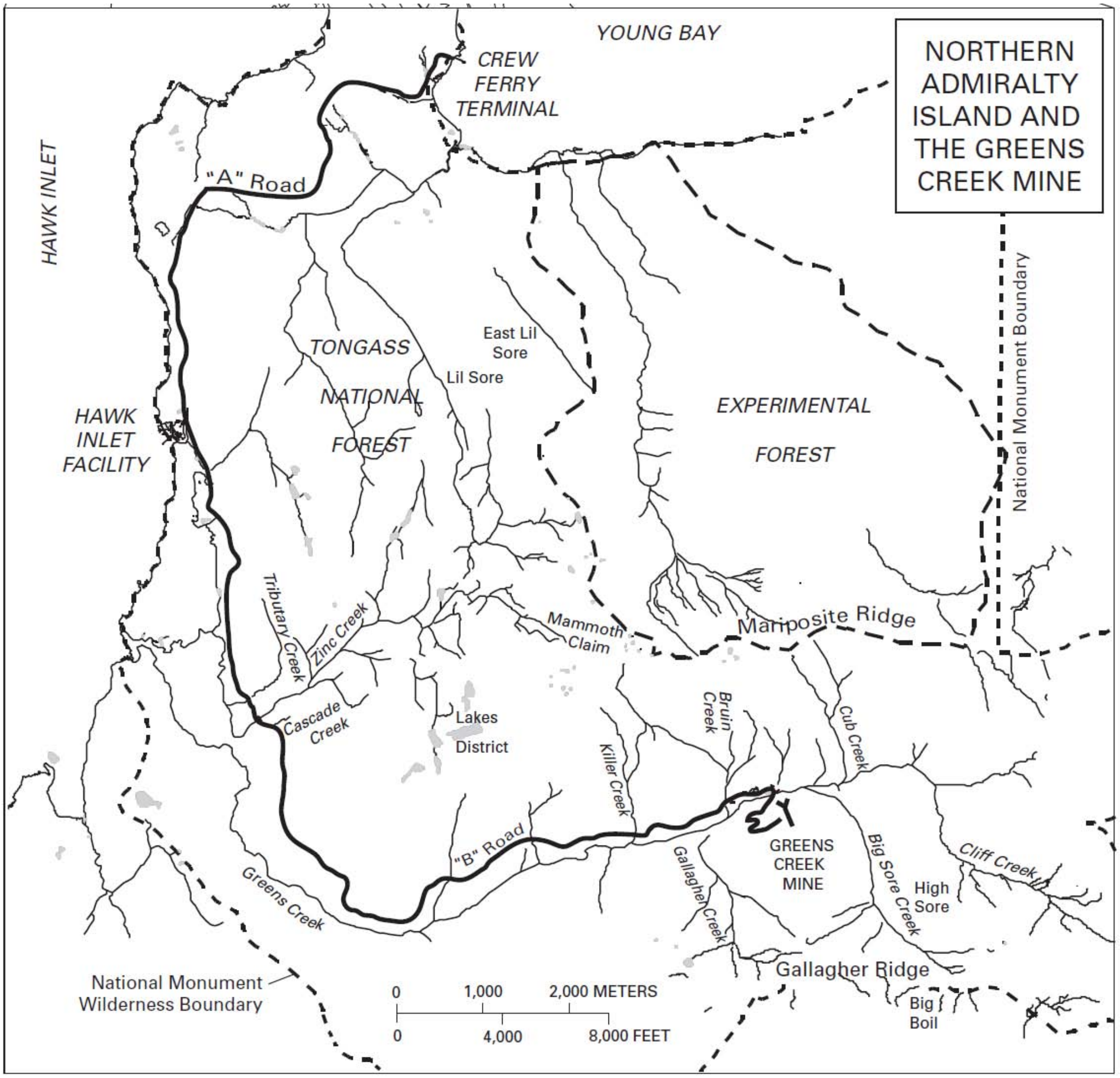
Year	Operator	Work Completed/Company	Comment
1981–1982		Metallurgical bulk sample. Surface core drilling (12 holes totaling 11,210 ft or 3,417 m) was conducted, with nine holes completed in the Big Sore area, two in Gallagher Creek, and one in Bruin Creek, on the north side of Greens Creek. Detailed geological mapping at a scale of 1 inch = 500 ft was conducted in the Greens Creek area	Development-support activities such as engineering and environmental studies. Mineral resource estimates updated.
1983	Anaconda purchased all of Martin-Marietta's interest in the Greens Creek Joint Venture in March 1983	17 holes drilled	Feasibility study completed.
1984	At the end of the year, Anaconda and Noranda equally bought out Bristol Bay Native Corporation's properties at Hawk Inlet for a cash payment and a 0.28-percent net smelter royalty. The land would revert back to Bristol Bay Native Corporation upon termination of the Greens Creek Joint Venture.	Surface drilling, mapping, trenching. Two bulk samples were mined, one of which was tested by Noranda, the second by Anaconda	
1985		10 holes totaling 12,266 ft (3,739 m) were completed from surface, and 47 holes and 34,749 ft (10,591 m) of drilling from underground	A 10-year lease with a drill commitment and royalty payment obligation on production was signed with the owners of the nearby Mammoth claims.
1986	Amselco (BP) become operator by buying out Anaconda and Noranda. Amselco sells portion to Hecla (%); CSX acquires Texas Gas.	Three surface holes, totaling 4,694 ft (1,431 m), and one underground exploration hole was drilled to 1,271 ft (387 m). Surface mapping and exploration at the Mammoth and Mariposite claim groups. Four EM and magnetic survey lines were flown. Mill and surface road construction begins.	No magnetic anomalies were delineated but six electo-magnetic anomalies were co-incident with known soil geochemical anomalies in the Big Sore area. At the end of the year, the Greens Creek Joint Venture lost all rights to the Big Sore claims except for the eight core claims and the nine additional perfected claims.
1987		Structural mapping and interpretation	
1988–1989		Engineering and technical studies in support of mine development	
1989	Rio Tinto Zinc buys Kennecott from BP(Amselco) and becomes operator.	Two surface holes were drilled in 1989, and underground exploration drilling conducted.	Mill start-up occurred in February 1989. Surface holes tested for down-dip extensions of the North ore zone. Underground drilling, also testing the North ore zone, identified mineralization at a previously unrecognized horizon at a lower elevation than the North ore zone.
1990		10 holes totaling 23,287 ft (7.098 m) completed to validate claims to the west of the core claim group at Big Sore	Underground drilling program intersected three new orebodies: the Central West, the Northwest West, and the Southwest zones. No additional surface drilling subsequently took place until the passage of the Land Exchange Act in 1996.
1990–1993		Underground drilling was continued to define the West, Northwest-West	Negotiations began on a new land-exchange proposal whereby

Year	Operator	Work Completed/Company	Comment
		and Southwest zones	private land in-holdings on Admiralty Island and other areas of the Tongass National Forest would be conveyed to the US Forest Service in return for the subsurface mineral rights to 6,875 acres (2,782 ha) surrounding the core claims. Greens Creek received title to the 17 core claims and one millsite claim in 1992 after the USDA Forest Service and Bureau of Land Management approved the final validity test in December.
1993	Exhalas share bought out by Kennecott/Hecla	Underground drilling was continued to define the Southwest Ore zone	Mine closure due to low metal prices.
1994	CSX bought out; Greens Creek Joint Venture now Kennecott (70.27%), Hecla (29.73%)		The land exchange agreement was with the US Forest Service concluded.
1996		Updated feasibility study. Airborne EM, radiometric, and magnetometer surveys were completed during 1996–1997 to determine which might be more effective in surface exploration. Geological mapping. Underground definition drilling in the Northwest West and 5250 Ore zones. Underground and surface gravity surveys were completed. Two test lines over the West and Northwest West Ore zones were surveyed by the controlled source audio-magnetotelluric (CSAMT) method. A time-domain electromagnetic (TEM) survey was completed over eight lines and measured a strong response from the West Ore. Down-hole TEM surveys were completed on surface and underground holes.	The land exchange agreement approved by Congress. A total of 745 line miles (1,200 line kilometers) of surveys covered the entire Greens Creek area, including the land exchange parcel. Distinct magnetic anomalies corresponded with already mapped ultramafic bodies. The EM survey proved useful in identifying graphitic rocks, such as the Hyd argillite. A completely revised 1 inch = 1,000 foot scale district map and numerous 1 inch = 200-foot scale mine geologic maps were compiled during 1996–1997, and the prospective mine stratigraphy was traced to the south and north. Milling operations re-commence in July.
1997		Nine holes (7,755.5 ft or 2,364 m) were completed, targeting extensions to known mineralization at the North Ore zone, the Upper Plate Extension of the Northwest West Ore zone, and a possible north extension of the West Ore. Four diamond drill holes (6,316 ft or 1,925 m) were completed in 1997 at Big Sore with limited results. Soil sampling, gravity, magnetic and TEM geophysical surveying, and geologic mapping on cut grids	No high-priority, near-surface coincident gravity and TEM anomalies (possible shallow massive-sulfide bodies) were identified. Soil sampling and geologic mapping outlined drill targets or areas for detailed follow up work in Bruin, Gallagher, and Lower Zinc Creeks. However, underground drilling identified the very high-grade 200 South orebody.
1998		Four holes were drilled in Bruin Creek; grid extension and development, geochemical sampling and geophysical surveys.	One new grid (Upper Big Sore) and extensions of three 1997 grids (Lower Zinc, Bruin, and “A” Road) were geochemically sampled and geophysically surveyed. The work outlined numerous multi-element anomalies with coincident TEM anomalies; however, none were considered immediate drill targets.
1999		Grid expansion, geochemical sampling and geophysical surveys. Ten diamond drill holes were completed (12,715 ft or 3,875 m), seven at	Grid expansion continued at Killer Creek, Upper Zinc Creek and Cub. Numerous high-rank, multi-element soil anomalies were

Year	Operator	Work Completed/Company	Comment
		Bruin Creek and three at Killer Creek.	defined, and numerous sulfide-bearing outcrops and gossan zones were sampled and mapped. No mineralization was encountered in the Bruin Creek holes; the Killer Creek drilling intersected chalcopyrite and minor sphalerite mineralization.
2000		CSAMT geophysical survey; drilling	A CSAMT geophysical survey was completed along three lines in Bruin and Cub Creek in 2000. Three lines were also surveyed in Killer Creek. In conjunction with soil survey results, the identified Bruin and Cub Creek anomalies were tested by six core holes, with limited results. Five holes were drilled in Killer Creek. Four moderately southwest-dipping zones with silver and zinc enrichment were outlined.
2004		On surface 41 holes from 17 sites totaling 47,034 ft (14,335 m). Detailed geological mapping by John Proffett continued in the Gallagher Creek area. Down-hole electro-magnetic (DH-UTEM) and natural source audio-magnetotelluric geophysical surveys were completed.	Underground drilling identifies Gallagher ore body. Four holes in Lower Gallagher intersect sub-economic to economic -grade mineralization. Upper Gallagher drilling identified mineralization on wide side of Gallagher Fault. Lower zinc drilling identified silica and massive pyrite at contact.
2005		On surface 35 drill holes from seven sites totaling 36,100 ft (11,003 m). Soil geochemistry grids completed at Cliff Creek, and grid extensions to Killer Creek, Cub Creek and Upper Gallagher. Geological mapping along Killer Creek, Cliff Creek and Cub Creek. Larger scale Magneto-Telluric (MT) survey in Upper Gallagher that targeted the West Gallagher contact.	Intersection of mineralized intervals underground in Southwest West Bench (Middle Gallagher) and within East Ore. MT survey refines local geology and may extend West Gallagher horizons to the north, west, and south. Surface drilling at surface identified mineralization at Lower Zinc Creek and Lil' Sore.
2006		25 drill holes from six sites totaling 30,201 ft (9,205 m) on surface. Prospecting, geochemistry and mapping grids extended at Cliff Creek, High Sore and Killer Creek. Mobile metal-ion (MMI) sampling tested at Killer Creek, West Bruin, and Lil' Sore. Detailed mapping at High Sore and Cliff Creek.	Northern projection of West Bench mineralization intersected underground. Minor mineralized intersections at West Gallagher and Lower Zinc. Mine contact intersected at Bruin and Cub Creeks. Discovery of the 5250 North extension underground.
2007		Surface drilling from seven sites totaling 28,920 ft (8,815 m) on Lower Zinc Creek, Cub Creek, West Gallagher and Lil' Sore. Mapping and geochemical sampling at Killer Creek and West Bruin. CSAMT and AMT/MT geophysical surveys completed West Gallagher.	Definition of the Deep 200 South at depth and the identification of the Northeast contact below the current mine infrastructure. Weak mineralization defined at Lower Zinc and Cub Creek along mine contact. Claims near Young Bay staked.
2008	Hecla buys out the Kennecott interest in the Greens Creek Joint Venture, becomes 100% owner-operator	Surface drilling from 7 sites totaling 20,649 ft (6,293 m) on North Big Sore, East Ridge, Cub (northwest contact), and East Ore. LiDAR surveys, geological mapping and geochemical sampling initiated on newly staked Young Bay ground.	Deep 200 South drilling defines two distinct zone or fold limbs and 5250 extended to the south. Southern extension to East Ore mineralization intersected from surface. Detailed mapping defined mine contact at Lower Zinc and Killer Creek.
2009		20 drill holes from surface totaled 18,064 ft (5,506 m) on East Ore, West Gallagher, Bruin and Northeast contact (Cub). Detailed mapping	Intersections of mineralization at south extent of East Ore. Disseminated sulfides defined with drilling at Bruin and Cub along

Year	Operator	Work Completed/Company	Comment
		Bruin along projected northeast contact. Reconnaissance mapping and geochemical sampling at Young Bay claims.	projection of Northeast contact.
2010		Surface drilling of 17 holes totaling 21,217 ft (6,467 m) at Northeast contact (Cub and Bruin), East Ridge and Killer Creek. Geochemical and MMI survey in the North Young Bay area. Compilation of historic geophysical data.	Expansion of the Deep 200 South, Northwest West and 5250 resources. Mapping and drilling extend the Northeast contact to the northeast of the mine infrastructure. Weak mineralization along mine contact identified by drilling at East Ridge and Killer Gossan.
2011		14 surface holes totaling 27,384 ft (8,346 m) at Northeast contact, West Bruin, and East Ore. 3D inversion analysis on portion of historic Aerodat airborne geophysical data. Surface and borehole Pulse EM surveys used to define targets. Reconnaissance mapping and geochemical sampling in North Young Bay area. Detailed mapping in Keller Creek area.	Continued expansion of the Deep 200 South, East Ore and 5250 resources. Surface drilling continues to define the Northeast contact beyond Bruin and Cub. Pulse EM identified conductor in sufficient detail to conduct drilling at Killer Creek and West Gallagher.
2012		Eight surface holes totaling 17,710 ft (5,398 m) at Killer Creek, West Gallagher, West Bruin and East Ore. Reconnaissance and detailed mapping and geochemical sampling in North Young Bay area. Detailed mapping of Killer Creek area.	Strong mineralization intersected underground at Deep 200 South, Southwest Bench, and Northwest West. Surface drilling at Killer Creek identified a broad copper-rich vein zone which may represent a new mineralizing vent area. Drilling to the southeast identified zinc-rich zones near the mine contact.

Figure 6-1: Locality Plan



Note: Figure from Taylor et al., 2010. Map north is to top of plan.

Table 6-2: Production History, 1989–2012 (US Customary Units)

Year	Tons Milled (tons)	Head Grade Zn (%)	Head Grade Pb (%)	Head Grade Ag oz/ton	Head Grade Au oz/ton	Recovery Zn (%)	Recovery Pb (%)	Recovery Ag (%)	Recovery Au (%)	Contained Metal in Feed Zn (lb)	Contained Metal in Feed Pb (lb)	Contained Metal in Feed Ag (oz)	Contained Metal in Feed Au (oz)
1989	264,672	8.71	4.39	24.22	0.139	84.0	77.6	80.6	63.9	46,131,840	23,244,531	6,411,469	36,813.4
1990	382,574	10.43	4.89	23.04	0.120	89.1	82.9	86.6	83.3	79,809,878	37,430,926	8,816,327	45,731.7
1991	427,942	11.05	4.65	22.00	0.116	85.3	76.3	80.6	73.9	94,534,513	39,808,189	9,416,726	49,480.7
1992	439,828	10.82	4.66	20.78	0.113	80.2	71.4	76.3	65.1	95,208,886	40,971,812	9,140,516	49,778.4
1993	119,772	11.30	4.58	20.70	0.131	86.1	75.2	79.1	64.1	27,070,136	10,974,377	2,479,775	15,698.2
1996	143,737	9.98	4.85	23.81	0.108	80.1	72.9	80.8	66.4	28,693,863	13,931,902	3,422,776	15,501.0
1997	489,854	10.47	4.79	25.68	0.177	80.0	74.8	77.3	64.3	102,578,391	46,975,256	12,577,783	86,788.6
1998	540,028	11.93	5.13	22.74	0.170	84.1	75.8	77.3	65.9	128,904,631	55,368,827	12,280,766	91,883.9
1999	578,298	13.47	5.66	23.64	0.212	80.6	70.3	75.9	65.7	155,816,340	65,441,449	13,673,052	122,725.5
2000	619,438	13.57	5.28	20.06	0.208	79.6	68.1	74.3	64.8	168,163,216	65,353,086	12,424,093	128,708.7
2001	658,008	12.12	4.75	21.76	0.194	80.1	71.7	76.6	68.6	159,487,263	62,455,346	14,315,983	127,701.8
2002	733,431	12.52	4.73	19.73	0.203	79.9	70.9	75.4	68.9	183,705,511	69,390,564	14,467,824	149,018.8
2003	781,275	12.29	4.60	19.69	0.187	79.3	69.1	76.1	68.0	192,049,779	71,813,117	15,385,680	146,197.7
2004	805,353	11.14	4.05	16.65	0.163	77.1	67.1	72.4	65.5	179,426,511	65,234,289	13,408,837	131,596.1
2005	717,564	10.34	3.98	18.17	0.149	78.6	65.1	74.1	67.9	148,440,135	57,180,768	13,039,599	107,092.1
2006	732,100	9.36	3.66	15.78	0.130	76.5	69.5	76.8	66.2	137,022,103	53,604,807	11,550,065	95,026.7
2007	732,150	9.67	3.66	15.45	0.137	79.1	70.0	76.4	68.0	141,526,806	53,582,002	11,313,567	100,055.2
2008	734,907	10.09	3.58	13.38	0.142	78.5	70.5	72.7	64.5	148,322,620	52,642,781	9,832,000	104,715.1
2009	790,871	10.13	3.64	13.01	0.133	79.1	68.5	72.5	63.8	160,261,710	57,548,270	10,290,873	105,468.2
2010	800,397	10.66	4.09	12.30	0.134	78.1	68.0	73.2	64.3	170,590,893	65,544,809	9,845,020	107,066.0
2011	772,068	9.81	3.52	11.49	0.118	78.8	68.1	73.2	62.3	151,461,861	54,425,159	8,873,971	91,156.1
2012	789,569	9.35	3.49	11.13	0.115	77.7	67.8	72.8	61.0	147,588,687	55,049,097	8,784,663	90,975.8

Notes:
Zinc recovery: to Zn concentrate, bulk concentrate
Lead recovery: to Pb concentrate, bulk concentrate
Silver recovery: to doré, Pb concentrate, Zn concentrate, bulk concentrate
Gold recovery: to doré, Pb concentrate, Zn concentrate, bulk concentrate

Table 6-3: Production History, 1989–2012 (Metric Units)

Year	Tonnes milled (tonnes)	Head grade Zn (%)	Head grade Pb (%)	Head grade Ag g/t	Head grade Au g/t	Recovery Zn (%)	Recovery Pb (%)	Recovery Ag (%)	Recovery Au (%)	Contained Metal in Feed Zn (tonnes)	Contained Metal in Feed Pb (tonnes)	Contained Metal in Feed Ag (oz)	Contained Metal in Feed Au (oz)
1989	240,106	8.71	4.39	831	4.77	84.0	77.6	80.6	63.9	20,925	10,544	6,411,469	36,813
1990	347,065	10.43	4.89	790	4.10	89.1	82.9	86.6	83.3	36,201	16,978	8,816,327	45,732
1991	388,223	11.05	4.65	754	3.96	85.3	76.3	80.6	73.9	42,880	18,057	9,416,726	49,481
1992	399,005	10.82	4.66	713	3.88	80.2	71.4	76.3	65.1	43,186	18,585	9,140,516	49,778
1993	108,655	11.30	4.58	710	4.49	86.1	75.2	79.1	64.1	12,279	4,978	2,479,775	15,698
1996	130,396	9.98	4.85	816	3.70	80.1	72.9	80.8	66.4	13,015	6,319	3,422,776	15,501
1997	444,388	10.47	4.79	880	6.07	80.0	74.8	77.3	64.3	46,529	21,308	12,577,783	86,789
1998	489,905	11.93	5.13	780	5.83	84.1	75.8	77.3	65.9	58,470	25,115	12,280,766	91,884
1999	524,623	13.47	5.66	811	7.28	80.6	70.3	75.9	65.7	70,677	29,684	13,673,052	122,726
2000	561,945	13.57	5.28	688	7.12	79.6	68.1	74.3	64.8	76,278	29,644	12,424,093	128,709
2001	596,935	12.12	4.75	746	6.65	80.1	71.7	76.6	68.6	72,342	28,329	14,315,983	127,702
2002	665,358	12.52	4.73	676	6.97	79.9	70.9	75.4	68.9	83,327	31,475	14,467,824	149,019
2003	708,761	12.29	4.60	675	6.42	79.3	69.1	76.1	68.0	87,112	32,574	15,385,680	146,198
2004	730,604	11.14	4.05	571	5.60	77.1	67.1	72.4	65.5	81,387	29,590	13,408,837	131,596
2005	650,963	10.34	3.98	623	5.12	78.6	65.1	74.1	67.9	67,331	25,937	13,039,599	107,092
2006	664,150	9.36	3.66	541	4.45	76.5	69.5	76.8	66.2	62,152	24,315	11,550,065	95,027
2007	664,195	9.67	3.66	530	4.69	79.1	70.0	76.4	68.0	64,195	24,304	11,313,567	100,055
2008	666,697	10.09	3.58	459	4.89	78.5	70.5	72.7	64.5	67,278	23,878	9,832,000	104,715
2009	717,466	10.13	3.64	446	4.57	79.1	68.5	72.5	63.8	72,694	26,103	10,290,873	105,468
2010	726,108	10.66	4.09	422	4.59	78.1	68.0	73.2	64.3	77,379	29,731	9,845,020	107,066
2011	700,409	9.81	3.52	394	4.05	78.8	68.1	73.2	62.3	68,702	24,687	8,873,971	91,156
2012	716,285	9.35	3.49	381	3.95	77.7	67.8	72.8	61.0	66,945	24,970	8,784,663	90,976

Notes:
Zinc recovery: to Zn concentrate, bulk concentrate
Lead recovery: to Pb concentrate, bulk concentrate
Silver recovery: to doré, Pb concentrate, Zn concentrate, bulk concentrate
Gold recovery: to doré, Pb concentrate, Zn concentrate, bulk concentrate

Table 6-4: Life of Mine Production 1989–2012

US Customary Units			Metric Units		
Item		**Production**	**Item**		**Production**
Tons milled		13,053,836	Tonnes milled		11,842,244
Head Grade			*Head Grade*		
Zinc	%	10.9	Zinc	%	10.9
Lead	%	4.3	Lead	%	4.28
Silver	oz/ton	17.8	Silver	g/tonne	610.3
Gold	oz/ton	0.153	Gold	g/tonne	5.25
Metal in feed			*Metal in feed*		
Zinc	lb	2,846,795,572	Zinc	tonnes	1,291,285
Lead	lb	1,117,971,363	Lead	tonnes	507,103
Silver	oz	231,751,367	Silver	oz	231,751,367
Gold	oz	1,999,180	Gold	oz	1,999,180
Metal Recovered			*Metal Recovered*		
Zinc	lb	2,272,161,525	Zinc	tonnes	1,030,635
Lead	lb	789,494,274	Lead	tonnes	358,109
Silver	oz	176,085,796	Silver	oz	176,085,796
Gold	oz	1,326,937	Gold	oz	1,326,937

7.0 GEOLOGICAL SETTING AND MINERALIZATION

7.1 Regional Geology

The regional geological description is based on work documented in United States Geological Survey (USGS) Professional Paper 1763 (Taylor and Johnson, 2010).

The lithologies of northern Admiralty Island are part of the Admiralty subterrane of the Alexander Terrane (Alexandria), a Late Proterozoic to Paleozoic island arc. Together with the Wrangellia Terrane, the Alexander Terrane forms the Wrangellia Superterrane that is assigned a Late Carboniferous formation date. The Wrangellia Superterrane collided with, and accreted to, the North American craton during the Early Jurassic and the Early Tertiary.

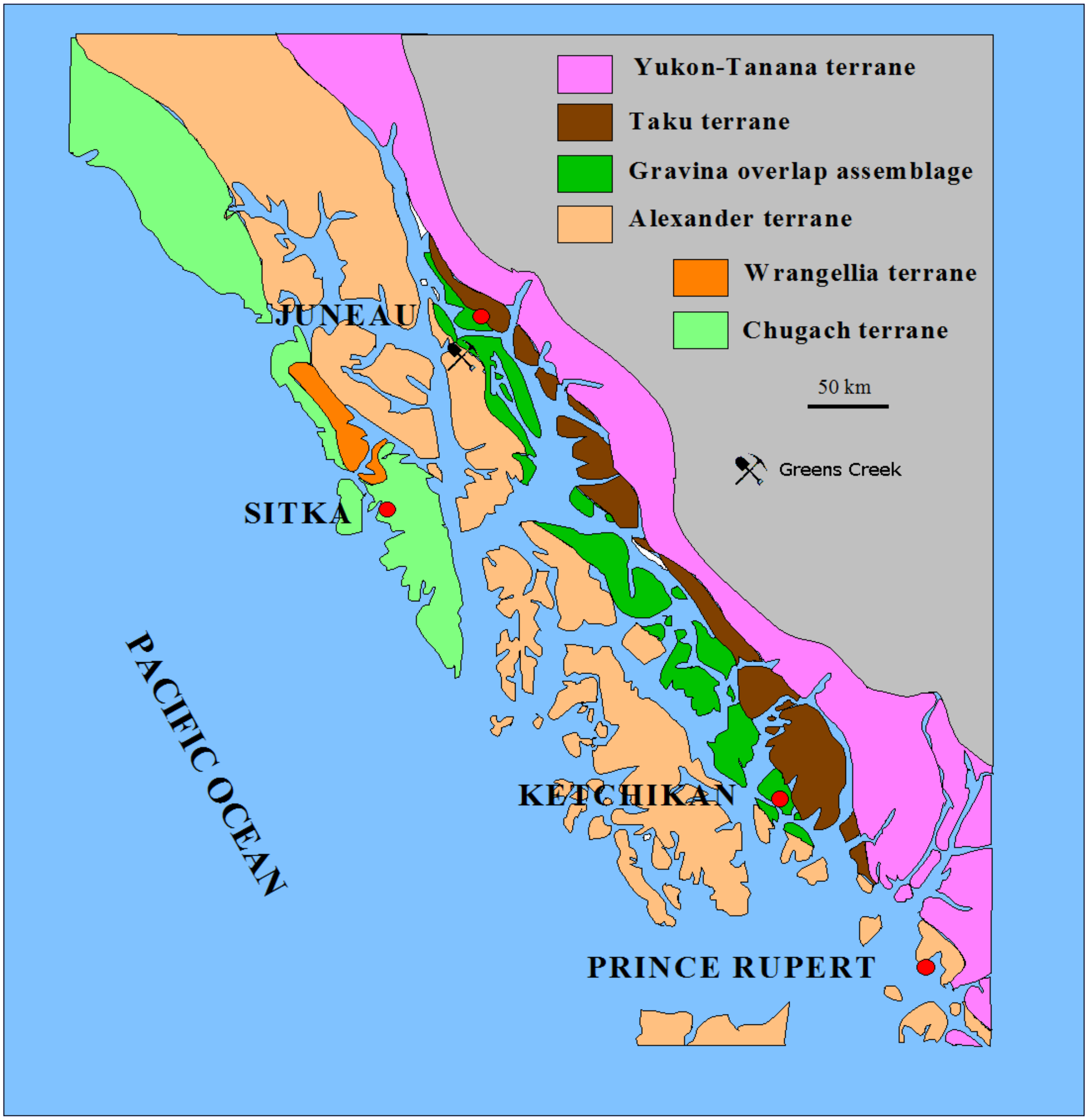
Figure 7-1 is a regional tectono-stratigraphic plan.

The Greens Creek polymetallic sulfide deposit occurs within the low-grade metamorphic core of the Admiralty subterrane. Local tectonostratigraphic assemblages constitute a late Paleozoic back-arc basement and its upper Triassic flood basalt cover sequence. The Admiralty back-arc basin was volcanically active into the Devonian, giving rise to greenstone rocks of the Retreat Group. Overlying the greenstones are Mississippian to Permian siliciclastic rocks and dolomite–chert facies of the Cannery Formation, which are in turn overlain by shallow-water, dolomitic carbonates of the Lower Permian Pybus Formation. The uppermost Pybus Chert signals the termination of back-arc sedimentation through shoaling accompanying the amalgamation of Alexandria and Wrangellia terrane. Amalgamation of the Alexander and Wrangellia terranes resulted in sub-aerial exposure of the region, and the formation of an unconformity.

The post-amalgamation unconformity ended with late Triassic rifting driven by the Nikolai plume: the Carnian (circa 235–228 Ma) Nikolai and Norian (circa 228–208.5 Ma) Hyd flood basalt provinces, occurring respectively in Wrangellia and Alexandria, overlap in time. The Greens Creek deposit is hosted within a Carnian/Norian-age black argillite that occurs below the Hyd basalts.

Protracted compressional tectonism attended the suturing of the Wrangellian superterrane to continental North America. Mid-Cretaceous collision resulted in fold and thrust-style imbrication, while dextral transpression on the Tertiary Denali transform system caused severe strike-slip dislocation of the imbricated stratigraphic package. The back-arc assemblage and its flood basalt cover were decoupled, resulting in a stacked series of inversely metamorphosed thrusts south of the Greens Creek mine.

Figure 7-1: Regional Tectono-Stratigraphic Plan



The Greens Creek deposit occurs in low-grade phyllites which make up the lowest exposed thrust plate. This mineralized domain is bound by major ductile faults bordering on Hawk Inlet and Young Bay. Brittle northwest–southeast fault fracture systems are common; the Maki Fault through the immediate mine site dextrally offsets the mineralization by about 1,800 ft (549 m).

The Hyd flood basalts are subdivided into basal growth fault-related breccia/conglomerate, medial Mine Argillite, and upper Basalt members. At the mine, the Retreat Creek Group greenstone substrate to Mine Argillite is interleaved with sheets of serpentinite and lesser metagabbro. Intense hydrothermal alteration of this rock association has formed the Mine Phyllite unit in the stratigraphic footwall of the ore.

On a project scale the widespread occurrence of barian mariposite links hydrothermal alteration of serpentinite to massive baritic ores capping the Mine Phyllite. High-grade laminated ores at the base of Mine Argillite are capped by bedded pyrite, and thin, cherty, black Mn-dolomite beds persist into overlying slaty argillite.

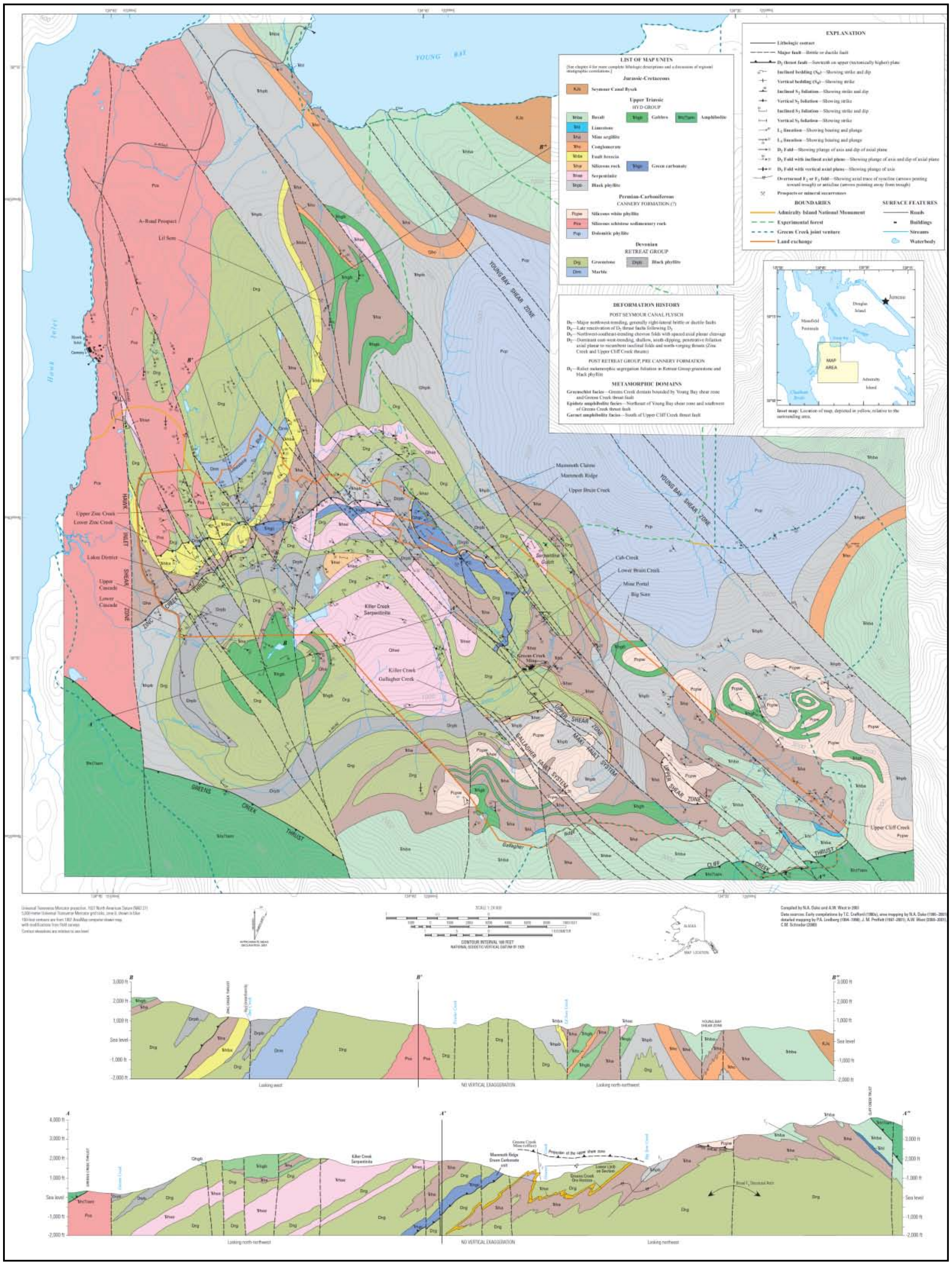
Regionally, Taylor and Johnson (2010) places Greens Creek into a series of deposits and prospects that he terms the Alexander Triassic metallogenic belt. The belt is located along the eastern margin of the Alexander terrane throughout southeastern Alaska and northwestern British Columbia and exhibits a range of characteristics consistent with a variety of syngenetic to epigenetic deposit types. Occurrences included in this group include: Windy Craggy, Mt. Henry Clay, Greens Creek, Pyroloa, and Yellow Bear Mountain among others.

7.2 Project Geology

7.2.1 Lithological Setting

The regional map (Figure 7-2) displays a compilation of mapping done from 1974 through to the present day. The methods used to create this map are discussed in Section 9.2. The discussion in the sub-sections that follow relate the mapped lithologies to the major tectono-stratigraphic units in the Greens Creek Project area.

Figure 7-2: Regional Map



Note: Figure from Taylor and Johnson, 2010

Retreat Creek Group

Three lithotypes are differentiated in the Retreat Creek Group: greenstone, black phyllite, and marble. Units of Retreat Creek Group greenstone are dominated by monotonous green chloritic phyllite with variable interlayering of lustrous gray phyllite after graphitic shale and rare thin gray to white marble bands. The greenstones are characterized by streaky light/dark green layering of tectonic origin. Retreat marble is restricted to Limestone Bluff at a map-scale, and has an age date of middle-Devonian, based on conodont fossils. The phyllites likely represent background sedimentation coincident with Retreat Creek Group mafic volcanism. Greenstone contacts against graphitic units are strongly carbonatized. Contacts with interleaved serpentinites are extremely slivered, with greenstone/serpentinite sheeting on the meter scale.

Based on the present level of mapping, Retreat Creek Group greenstone forms the primary flooring for the Hyd Group at the site of the Greens Creek mineralization.

Cannery Formation

Two variations of the Cannery Formation lithologies have been identified. Low metamorphic-grade phyllites after core dolomitic arenite, medial dolomitic siltstone, and peripheral phyllitic chert occur in the Young Bay shear zone. At Limestone Bluff, however, the units are dominantly lustrous black and white siliceous schist. The Cannery Formation exposed along the shore of Hawk Inlet at the Cannery and along the A-road to Young Bay comprises varicolored gray-green-white-black banded schists, in part graphitic (black), in part marly (green) and in part dolomitic (white). The graphitic units are locally rich in nodular pyrite.

A timing issue as to which unit some of the black phyllite lithologies belong to still remains to be resolved. Panels of Retreat Creek Group greenstone that are interlayered with panels of lustrous black phyllite indicate that black phyllite is a major member of the Retreat Creek Group. However, that black phyllite also occurs peripheral to siliceous schist domains tentatively correlated with Pybus Formation suggests a black phyllite member that is younger than the uppermost member of the Cannery Formation.

Serpentinite

A large serpentinite body crops out at Killer Creek, 1.5 miles (2.4 km) west–northwest of the mine site. This unit is strongly sheared on its upper and lower contacts against variably altered Retreat Creek Group greenstone. Serpentinite-injected greenstone forming substrate to mine argillite is strongly carbonatized. The panel of Retreat Creek Group greenstone in the immediate footwall of mine argillite is variably sulfidized, with pyrite-pyrrhotite-chalcopyrite forming patchy disseminations and locally massive replacement pods of meter scale. The northern contact of the serpentinite of Killer Creek has occasional talc-sericite-carbonate shears with associated zinc–lead–silver disseminations. The faulted southeast nose, exposed in Killer Creek at the B-road bridge, has associated massive magnetite-pyrite skarn mineralization.

It is hypothesized that the serpentinite sheets were injected into growth faults that controlled the deposition of the mine argillite member of the Hyd Group.

Hyd Group

The Hyd Group can be subdivided into basal growth fault-related breccia/debriite/conglomerate deposits, medial argillite, and upper basalt members. Other units include local argillaceous limestones at the base of the upper basalt and gabbro sills within medial mine argillite. Gabbro sill–argillite complexes occur below the upper Hyd basalts capping the Gallagher Ridge south of the mine, in the Lakes District, and in lower Lil Sore Valley south of Young Bay.

7.2.2 Structural Setting

A penetrative S_1 metamorphic segregation foliation characterizes the Retreat Group, and may have developed as a result of the amalgamation of Alexandria and Wrangellia.

D_2 thrusting caused the development of S_2 foliation in the Retreat Group and Cannery Formation lithologies, and F_2 folding in the mine argillite.

Following the D_2 overprint, the accreted complex was subjected to protracted transpression, giving rise to upright chevron-style F_3 folding and related steeply dipping shear zones that strongly disrupt the regional D_2 structural/stratigraphic framework. Reactivation of D_2 thrusts post-D_3 produced shallow-dipping D_4 shears that locally overprint S_3.

Mid- to late-Tertiary dextral transform faulting caused brittle D_5 faults such as the Maki system that cuts through the immediate Greens Creek mine site area. The similar orientations of D_3-ductile and D_5-brittle structures indicate that the D_3 structural grain was reactivated in D_5. The late dextral fault strands locally develop complementary interior sinistral fault/fracture sets of minimal displacement.

7.3 Deposit Characteristics

The Greens Creek sulfide mineralization is developed along the contacts between altered and metamorphosed mafic/ultramafic (phyllite) rocks and overlying argillites. The contact is known as the Mine Contact.

7.3.1 Footwall

The stratigraphic footwall to the Greens Creek mineral deposit consists of variably-altered mafic to ultramafic volcanic rocks, minor clastic sediments, and hypabyssal sills and intrusions.

The mafic lithologies are subdivided into siliceous phyllite, which typically occurs adjacent to mineralization, sericite phyllite, which is more distal, and chlorite phyllite, which is found farthest from mineralization:

- The siliceous phyllite is typically white to dark gray, dense, and displays a broadly spaced S2 foliation. Angular to rounded quartz or chert clasts in the siliceous phyllite may be derived from sedimentary conglomerates or could represent tectonic breccias;
- Sericite phyllite is tan to greenish gray in color, displays a strong S2 foliation and S3 crenulation cleavage. Pyrite is present as disseminations and massive bands, generally increasing in abundance toward ore where it can reach as much as 40 volume percent or more. Sphalerite, galena, and chalcopyrite disseminations are also common. Remobilized sulfides and remobilized tetrahedrite are present in quartz-carbonate veins adjacent to mineralized zones. The unit is subdivided on the basis of alteration mineralogy and is mapped using the modifiers siliceous, graphitic, chloritic, carbonate-rich, and tan (leucoxene);
- Chlorite phyllite is medium to dark green and thinly to broadly foliated. Quartz and quartz–carbonate veins are common with thicknesses up to 20 cm. Locally, these veins contain sphalerite, galena, pyrite, chalcopyrite, and rare silver sulfides and sulfosalts.

Mariposite phyllite, which is interpreted to have a mafic protolith, has an irregular distribution and is less common than the other mafic lithologies. The lithology is typically a banded to foliated, gray-green to brilliant green rock that is characterized by the presence of chromian phengite (mariposite or fuchsite).

The ultramafic lithologies are subdivided into serpentinite and quartz–carbonate–mariposite phyllite, which is interpreted to be an alteration product of serpentinite:

- Serpentinite can be light to dark green in color and is typically sheared or crudely foliated but can be massive. The mineralogy is serpentine, chlorite, carbonate (normally ankerite), and talc, with minor leucoxene and chromian phengite. It occurs as large masses or irregularly shaped bodies within shear zones, fault zones, or fold noses;
- Quartz–carbonate–mariposite phyllite is massive to crudely foliated, and can be white, orange, green, or lavender. The rock is composed of quartz, ankerite, and

chromian phengite with local occurrences of a lavender chromian chlorite phyllosilicate. It forms massive irregular pods adjacent to serpentinite or dolomitic massive argillite

Less common ultramafic units identified in the mine area include diabase dikes and highly-altered gabbros. The dikes are medium to dark gray, aphanitic to fine-grained granular, and range from less than 0.4 inches (1 cm) to 39 inches (1 m) in thickness.

Two footwall breccia types have been identified, and serve as marker horizons for regional stratigraphic correlation:

- Polymict breccia with sub-rounded clasts;
- Monomict breccia with subangular clasts.

Sedimentary units in the footwall are interpreted to be the result of debris flows that formed during rifting in Late Triassic time. Sediments include 30 m thick lenses of dense, white to gray, silicified, quartz + carbonate or chert clasts in a siliceous matrix. The clasts are generally 0.4–4 inches (1–10 cm) in diameter and, based on mineralogy, could be derived from the underlying phyllites and or footwall carbonate units.

7.3.2 Hanging Wall

Hanging wall rocks are typically classified as either massive argillite or slaty argillite:

- Massive argillite is light gray to black in color and has 0.1–20 inches (1–50 cm) thick beds separated by slaty intervals. Where it is graphite-rich, the rock tends to be finer grained than where it is carbonate-rich. Fractures are commonly filled with quartz ± calcite or quartz ± dolomite;
- Slaty argillite is light gray to black, displays an S2 slaty cleavage and an S3 crenulation cleavage near F3 fold hinges. Quartz ± calcite or quartz ± dolomite veins are common.

The massive argillite can also be strongly dolomitic, and in the dolomitic phase is characterized by light to medium gray, 39–80 inches (1–2 m) thick beds of medium to coarse dolomite separated by thin micaceous bands. The unit can grade into carbonate-bearing mineralization or ore, particularly in the Lower Southwest zone. In other mineralized zones, dolomitic massive argillite can be absent in favor of greater thicknesses of silica rock, which may be a replacement of original carbonate rock.

Where more dolomitic, the slaty argillite contains dolomite, quartz, sericite, graphite, and coarse pyrite (15 volume percent or more). Discontinuous siliceous lenses, 0.4 to 10 inches (1 to 25 cm) in length, are common. Adjacent the stratigraphic footwall, pyrite can be massive. Based on the location of the dolomitic slaty argillite close to mineralization, and the high pyrite content, the dolomitization of the argillite is interpreted to be related to sulfide emplacement.

A polymict breccia of white quartz and argillite clasts in a matrix of fine-to-coarse subhedral pyrite has also been identified in the hanging wall.

7.3.3 Structural Setting

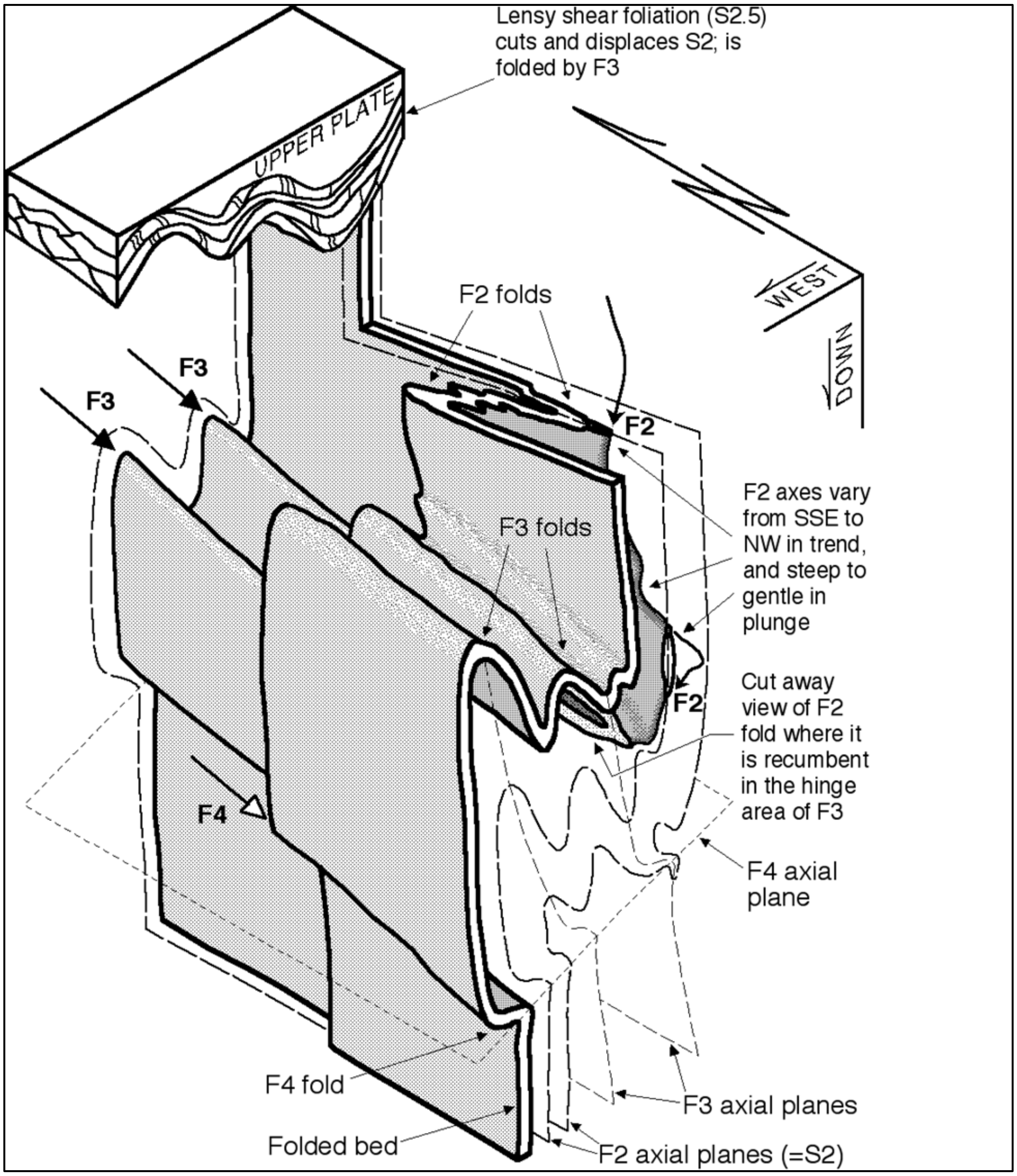
The Greens Creek deposit has been subjected to at least four deformational events (Figure 7-3) and one earlier one (D1) that only affected some or all of the footwall rocks. The first event (D2) that affected all rocks resulted in tight to isoclinal folding with a well-developed penetrative axial planar cleavage that is the most discernible texture of the mine rocks. The D3 event resulted in less severe folding and is the dominant folding seen underground. S3 axial planar cleavage is usually only developed near hinge zones. The D4 event was minor and is only preserved as rare kinks in F3 folds and possible re-activated shears.

Various shear events have been described, most important of which is the Upper Shear Zone that appears to be a major structural/lithological boundary. The shear zone truncates S2 and is folded by F3. The Klaus fault with about 200 m of displacement appears to be D3 in age and affects the East and West zones. Similar unnamed D3 faults also insect the upper portion of the Northwest West zone, northern portions of the 5250, Upper Southwest, Deep 200 South zones, and possibly the Gallagher zone.

Large, regional, dextral-slip faults with displacement in the hundreds of meters characterize the D5 event. The Maki fault is most important at the Greens Creek mine and bisects the deposit. It is a right lateral (1,500 ft or 457 m) fault with 100 ft (30 m) upward displacement on the west side. The Gallagher Fault is sub-parallel to the Maki Fault and displaces the lithologies to the west of Deep 200 South. It also plays a prominent role in the distribution of mineralization in the Gallagher zone.

The D2, D3, and D5 events are most important in determining the distribution of the various mineralized zones.

Figure 7-3: Structural Setting Summary Plan



Note: Figure from Proffett, 2010.

7.3.4 Mineralization

Sulfide mineralization is nearly continuous along the phyllite/argillite contact (Mine Contact). The major sulfide accumulations are:

- The East zone, the southernmost portions of 9A, and 5250;
- The West zone (including the Central West, the middle and northern portions of 9A, and Northwest West);
- The Southwest zone (including the Upper and Lower Southwest, Southwest Bench, 200 South zones, and Deep 200 South zones);
- The Gallagher zone.

The boundaries between the various zones and mineralized areas are defined by faults, shear zones, or changes in the thickness of the mineralized horizon. Figure 7-4 is a deposit plan map. Figure 7-5 shows section through the mineralized zones and major faults.

The sulfide mineralization at Greens Creek is divided into two general types, massive or white ores/mineralization, which are further sub-divided into six and three sub-types, respectively.

In general, footwall siliceous phyllite is stratigraphically overlain by proximal copper–arsenic–gold-enriched massive pyritic ores centered over white siliceous ores. White ores are overlain by massive pyritic ores that change upward and outward toward lower copper–gold grades. Proximal ores transition to increasingly higher grade zinc–lead–silver (± gold)-rich, massive, fine-grained, base-metal-rich ores toward the argillite hanging wall and the margins of the deposit. Distal ore commonly is characterized by carbonate- and barite-rich white ores against footwall phyllites, which grade into massive, fine-grained, base-metal-rich ores toward the hanging wall (Figure 7-6).

The complex structure present at Greens Creek has not allowed detailed metal zonation studies to be completed. In the Central West zone, the thickest mineralized zone, a zonation pattern can be resolved that indicates the orebody has a copper-rich (0.7 to 4% Cu) center sitting on top of the footwall phyllites. Metal zonation continues outwards in order from Fe to Zn, then Zn + Pb, and finally polymetallic-Ag rich against the hanging-wall argillites. Similar zonation patterns have been mapped in the other minealized zones, but are incomplete or locally can show contradictory relationships (Figure 7-7).

Figure 7-4: Layout Plan, Zones

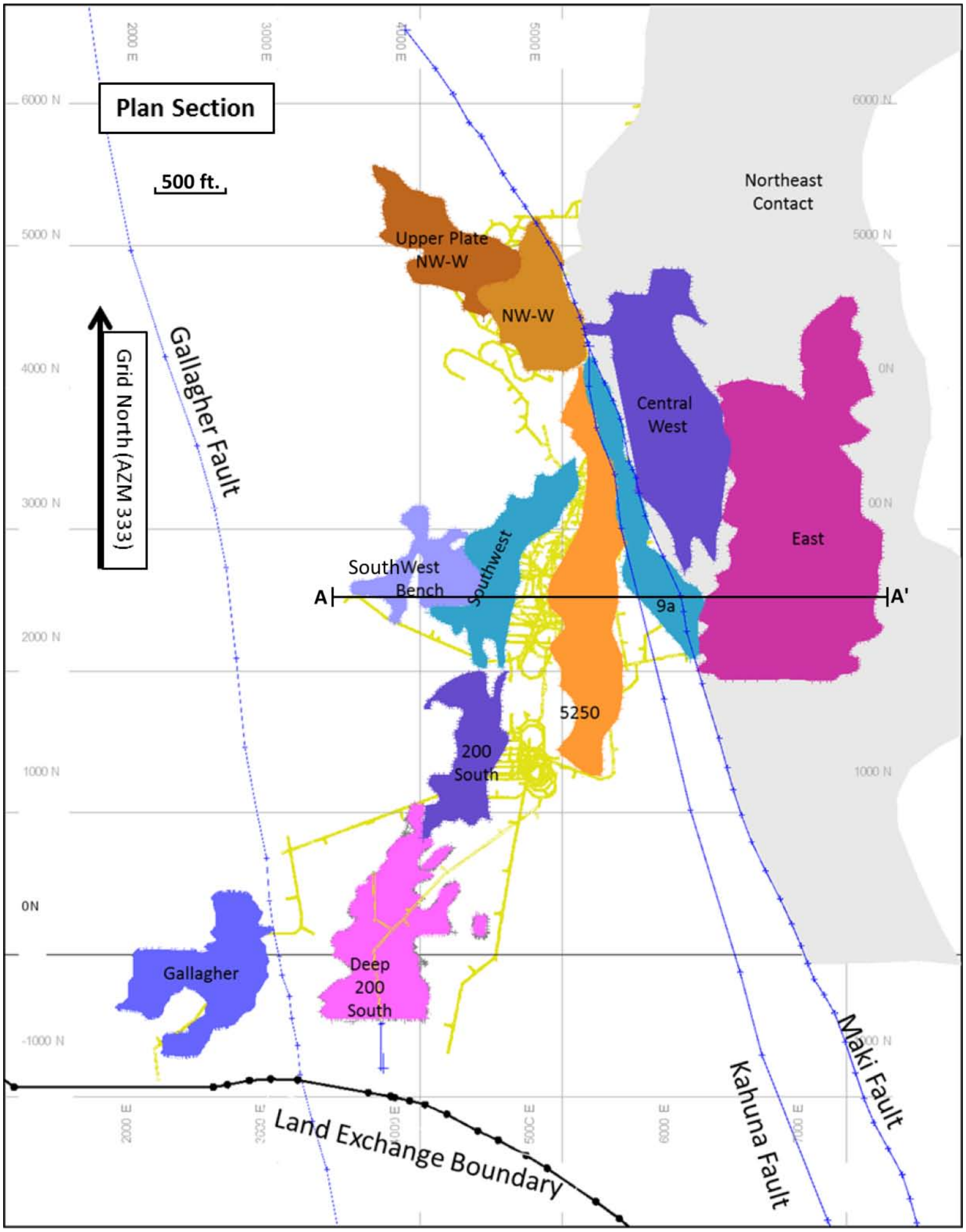


Figure 7-5: North-Looking Section through the East, 9A, 5250 and Southwest Zones (line of section A-A' is shown in Figure 7-4)

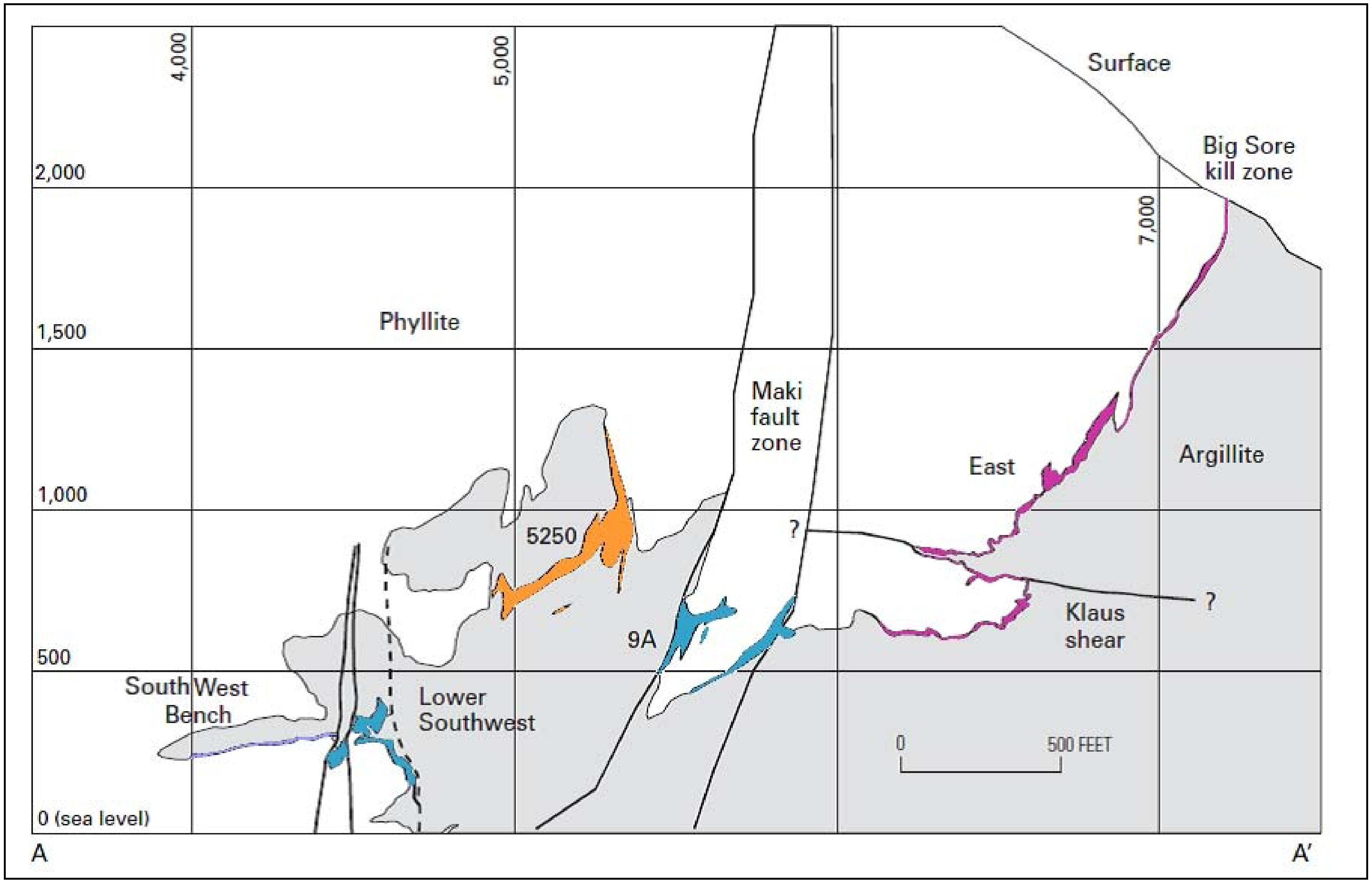
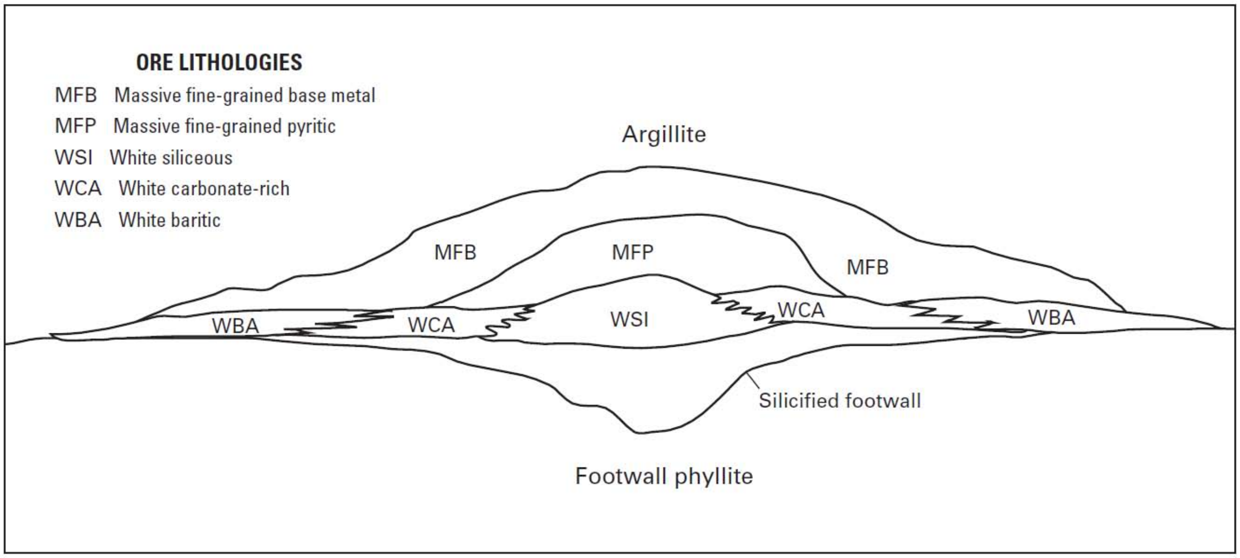
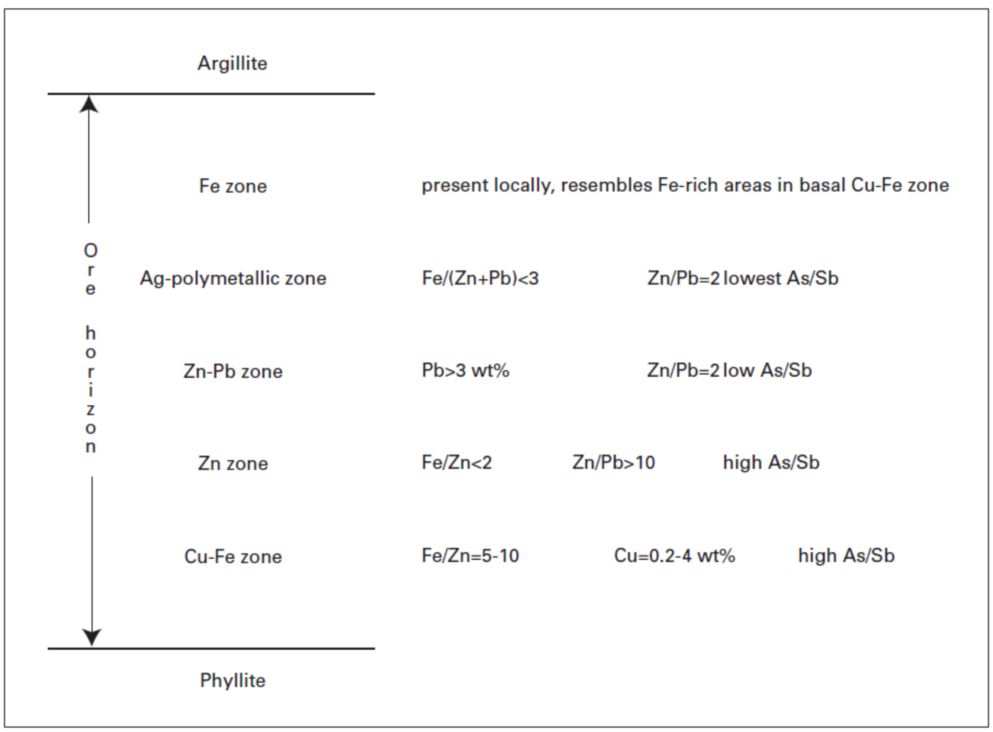


Figure 7-6: Simplified Mineralization Cross-Section



Note: Figure from Taylor et al., 2010.

Figure 7-7: Simplified Metal Zonation (Hanging Wall to Footwall)



Note: Figure from Taylor et al., 2010.

Primary mineral textures are characterized by framboidal, colloform, dendritic, and "spongy" pyrite intergrown with base-metal sulfides and sulfosalts. Primary assemblages also include sphalerite, galena, tetrahedrite, chalcopyrite, free gold, and a variety of lead–antimony–arsenic (±mercury–thallium) sulfosalts. Secondary mineralogy includes chalcopyrite, sphalerite (low iron), galena, free gold, electrum, tetrahedrite (antimony-rich), pyrargyrite, and many other sulfosalt minerals.

Massive Ores

Massive ore is classified as mineralization in which sulfides exceed 50 volume percent. Massive ores are subdivided into six types depending on the relative abundance of base-metal sulfides (sphalerite plus galena) and pyrite, whether the grain size is fine or very fine, and whether there is intercalated graphitic argillite:

- Massive fine-grained base-metal ore;
- Massive very fine-grained base-metal ore;
- Massive fine-grained base-metal ore with graphite;
- Massive fine-grained pyrite ore;
- Massive very fine-grained pyrite ore;
- Massive fine-grained pyrite ore with graphite.

The distinction between the fine- and very fine-grained ore types is subjective and based on the visual appearance of grain sizes in drill core. In general, the very fine-grained ore types are classified when individual sulfide grains cannot be seen with the naked eye.

Massive fine-grained base-metal ore is typically metallic gray, blue gray, or dull tannish-yellow depending on the relative abundance of sphalerite, galena, and pyrite. Layering is often apparent in which 0.04–0.2 inch (1–5 mm) thick bands are distinguished by different relative abundances of the sulfides. Gangue minerals are quartz, sericite, barite, and chromian phengite. Silver contents vary widely, particularly in the Lower Southwest zone.

Massive fine-grained pyrite ore is typically yellow–bronze to metallic brown, is coarser than massive fine-grained base-metal ore, and lacks visible banding. Quartz is the dominant gangue mineral in veins or in the matrix. Base-metal sulfides range from a few disseminated grains to segregations that collectively approach the abundance of pyrite. Massive fine-grained pyrite ore is not generally mined because the ore metal content is insufficient.

Very fine-grained massive ores lack megascopic sulfides and have a polished appearance in drill core. Graphitic varieties contain 15% or more argillite as massive bands, slaty intervals, or deformed rip-up clasts. In some locations argillite and massive sulfide appear to have been co-deposited, and in other locations the lithologies appear to have been mixed tectonically. Graphitic massive ore is characteristically high in precious metals content.

White Ores

White ore is classified as mineralization in which sulfides are below 50 volume percent. White ore is subdivided into three categories, depending on whether the dominant gangue mineral is carbonate, barite, or quartz (silica).

White carbonate ore, the most common white ore type, is massive and white to light gray. It is composed of granular dolomite with disseminated and banded sulfides. Quartz- and carbonate-filled fractures are ubiquitous. The sulfide assemblage in these rocks includes pyrite, sphalerite, galena, bornite, and, locally, chalcopyrite. Argentiferous tetrahedrite can be present within quartz–carbonate veins as sub-centimeter blebs. More rarely, acanthite, electrum, native silver, and native gold occur. Gangue minerals other than carbonate are not common. White carbonate ore can grade into massive ore, particularly in the West orebody where nearly pure sulfide bands 0.4 to 20 inches (1 to 50 cm) thick are interlayered with carbonate.

White siliceous ore is usually a minor constituent of all of the known orebodies. The silica is dominantly cryptocrystalline hydrothermal quartz with lesser vein quartz and chert, but there can also be appreciable carbonate, sericite, chromian phengite, or graphite. The rock is highly variable in texture, sulfide content, and gangue content and can show significantly elevated precious metal grades.

White baritic ore is commonly thinly laminated to massive and contains fine sulfides as disseminations or stringers. It displays a sugary texture and has a high specific gravity. Mineralization is typically silver-rich and base metal-sulfide poor.

White baritic ore tends to be base metal sulfide-poor (typically less than 5 volume percent), but silver-rich. Higher grade examples contain disseminated bright red pyrargyrite/proustite. However, in some locations white baritic ore has too low a metal content to support economic mining activity.

Textures

Locally, all of the ore types can be veined, brecciated, or crosscut by gouge or rubble zones as a consequence of post-ore faulting or folding. Veining is most common in the white ores. Vein-associated remobilization and recrystallization have resulted in enhanced concentrations of native gold and silver sulfosalts such as in the Upper Southwest zone. Brecciated ores have in some cases been formed by slumping of massive sulfide, often into weakly mineralized surrounding sediments. In other cases brecciated ores appear to have formed as a result of post-depositional faulting and shearing. Solution-collapse breccias have also been identified, particularly in the white carbonate ores.

7.4 Mineralized Zones

7.4.1 Overview

Due to variations in mineralization, structural complexity, and spatial location, the Greens Creek mineralization is segregated into eight separate mineralized zones, the first seven of which are classed as orebodies with declared Mineral Reserves:

- East;
- West;
- 9A;
- Northwest West;
- Southwest;
- 200 South;
- Gallagher.

The mineralization is stratigraphically controlled and typically found at the contact between the phyllites (stratigraphic footwall) and the argillites (stratigraphic hanging wall). Due to the intense structural deformation, mineralization may be tightly folded into the phyllite or argillite packages such that the original stratigraphic relationships are unclear. In rare cases there may be areas where the ore is stratigraphically above the phyllite/argillite contact but still proximal to it.

On a gross deposit scale the mineralization trend is N 30° W, dips variably to the west, and plunges to the south at approximately 20°. The East zone crops out near the northeastern edge of the Project, dips to the west, and transitions into the West zone near a tight F3 fold where the ore horizon transitions from a nearly flat orientation to a nearly vertical wall dipping steeply to the west. The East and West zones are bounded on the west by the Maki fault system which offset the ore horizon to the north in a dextral sense. The offset portions of the mineralization hosted inside the fault zone are called the 9A.

West of the Maki fault, the Northwest West zone represents the offset part of the major sulfide mass of the West zone. To the south, the 5250 zone is the analogous offset portion to the southern portions of the East zone. The Southwest and 200 South zones are the down-plunge continuation of the Northwest West trend.

The Gallagher zone lies to the west of the 200 South zone and is west of a second major dextral fault zone known as the Gallagher fault. The spatial relationship between the Gallagher zone and the Greens Creek orebodies located east of the fault is not fully understood. Sparse, widely-spaced drill intercepts from the Gallagher fault zone have indicated the Gallagher zone is likely to be an offset portion of the continued trend from either the 5250 or 200 South zones.

7.4.2 East Zone

The East zone crops out at the Big Sore gossan, and extends down-dip to the west until it meets the West zone near 6150E or south of section 2650N. At this point, the zone is truncated by the eastern edge of the Maki fault zone.

The East zone is bounded by 1800N to 4650N, 5950E to 7400E, and 400 to 1950 ft elevation. The mineralization occurs along the phyllite/argillite contact, varies from 1 ft to 30 ft (0.3 to 9 m) thick, and strikes N 15° E.

At the surface the mineralization dips at 60–80° to the west, but the dip shallows with depth to near-horizontal as a result of F3 folding. At the surface, to the north of Big Sore, the phyllite/argillite contact is weakly mineralized or shows only elevated pyrite with minor base-metal sulfides. At the surface to the south of Big Sore, the base and precious metals sulfides also decrease. Surface mapping shows the phyllite–argillite contact closing into a major antiform with the western limb being truncated by the Maki fault.

Down dip, south of 2300N, the mineralized horizon rotates to an east-west strike before truncation by the Maki fault. At depth, the orebody consists of two parallel flat-lying panels that were affected by the shallowly-dipping Klaus shear.

Figure 7-8 shows the outline of the 3D model for the East zone. Figure 7-9 is a cross-section through the East zone. Figure 7-10 is a level plan that shows the orientation of the mineralization in relation to the Maki fault, and the trace of the Mine Contact.

There are three lobes within the East zone that are thick enough to mine: the North, Central, and South zones. The apparent thickness of these zones may be due to original sulfide deposition and or fold-thickening. Within each lobe, selected areas appear to show zoning from Fe and base-metal rich massive ores with lesser white ores to relative silver-rich, white ore dominated by barite or carbonate with lesser siliceous and massive sulfide ore types. However, this generalized zoning sequence can repeat or reverse multiple times within the lobes.

Figure 7-8: 3D Model, East Zone

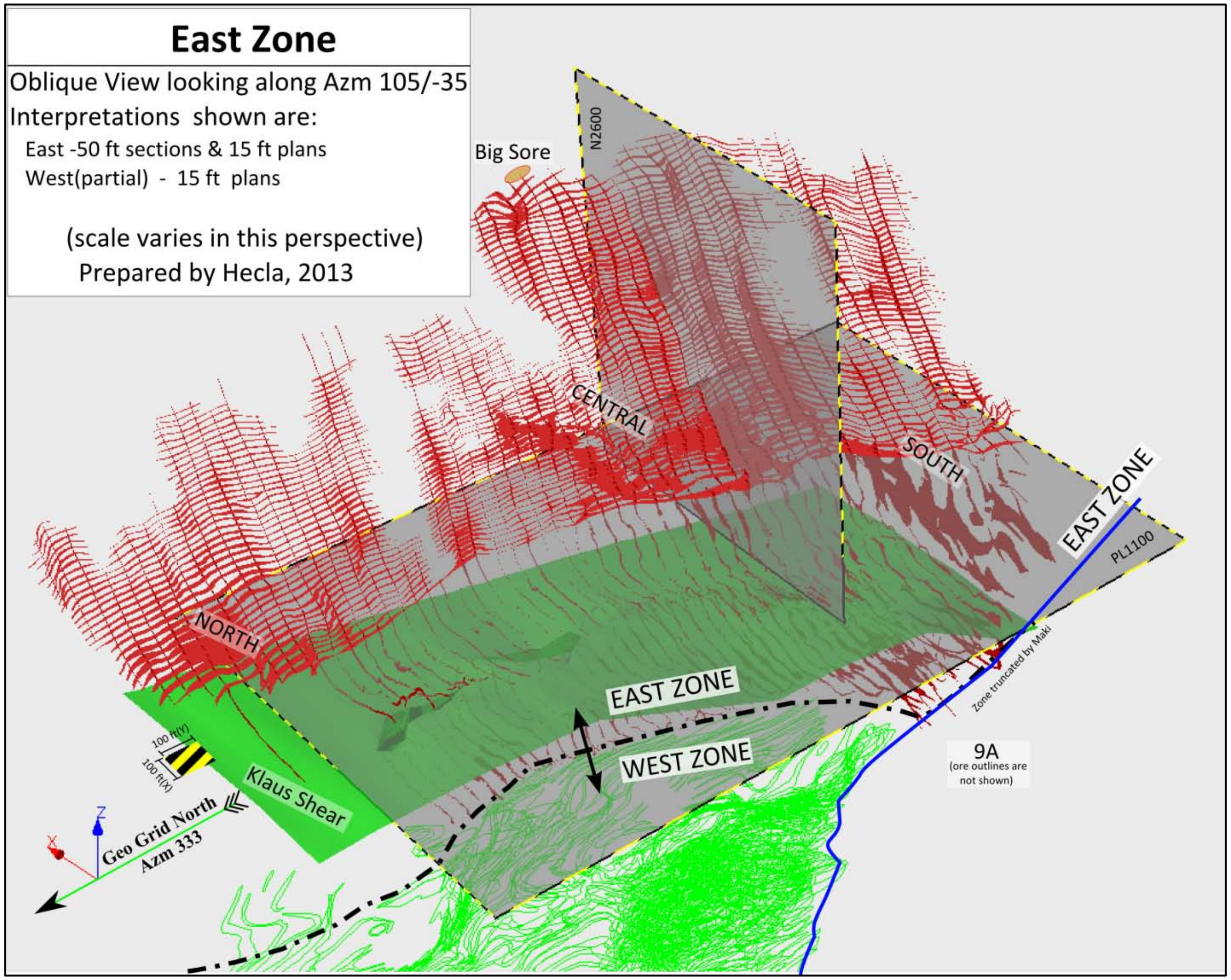


Figure 7-9: Cross Section 2600, East Zone

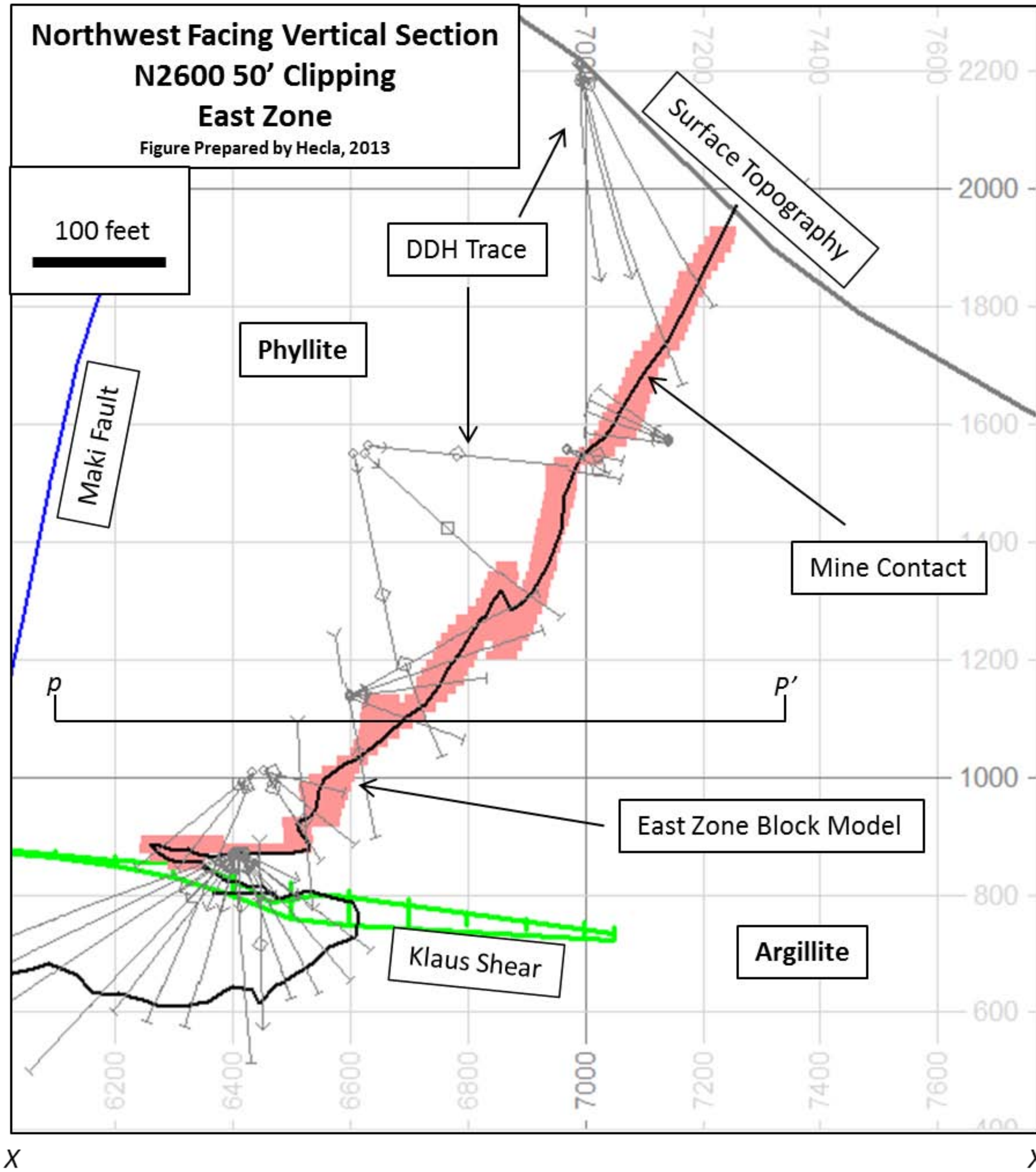
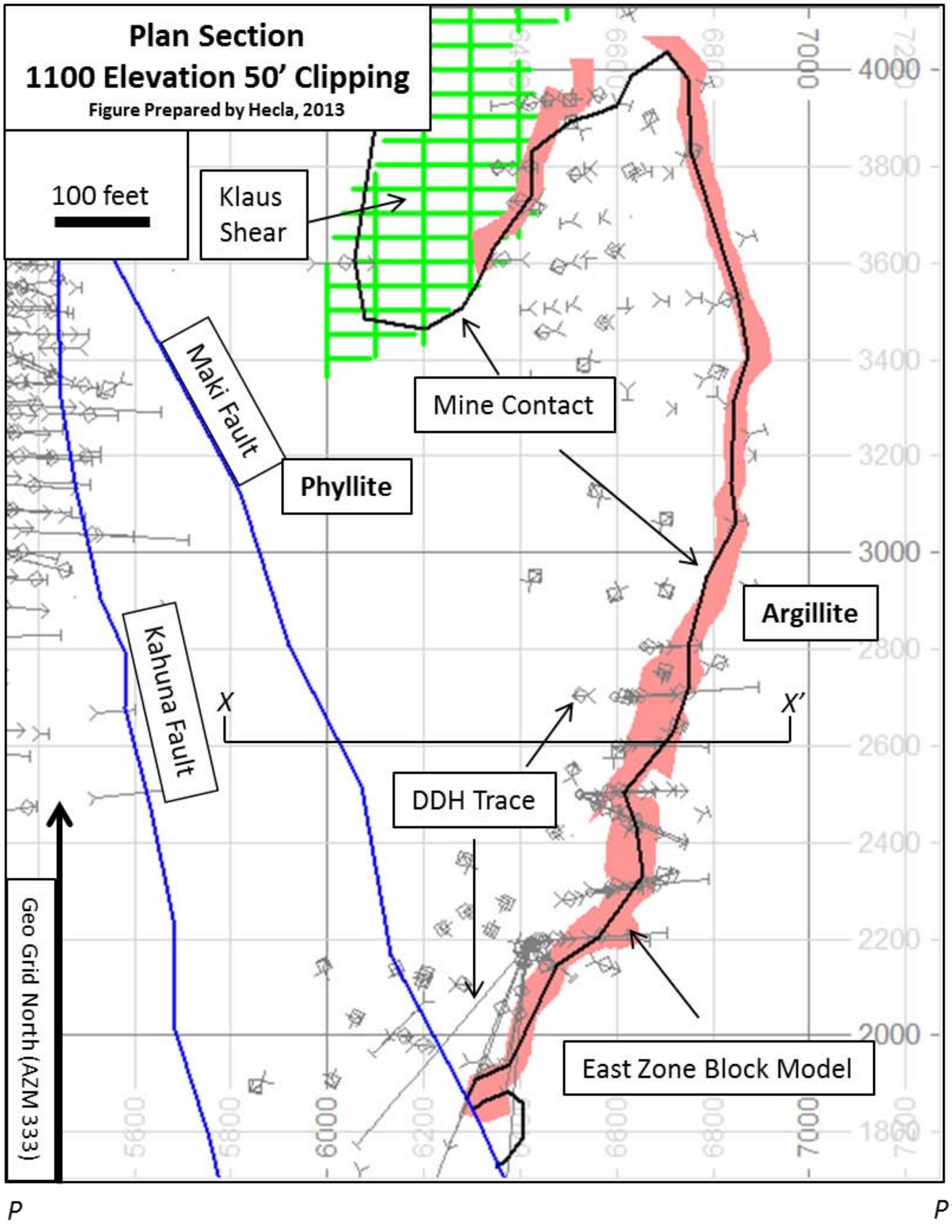


Figure 7-10: Level Plan 1100, East Zone



7.4.3 West Zone

The West zone is the down-dip extension of the East zone north of 2650N. The dividing line occurs where the relatively flat-lying western edge of the East zone rolls over into a near vertical drop-off of the phyllite/argillite structure. The zone is situated between 2650N and 4950N, 5100E and 6200E, and 75 to 1100 ft elevation. The West zone is currently subdivided into the Central West, 9A, and Northwest West zones. While quite variable, the overall trend strikes N. 30°W for over 2,500 ft (762 m) not including the offset due to the Maki fault. The thickness is also highly variable from less than 10 ft (3 m) at the top of the “Wall” to over 300 ft (91 m) in apparent thickness in the Central West. Ore types and mineralization styles for the thinner portions of the West are similar to those previously described for the East zone.

Figure 7-11 is an illustration of the 3D model for the zone. Figure 7-12 is a cross-section through the West zone. Figure 7-13 is a level plan showing the relationship of the block model to the Mine Contact.

Central West Zone

The Central West zone lies beneath the Klaus fault and between the East zone and the Maki fault. The eastern portion of the Central West is known as the Wall and is characterized by a near-vertical ore horizon that is 5–20 ft (1.5–6 m) thick. To the west, the mineralized horizon shallows, due to F3 folding, and progressively becomes horizontal and then east-dipping (10–20°). On the western boundary, the east-dipping ore band forms the upper limb of a recumbent F2 fold, the lower limb of which contains a 300 ft (91 m) thickness of ore. This significant thickening of the ore horizon is attributed to both a greater primary metal concentration build-up and structural thickening due to F2 folding. Below the main thickened centroid portion of the West zone the ore geometry becomes more typical with an ore horizon that gradually thins with depth and dips at 45° west. Excluding the centroid portion, the Central West zone ore types, zonation and mineralogy is very similar to that previously described for the East zone.

The West zone centroid shows the most well developed zoning patterns of any of the Greens Creek zones and is the basis for the metal zoning shown in Figure 7-5. The ore types also show a broad zonation pattern. Adjacent to the phyllite, the dominate gangue mineral is silica. As the metal zonation transitions from Fe–Cu to Zn, the dominant ore type becomes carbonate and massive. Progressing upwards from the Zn to Zn–Pb zone, the dominate gangue is still carbonate, but the massive ore bands begin to show more fine-scale banding. Finally, in the Ag–polymetallic zones that lie immediately adjacent to the argillite, the main ore type is massive but with substantial amounts of white carbonate and white baritic ore types.

Figure 7-11: 3D Model, West Zone

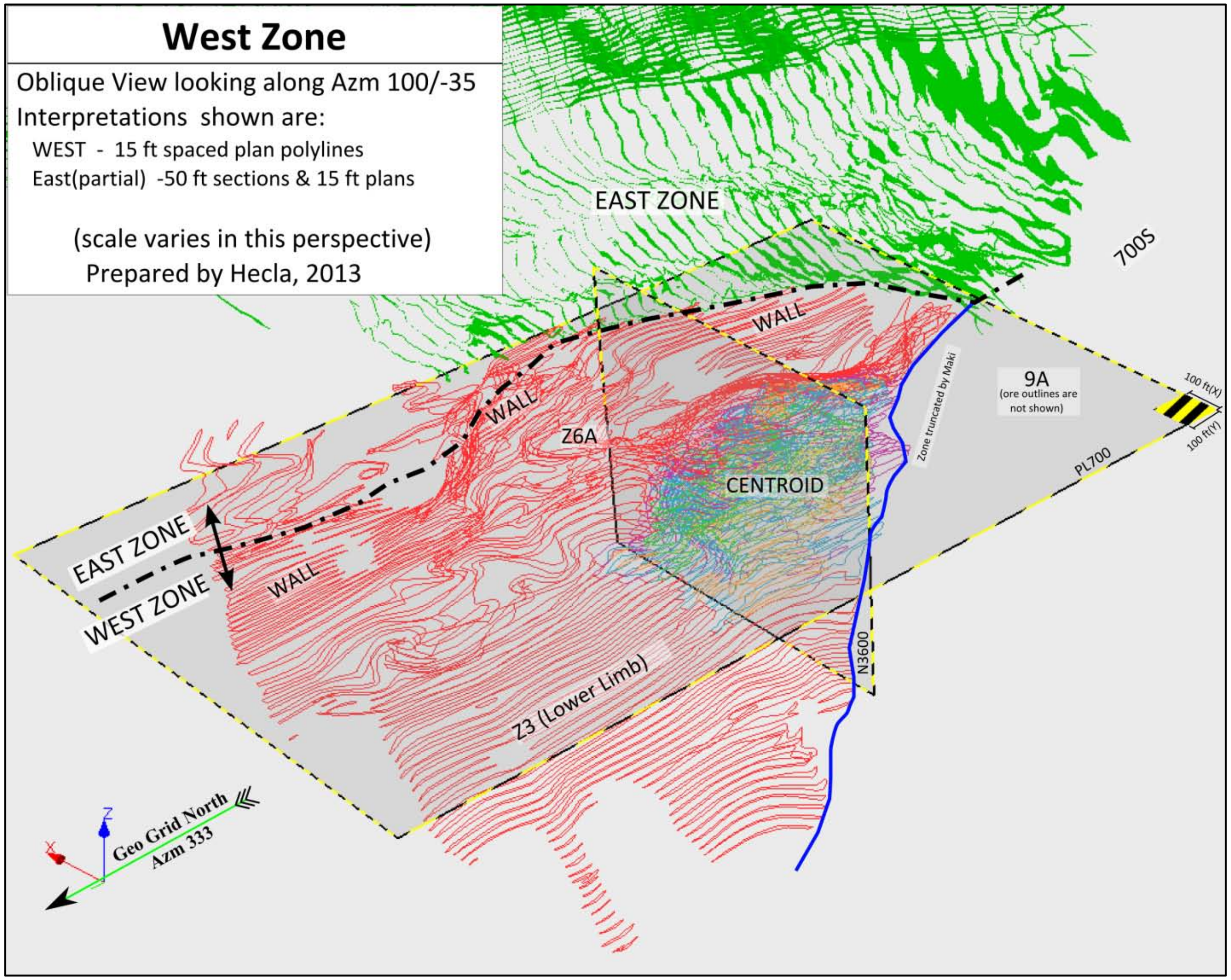


Figure 7-12: Cross Section 3600, West Zone

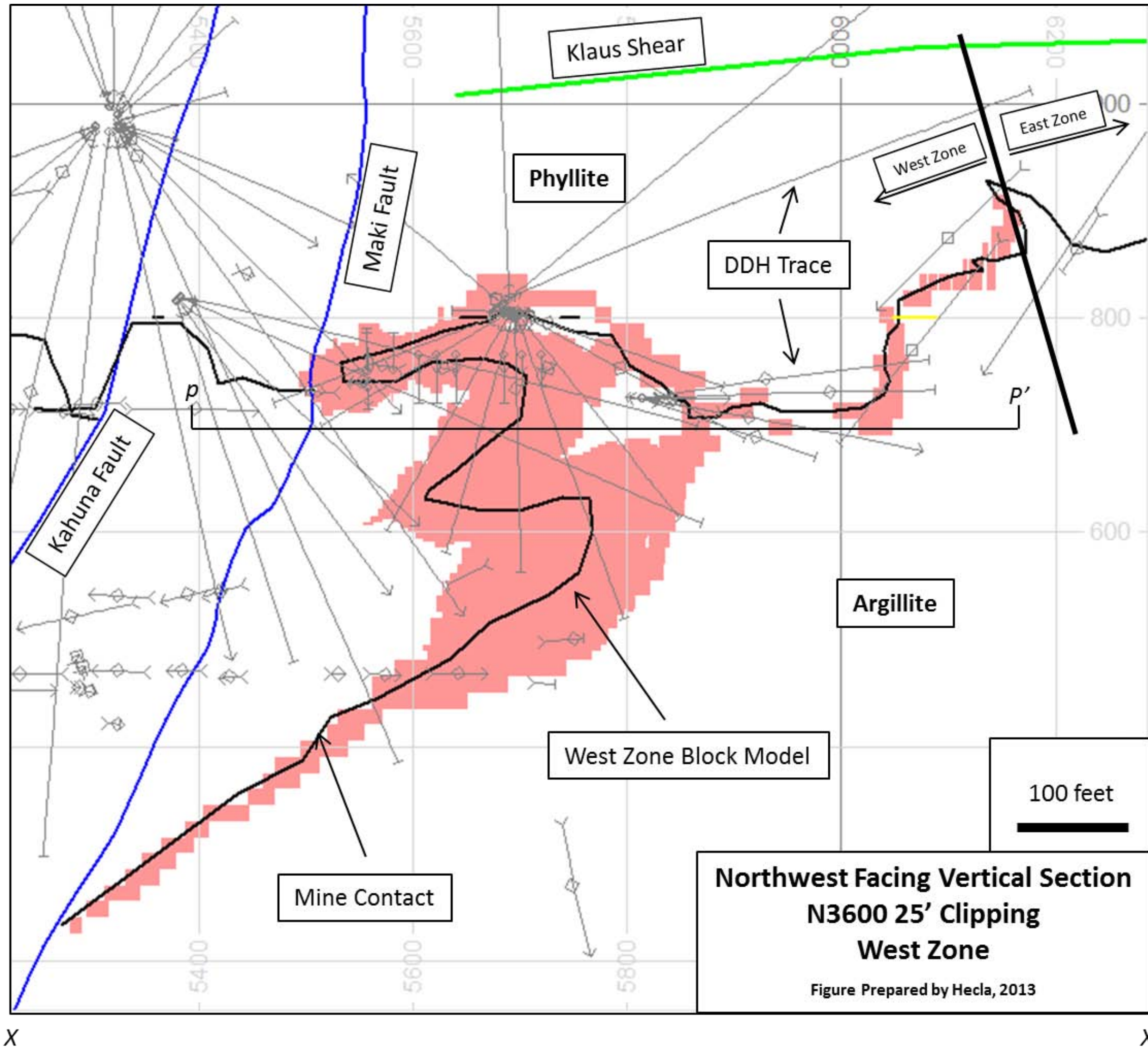


Figure 7-13: Level Plan 700, West Zone

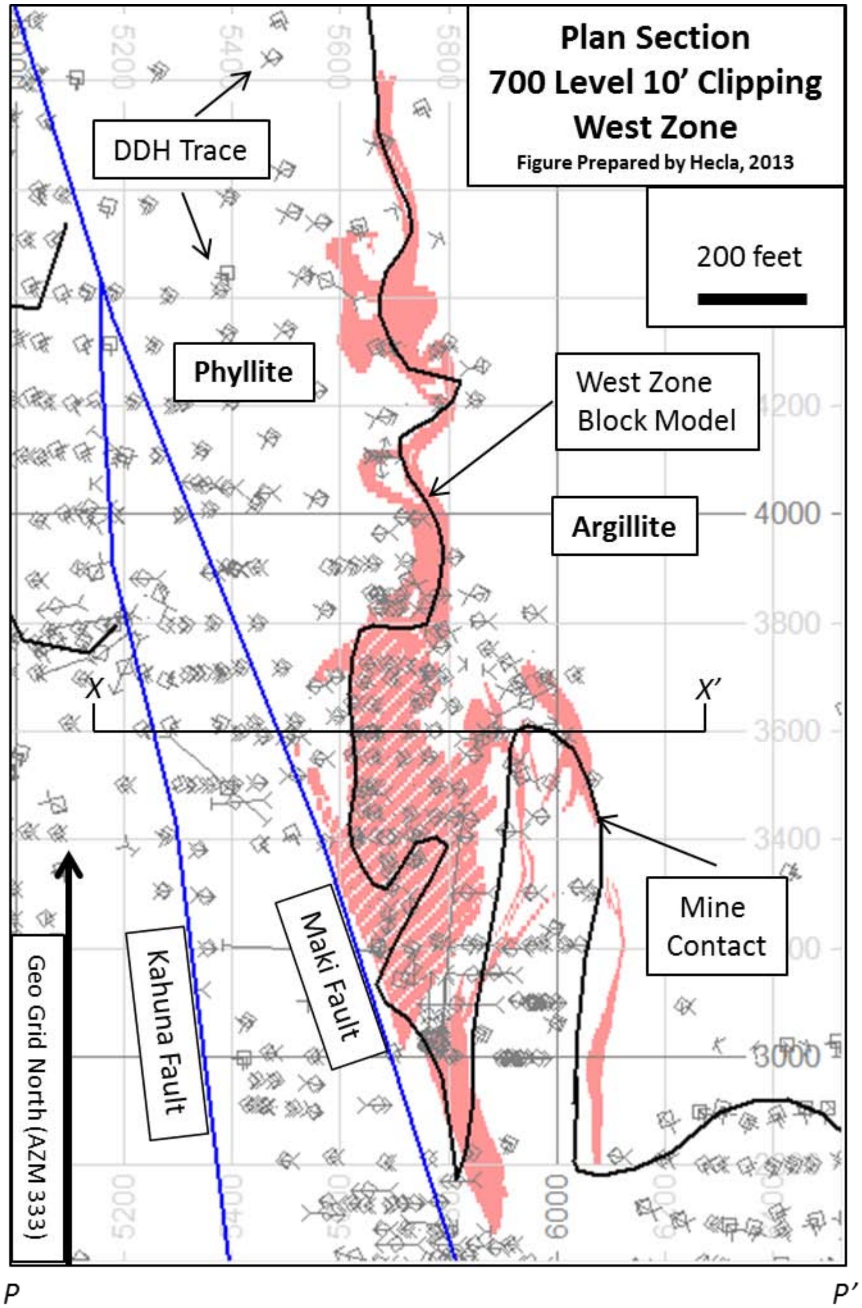


Figure prepared by Hecla, 2013.

7.4.4 9A Zone

The Maki fault is the marker used to separate the Central West and East zones from the 9A zone. The 9A zone is composed of numerous fault blocks whose boundaries are defined by fault contacts on one or more sides of the mineralization. It is situated between 2000N and 4200N, 5100 and 6200E, and 420 to 1000 ft elevation. The zone extends for 2,200 ft (610 m) parallel to the Maki fault zone which strikes approximately N 45° W and dips steeply to the west at 70° to 90°. In plan, mineralized widths range between less than 5 ft (1.5 m) up to 100 ft (30 m).

Restoration of the movement along the Maki fault suggests that the 9A zone represents the southwest-oriented down-plunge extension of the East zone and Central West zone.

Throughout the 9A zone, grain-size reduction during faulting has yielded gouge with 0.04 to 0.4 inch (1 mm to 1 cm) sized clots of electrum that are rich in gold, silver, and base metals.

Figure 7-14 is an illustration of the block model extents. Figure 7-15 is a cross-section through the 9A zone. Figure 7-16 is a level plan that shows the orientation of the mineralization in relation to the Maki fault, and the trace of the Mine Contact.

7.4.5 Northwest West Zone

The Main Northwest West zone is considered to be an extension of the Central West zone that was offset along the Maki fault. The zone is situated between 3950N and 5300N, 4300E and 5250E, and 90 to 950 ft elevation. The structural setting is dominated by a pair of recumbent F2 folds that form an acute S-shape in cross section, the upper fold an argillite-cored syncline, and the lower fold a phyllite-cored anticline. The main part of the ore zone lies on the lower limb of the syncline. Ore types and mineralization is similar to what has previously been described for the Central West “centroid”.

Figure 7-17 is an illustration of the 3D block model. Figure 7-18 is a cross-section through the Northwest West zone and Figure 7-19 is a level plan.

Northwest West–Upper Plate Zone

The Northwest West–Upper Plate zone is situated between 4300N and 5550N, 3650E and 5150E and from 990 to 1330 ft elevation. The mineralized zone strikes N49 W, dips 7° to 8° to the south, and is found in the hinges of an overturned isoclinal fold which opens up to the west.

Figure 7-14: 3D Model, 9A Zone

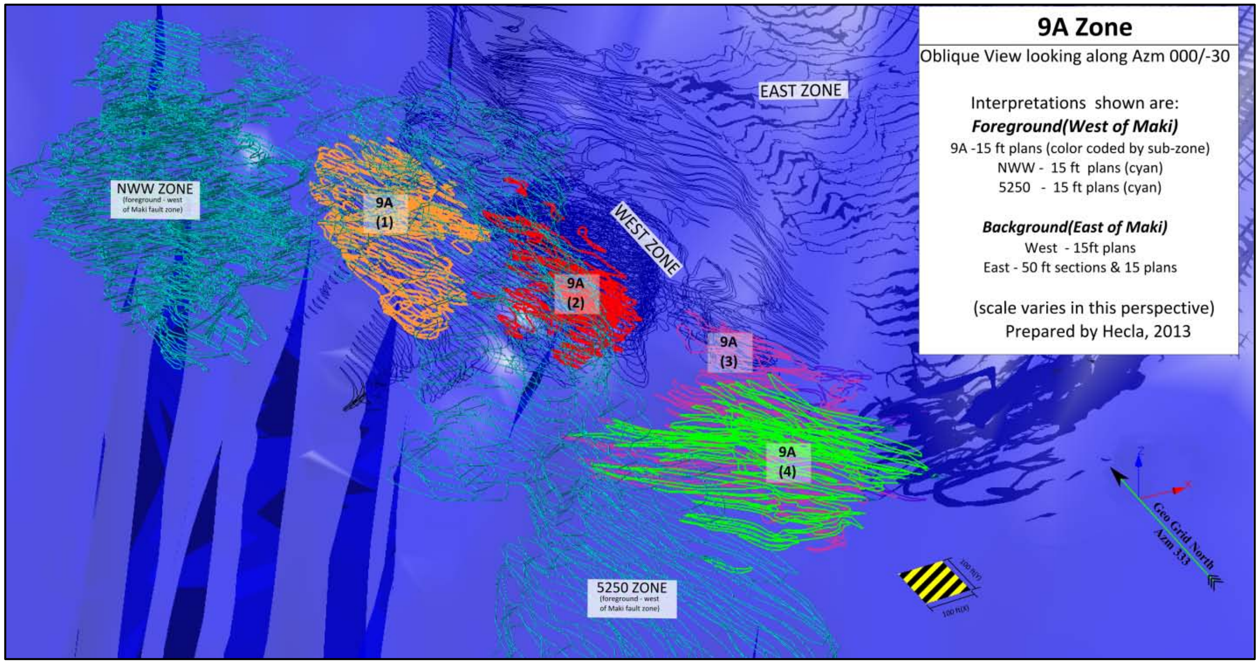


Figure 7-15: Cross Section 2700, 9A Zone

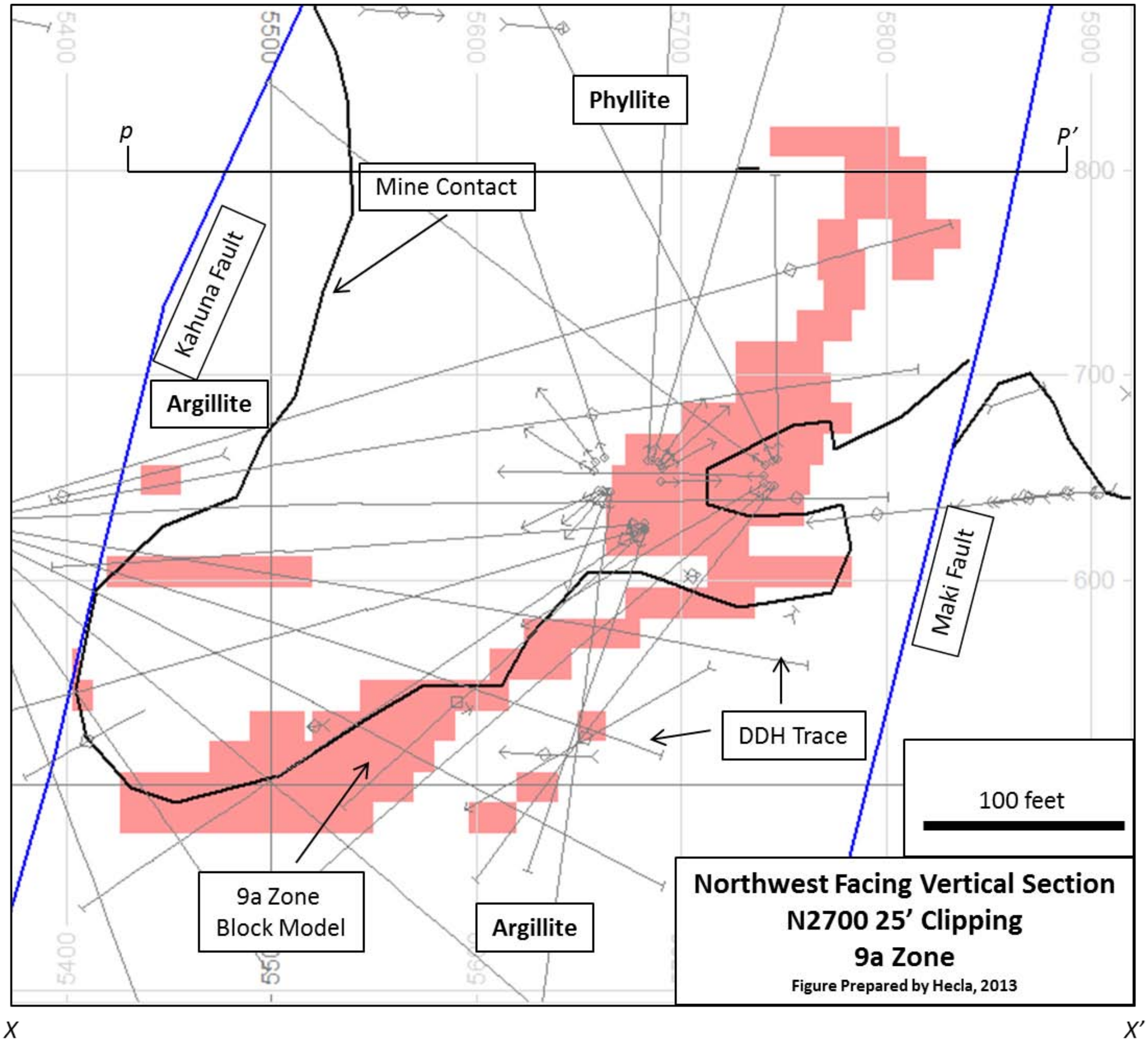


Figure 7-16: Level 800, 9A Zone

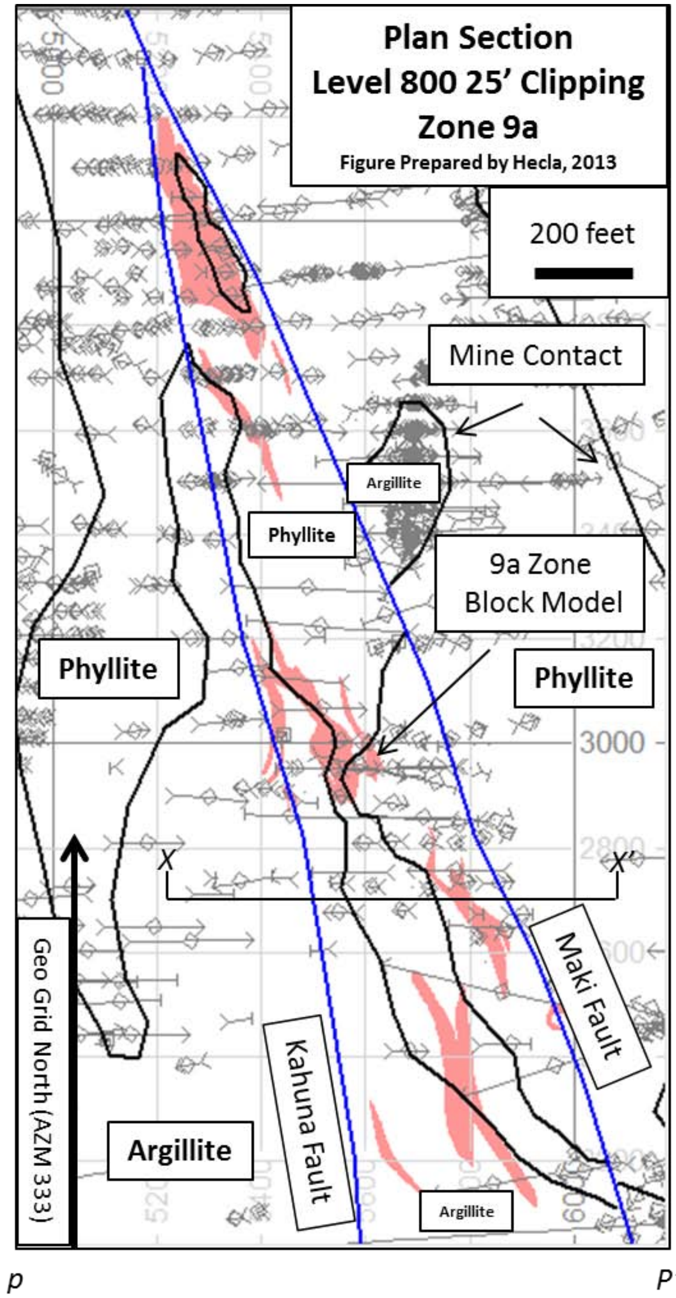
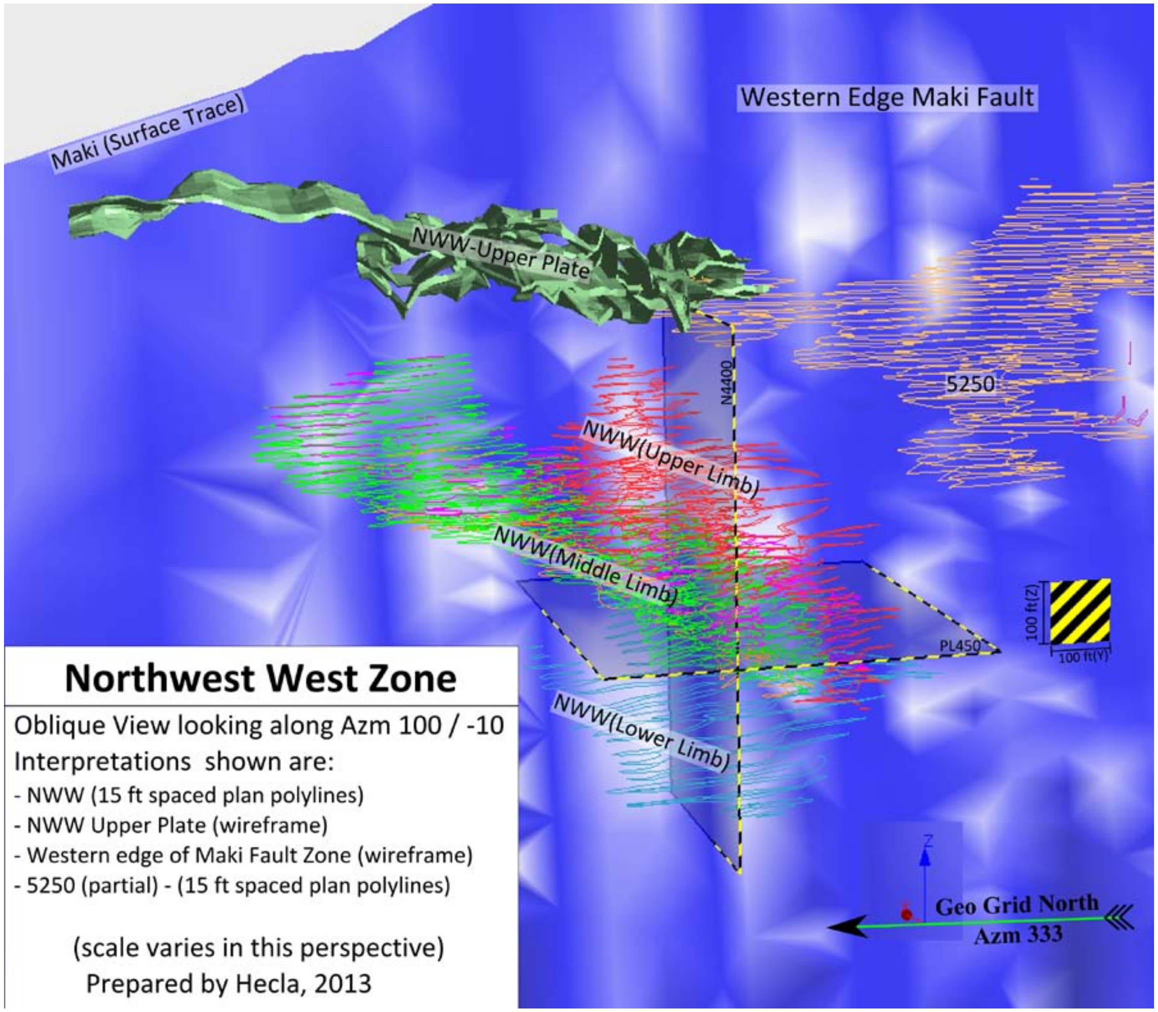


Figure 7-17: 3D Model, Northwest West Zone



Northwest West Zone

Oblique View looking along Azm 100 / -10
Interpretations shown are:
- NWW (15 ft spaced plan polylines)
- NWW Upper Plate (wireframe)
- Western edge of Maki Fault Zone (wireframe)
- 5250 (partial) - (15 ft spaced plan polylines)

(scale varies in this perspective)
Prepared by Hecla, 2013

Figure 7-18: Cross Section 4400, Northwest West Zone

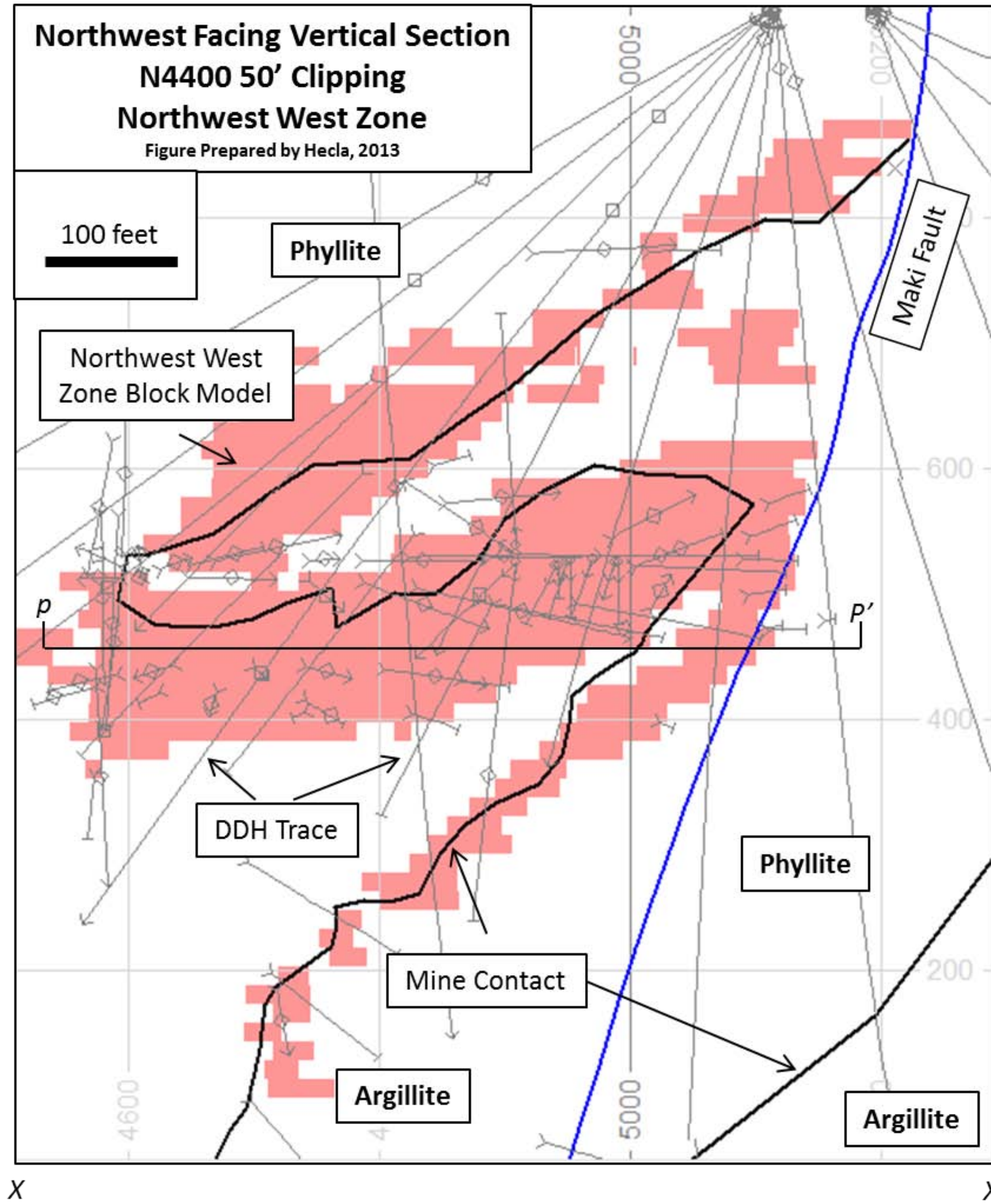
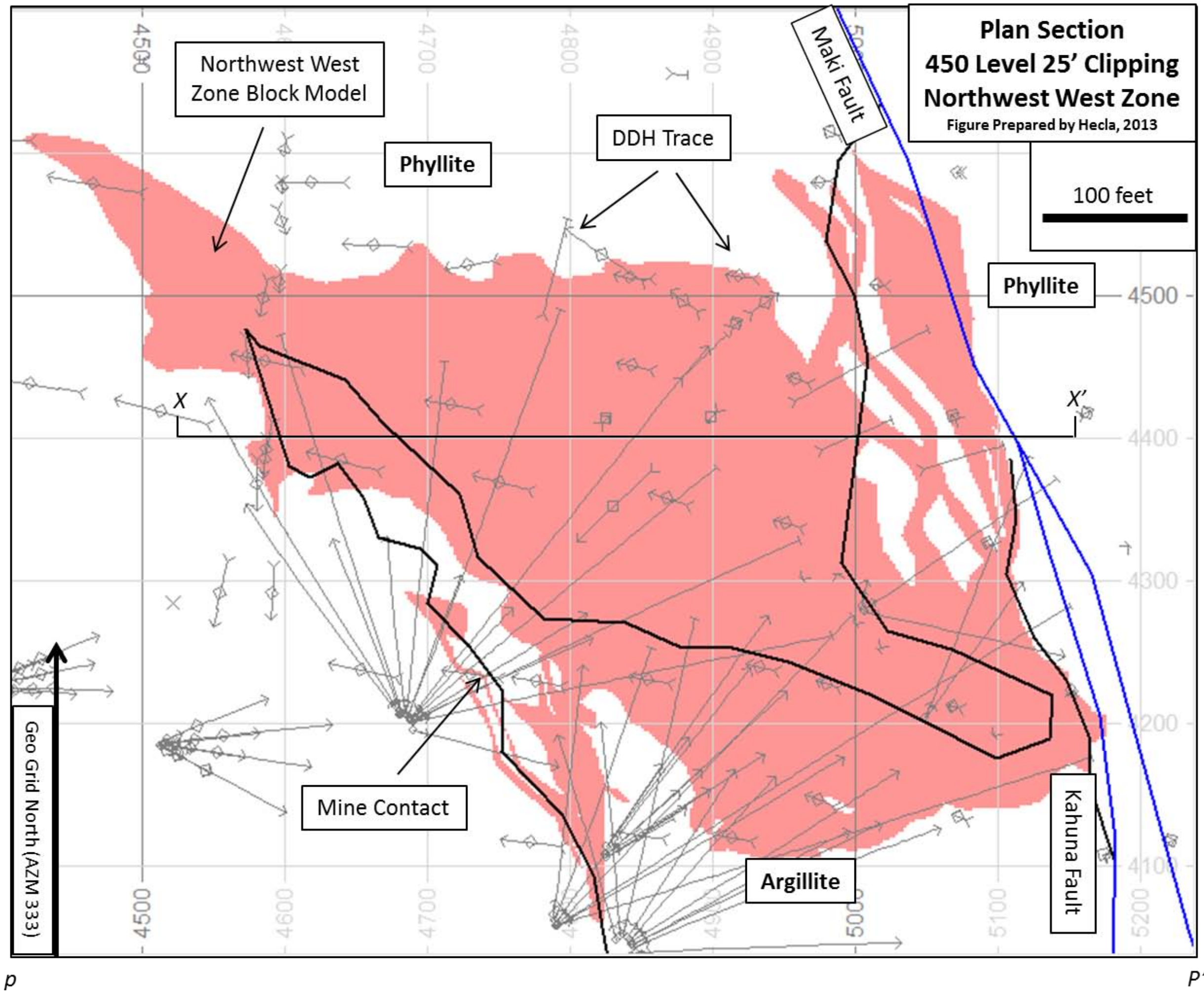


Figure 7-19: Level Plan 450, Northwest West Zone



The upper limb of the fold corresponds to the Upper Shear zone and is locally close to the overburden contact. Between sections 5550N and 4950N, the mineralized horizon is developed on the upper limb of the isoclinal fold as well as in the hinge zone. Mineralization is largely undeveloped in the lower limb. South of 5050N, the mineralized zone is transected by faults with a downward displacement to the east.

Mineralization is also developed on the lower limb of the isoclinal fold. South of section 4900N, the main mineralized horizon is no longer constrained to the hanging wall/footwall contact, but is found higher up in the hanging wall stratigraphy. A second, smaller, mineralized zone is developed on the contact zone. To the south of section 4500N, a single mineralized horizon is developed; it is transected by a fault with downward displacement to the east close to the nose of the fold, with mineralization is developed on both flanks.

Northwest West South Zone

The Northwest West South zone is situated between 3350N and 4100N, 4600E and 5000E and from the 200 to 650 ft elevation. Mineralization is situated to the south of the main Northwest West zone and is on the plunge of a major overturned anticline with small tight isoclinal folds. The Northwest West South mineralization occurs in fragments or lenses along the phyllite/argillite contact, and appears to be more closely associated with the phyllite units. The area where mineralization occurs is extremely tightly folded (F2) with F3 refolding resulting in horizontal fold axes moving away from the Maki Fault.

Mineralization in the Northwest West South zone appears much more discontinuous than the other zones. This may be a result of the original depositional environment. This area essentially bridges the northern end of the Southwest zones and lower, phyllite-cored anticline fold of the Northwest West zone. Individual lenses rarely extend more than 150 ft (46 m) in strike length and appear to be fairly thin (<10 ft or 2 m) in plan.

Ore types are a mixture of mostly massive and white-siliceous ore types with lesser carbonate, baritic and mineralized argillites.

7.4.6 5250 Zone

The 5250 zone is interpreted to be a continuation of the southern portion of the East zone that was offset by the Maki fault. The zone is situated between 1250N to 4550N, 4850E to 5500E, and 400 to 1250 ft elevation. The geometry, style and structural complexity of the zone differ between the northern and southern portions with the dividing line approximately near section 3300N.

South of section 3300N, the mineralization is continuous for up to 1,200 ft (366 m) along a N 30° W strike, dips to the west at around 50°, and plunges to the south at 20°. Apparent thickness can range up to 100 ft (30 m). The ore types in the southern section are dominated by white baritic ore with lesser massive ore and minor amounts of carbonate and siliceous ore types. Sections south of section 2350N show a regular zoning between the structural footwall and the structural hanging wall. Metal zoning is summarized by a regular decrease from structural footwall to hanging wall of Ag grades and an opposite sequence for base metals. The lithological and metal zoning becomes progressively less evident north of section 2350N and is replaced with a mixture of white baritic ore, massive sulfides, white siliceous ore, and white carbonate ore.

To the north of section 3300N, the intensity of F2 folding increases and a D3 style shear may intersect the mineralization. To the east the mineralization is bounded by the Kahuna Fault, which delineates the western edge of the Maki fault zone. The ore occurs along the phyllite/argillite contact and trends approximately N 35° W. The mixture of ore types is more typical of other Greens Creek zones with a mixture of massive sulfide, white baritic ore occurring in similar amounts with lesser white carbonate and siliceous ore types. The interpretation shows two limbs of a fold, the western limb dips generally 30º to the west/southwest and the eastern limb dips more steeply at approximately 80º.

Figure 7-20 is an illustration of the block model. Figure 7-21 is a cross-section through the 5250 zone showing the block model outline, drill traces in relation to the model, and the Mine Contact. Figure 7-22 shows the same information for Level 650 of the zone.

7.4.7 Southwest Zone

The Southwest zone is an extension of the Northwest West zone along the lower F2 fold. An upper zone extends 850 ft (260 m) along a N 20° W strike with an overall plan width of 650 ft (198 m). A lower zone extends for 1,200 ft (365 m) along a northerly strike and has an overall plan width of 790 ft (240 m). The transition between the upper and lower zones, which lies at an elevation of about 400 ft (122 m) above sea level, is marked by conspicuous changes in structure and style of mineralization.

Figure 7-23 is a view of the block model. Figure 7-24 is a cross-section through the zone and Figure 7-25 is a level plan.

Figure 7-20: 3D Model, 5250 Zone

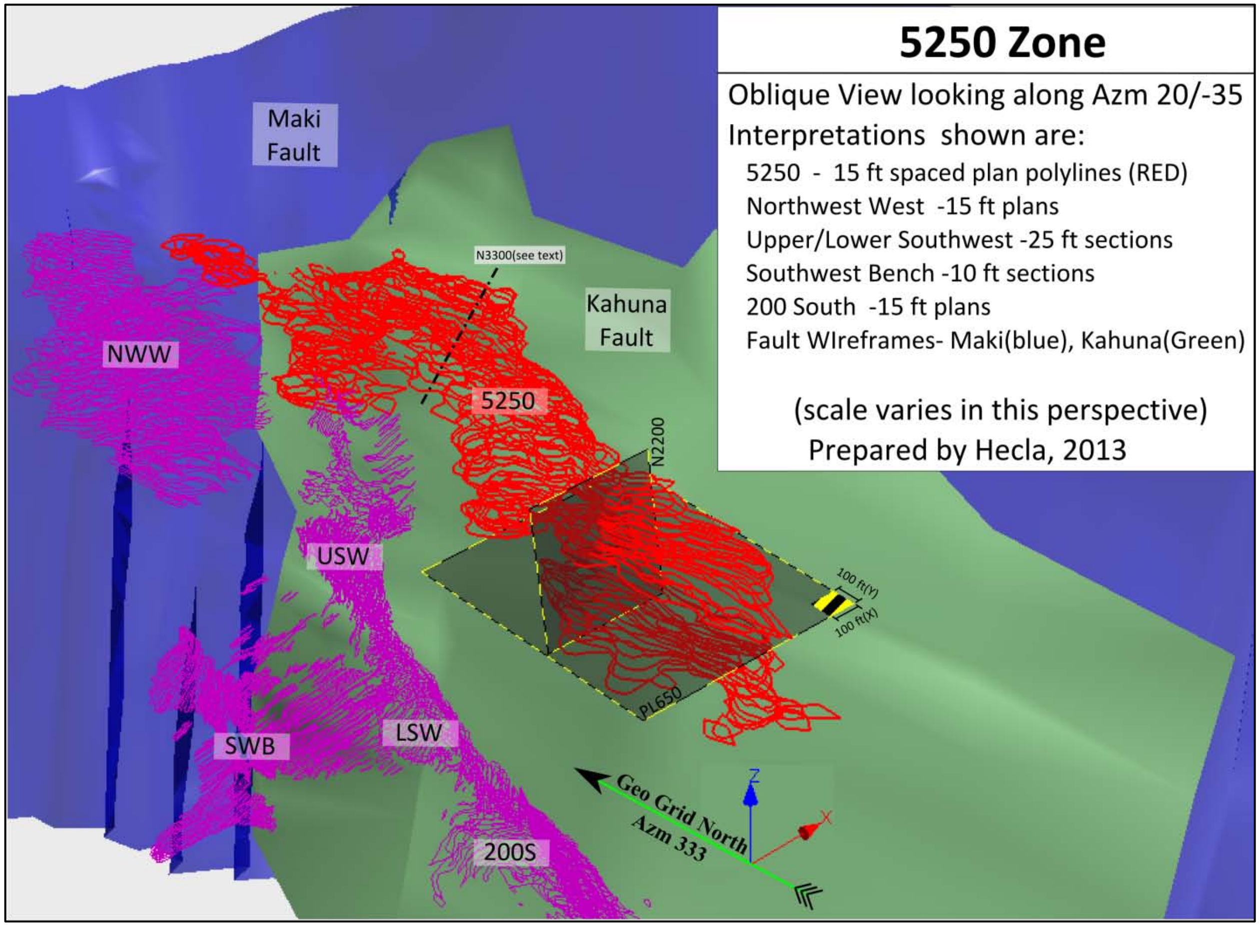


Figure 7-21: Cross Section 2200, 5250 Zone

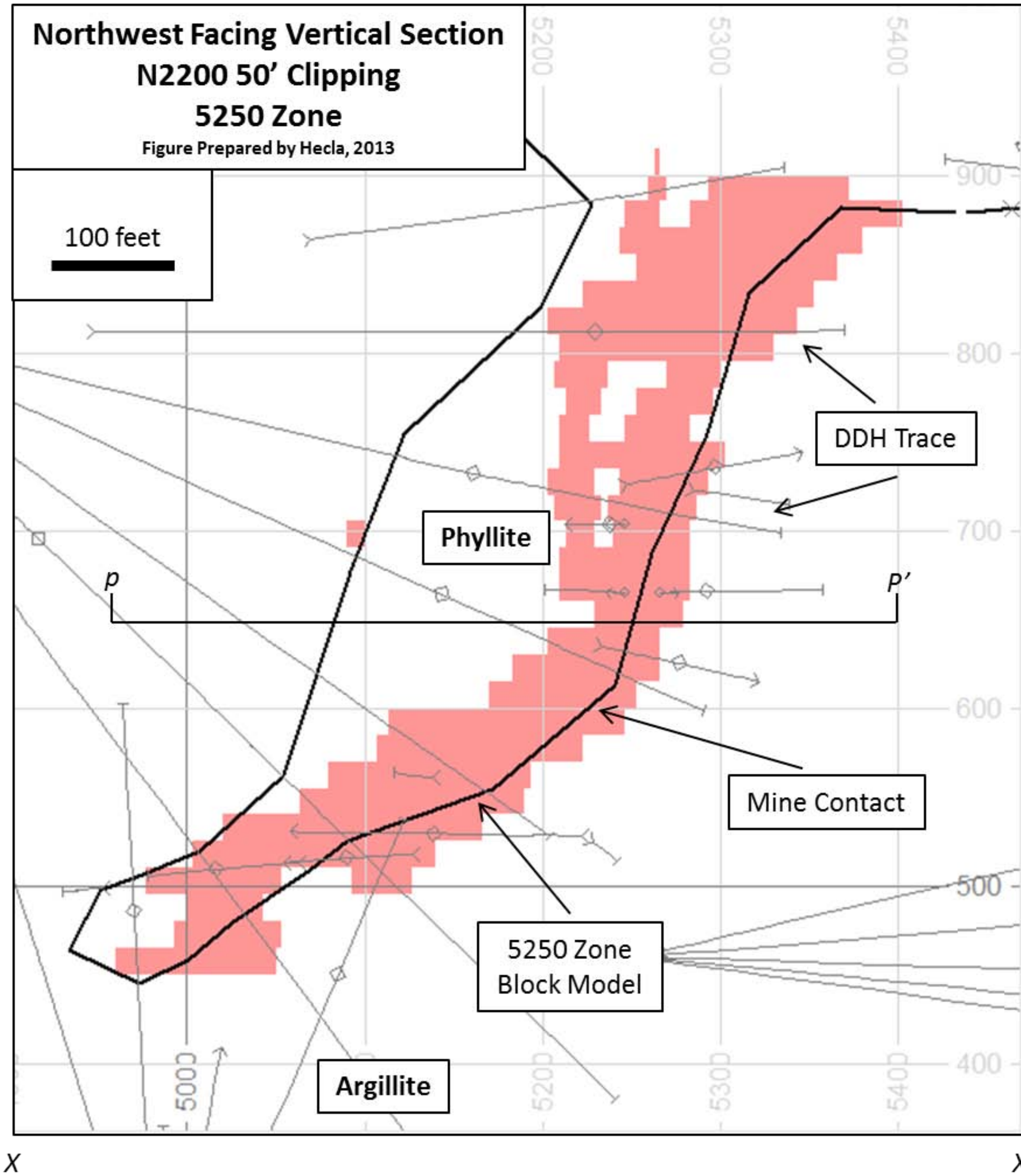


Figure 7-22: Level 650, 5250 Zone

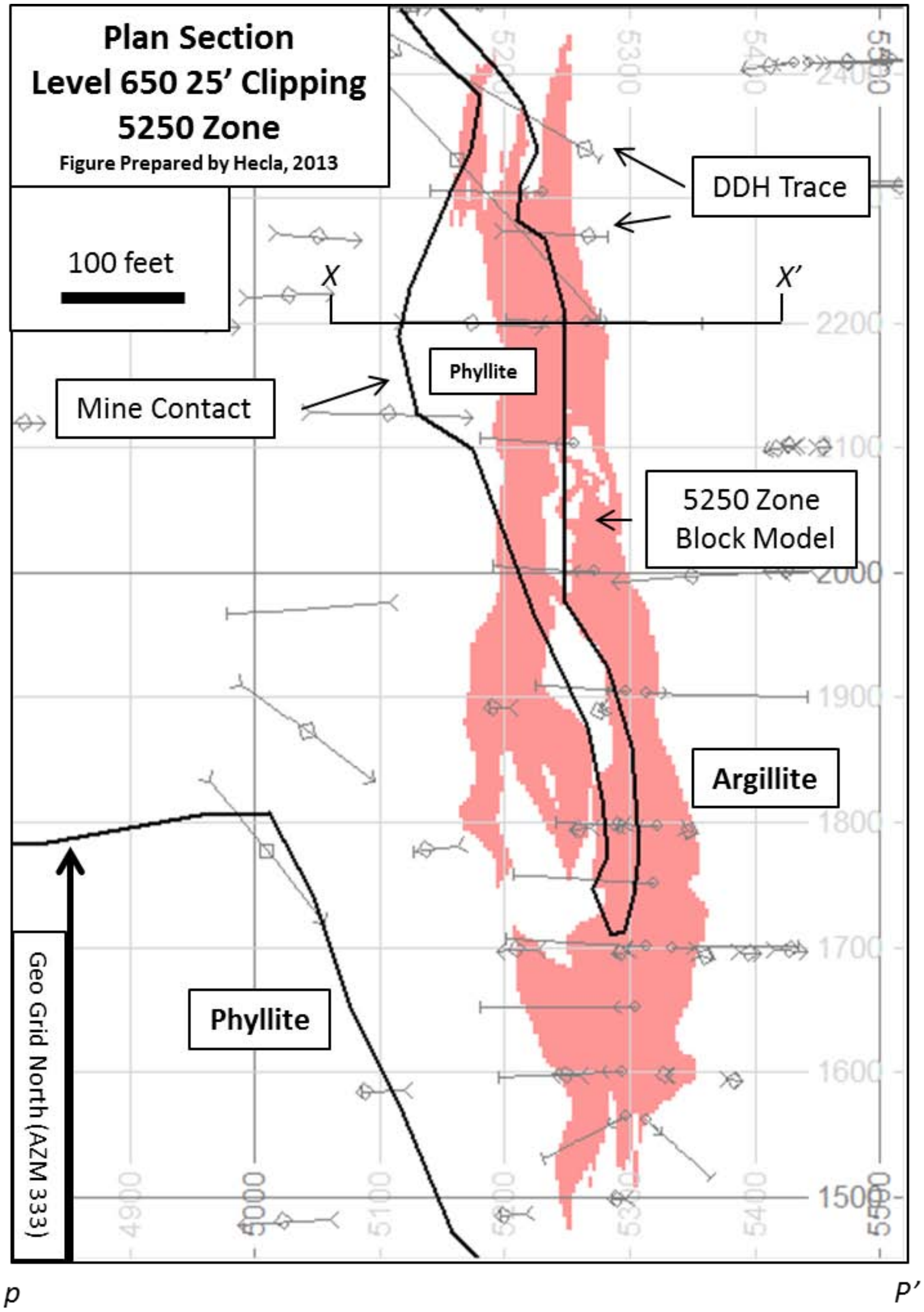


Figure 7-23: 3D Model, Southwest Zone

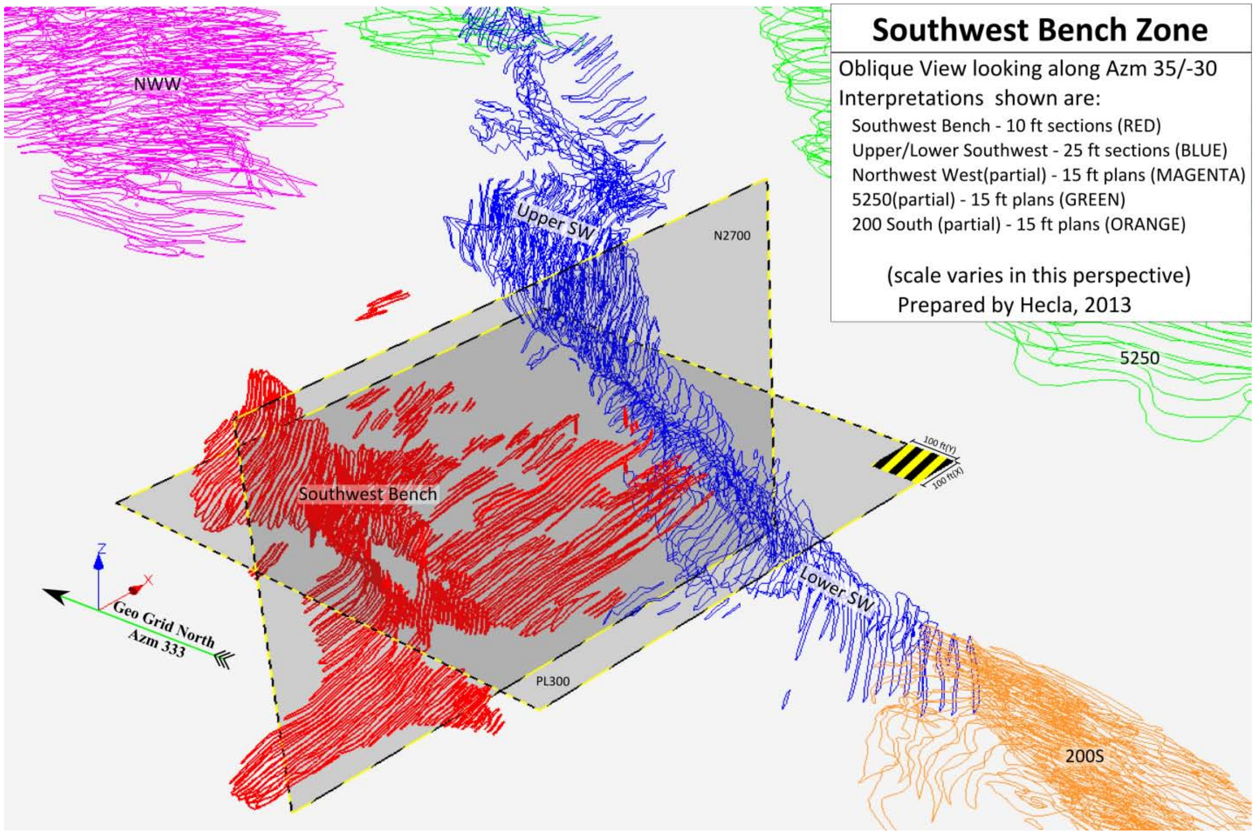


Figure 7-24: Cross Section 2700, Southwest Zone

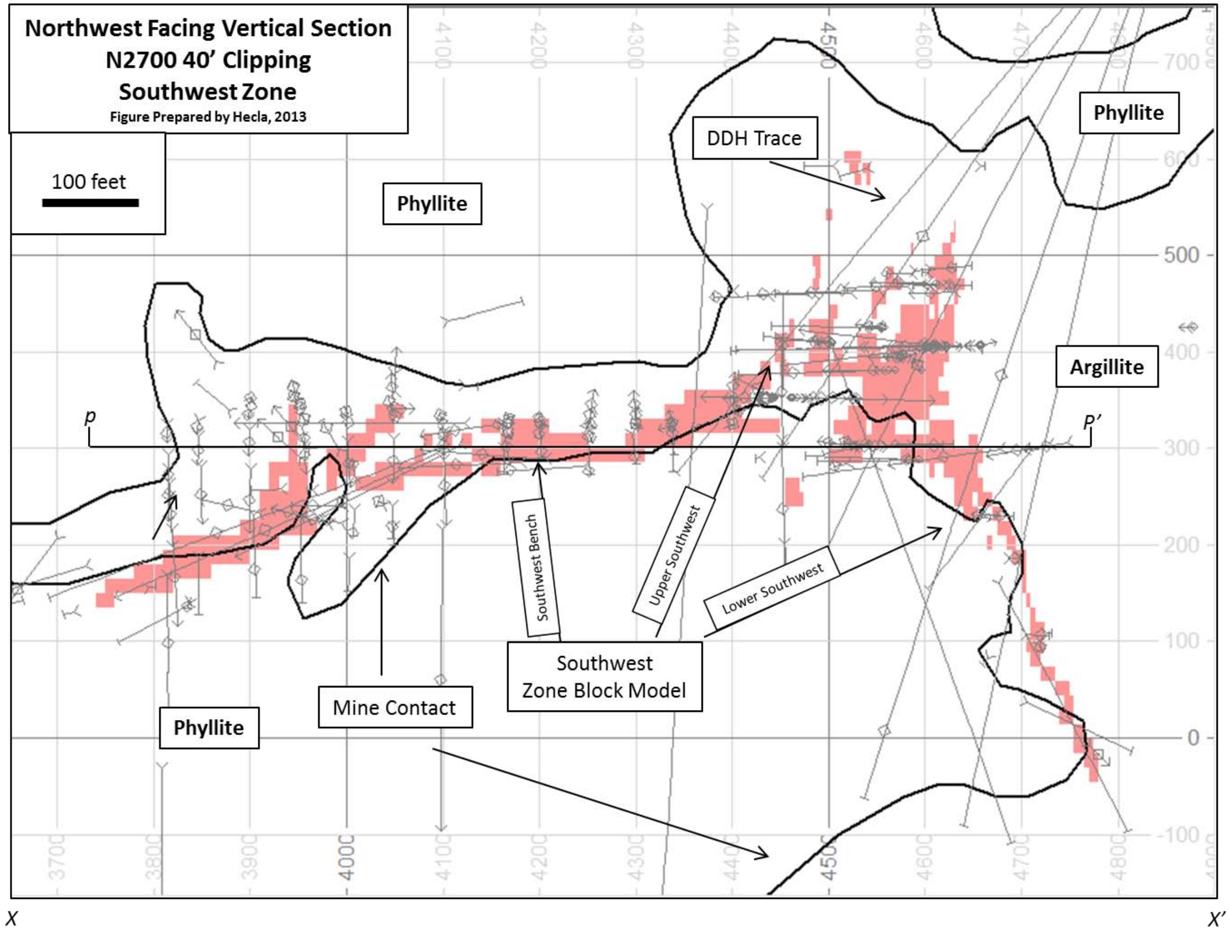
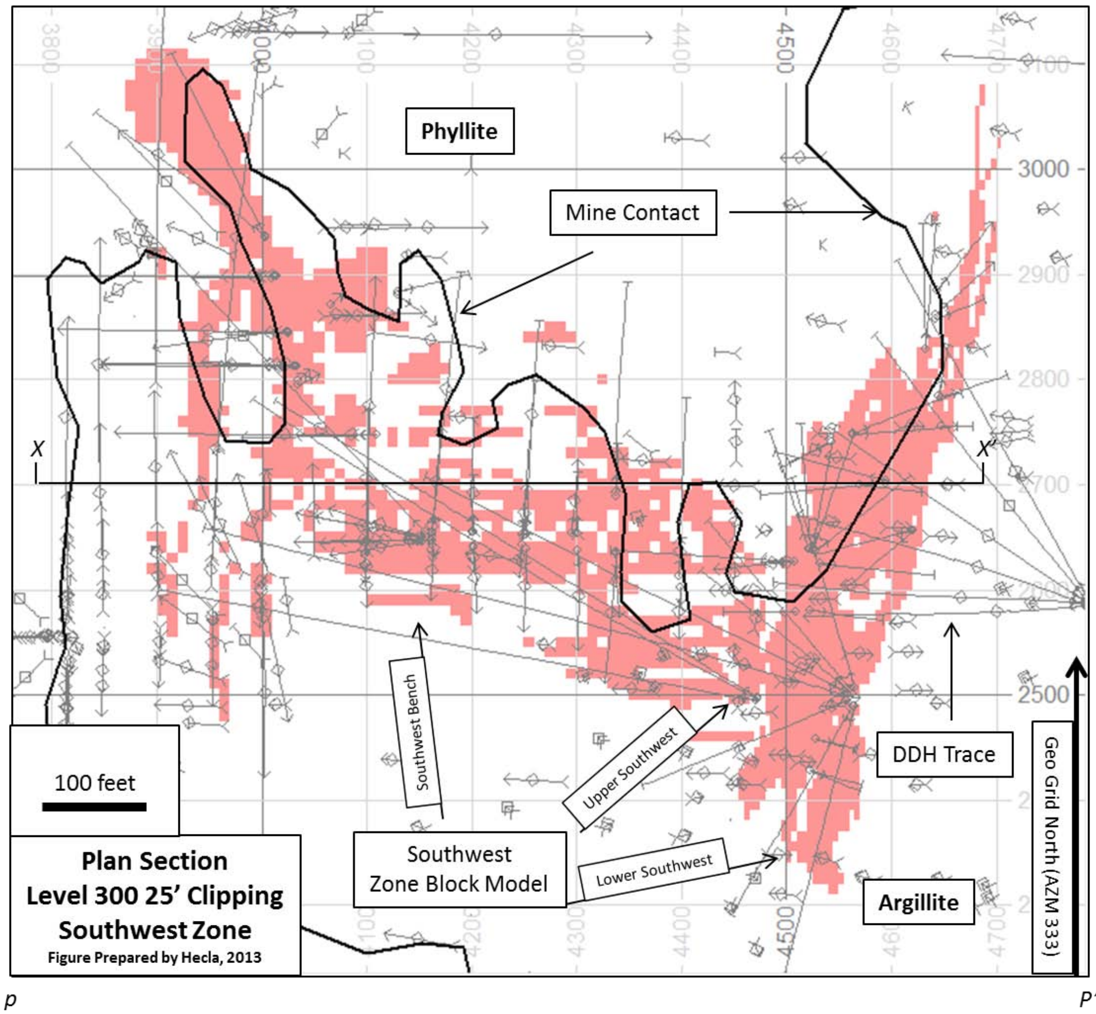


Figure 7-25: Level Plan 300, Southwest Zone



The upper Southwest zone has vertical, tight, south-closing F2 folds around phyllite cores. The overall geometry of the ore is that of a “ripple-fall.” The “falls” are the near-vertical F2 fold limbs, some of which extend to 150 ft (46 m) in height. The “ripple” areas, which show undulations on scales of a few meters or less, dip shallowly to the west as a consequence of F3 folding. The intense folding produced remobilizations with high precious-metal grades. The ore above the 700 ft elevation may also be offset by a D3 style shear. The total offset along this shear appears to be less than 50 ft (15 m).

Lower Southwest Zone

The Lower Southwest zone lies mainly along the limb of a major F2 fold. The overall geometry is a phyllite-cored upright anticline with a steeply-dipping eastern limb and a flat, undulating western limb. The ore is up to 80 ft (24 m) thick in the core of the anticline. Along the eastern limb, mineralization thins to less than 10 ft (3 m) before it is truncated by a series of moderately to steeply dipping D5 faults with right-lateral displacement of several hundred feet (over 100 m). The ore zone is cut by other steeply dipping right-lateral faults as well as by low-angle shears.

Southwest Bench Zone

The western limb (Southwest Bench) has continuous mineralization which extends from 2350N to 3200N, 3500E to 4500E, and from 80 to 500 ft in elevation. The ore horizon strikes approximately N 60° W and dips at 15° to the southwest. Ore thickness is typically less than 5 ft (1.5 m) and is a mixture of massive, siliceous, and mineralized-argillite ore types with lesser carbonate and baritic ores.

Silver and gold grades are higher than typical of other zones, and are associated with acanthine, proustite/pyrargyrite, and electrum.

7.4.8 200 South Zone

The 200 South zone is a continuation of the Lower Southwest trend. The mineralization does thin between sections 2000N and 1800N but is continuous. The 200 South zone is sub-divided into two major areas, the main 200 South and the Deep 200 South.

The main 200 South zone displays the same general anticlinal geometry as the Lower Southwest zone, with a steeply dipping eastern limb and a flat-lying western limb. Mineralization continues for 1,200 ft (366 m) along a strike of N 15° W. In the upper section the plan width is 120 ft (36 m) with an additional 150 ft (46 m) westward extension of bench-style mineralization. The mineralized horizon is 180 ft (55 m) thick in the crest of the anticline and tapers downdip and to the south. The main 200 South zone is bounded by 2000N to 900S, 4000E to 4600E, and +230 to -560 elevation.

There appears to be at least one major F2 anticline in the core of the deposit that has been affected by an F3 fold with east-dipping axial plane. Mineralization is bounded on the east by a steep, brittle fault zone that offsets the ore horizon several hundred feet (75 to 100 m) in a dextral sense.

Figure 7-26 is an illustration of the block model. Figure 7-27 is a cross-section through the 200 South zone that shows the relationship of the drilling to the block model and the Mine Contact. Figure 7-28 is a level plan at Level 100 that shows the outline of the block model in relation to the Mine Contact, and the major drill hole orientations.

Deep 200 South Zone

The Deep 200 South zone is bounded by 1100N to -1000S, 3300E to 4300 E, and from -400 to -1600 ft elevation. Two major sub-zones are apparent in the Deep 200 South zone: the Lower Limb and the South Bench.

The Lower Limb appears to be a direct continuation of the main 200 South ore trend and occurs as a band of ore at the phyllite/argillite contact that steeply dips to the west and plunges to the south at 40°. Apparent planar thicknesses typically range from 5 to 20 ft (1.5–6 m). The ore types trend from dominantly white ore above and to the north to Fe-rich massive ores deep and to the south.

The second sub-unit, South Bench, occurs as a sub-horizontal anticlinal fold that opens to the west and plunges shallowly to the south at 10° to 15°. The apparent fold closure to the west is complicated by a brittle D5 style fault of unknown offset. The apparent thickness of the ore band typically varies between 2 ft (0.6 m) to a maximum of 10 ft (3 m). Ore types range from massive to a mixture of white ores dominated by siliceous gangue.

Between the main 200 South and Deep 200S sub-zones there appears to be at least one and possibly two D3-style shears. The offset and geometry of these shears is not currently fully understood. In detail the ore trends are continuous between the main and Deep sub-zones but there is a noticeable thinning and or truncation at the shear boundary.

Figure 7-29 is an illustration of the block model. Figure 7-30 is a cross section through the Deep 200 South zone that shows the relationship of the drilling to the block model and the Mine Contact. Figure 7-31 is a level plan at Level 100 that shows the outline of the block model in relation to the Mine Contact, and the major drill hole orientations.

Figure 7-26: 3D Model, 200 South Zone

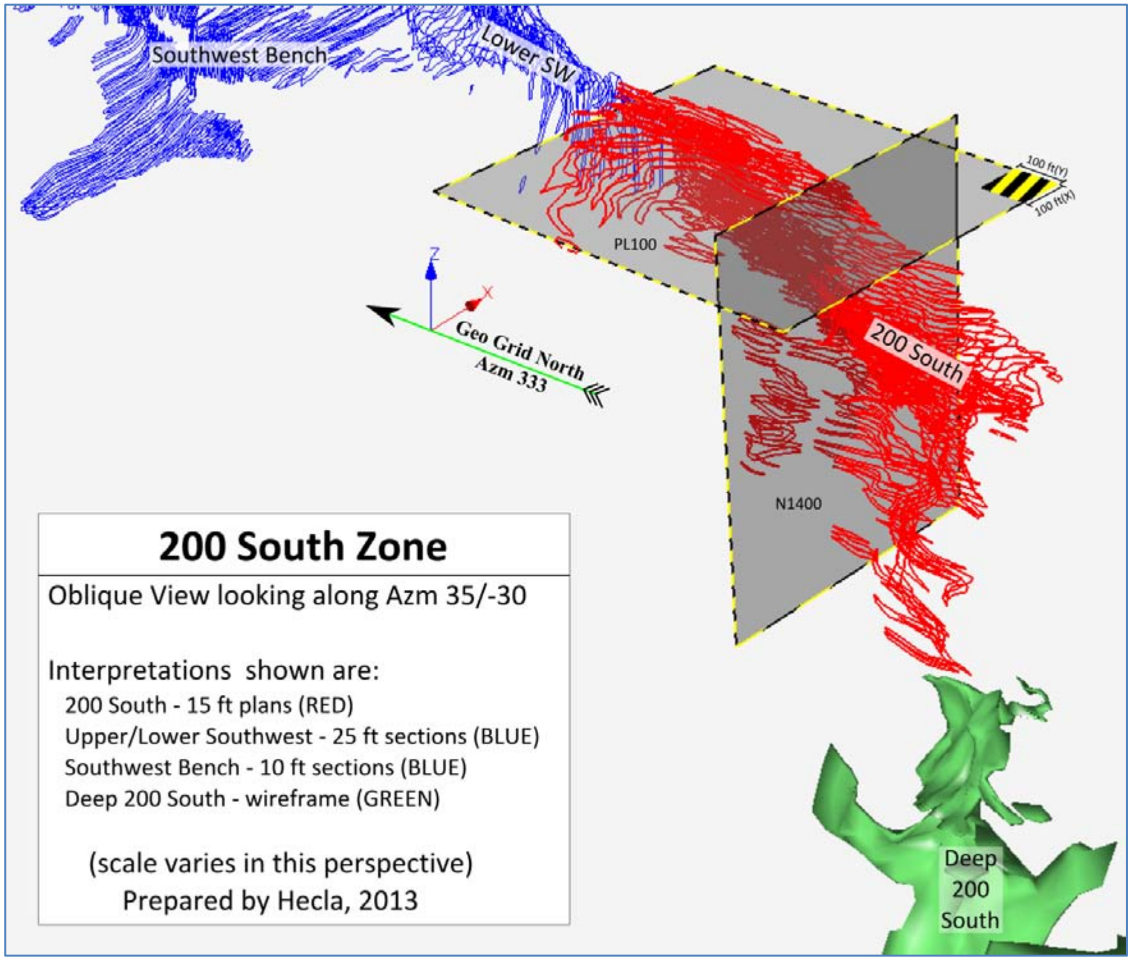


Figure 7-27: Cross Section 1400, 200 South Zone

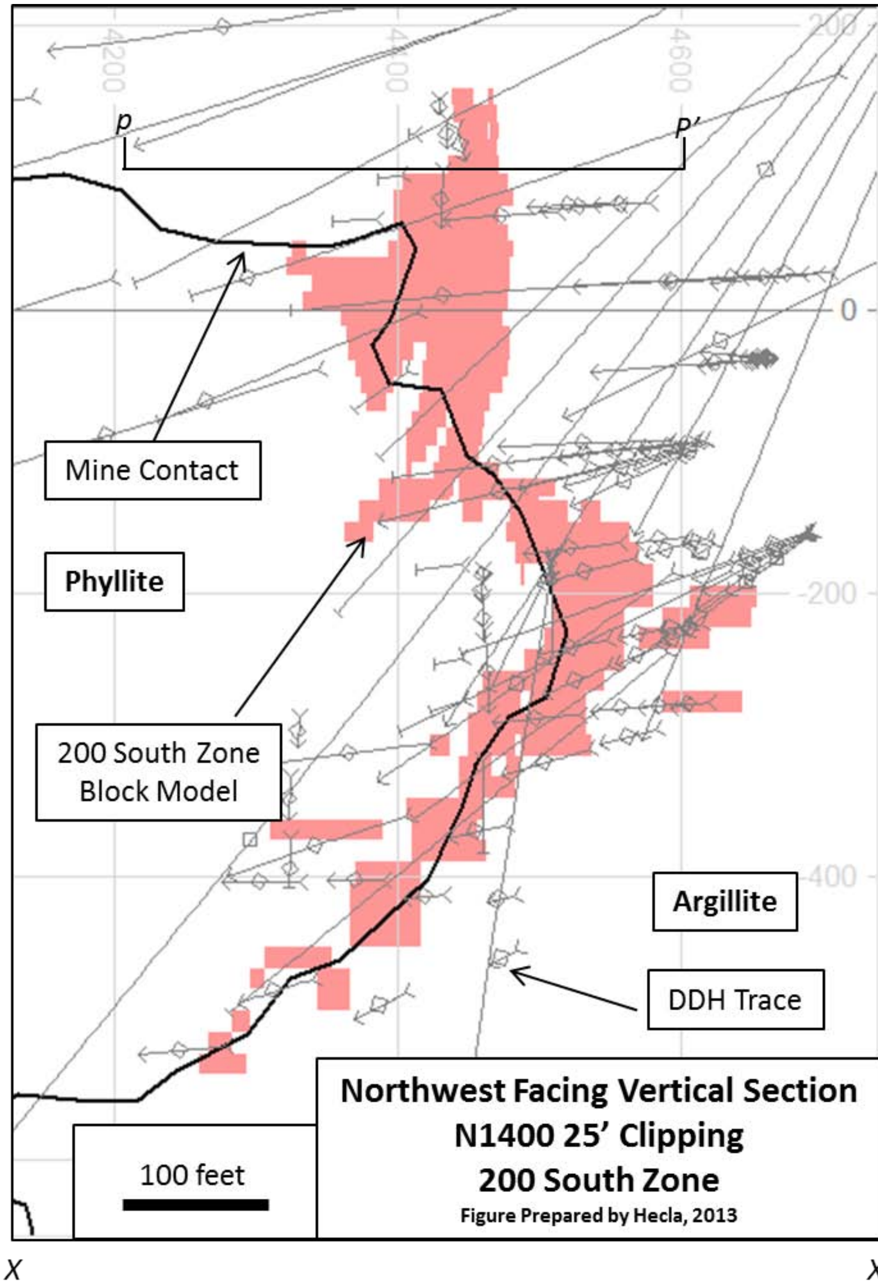


Figure 7-28: Level Plan 100, 200 South Zone

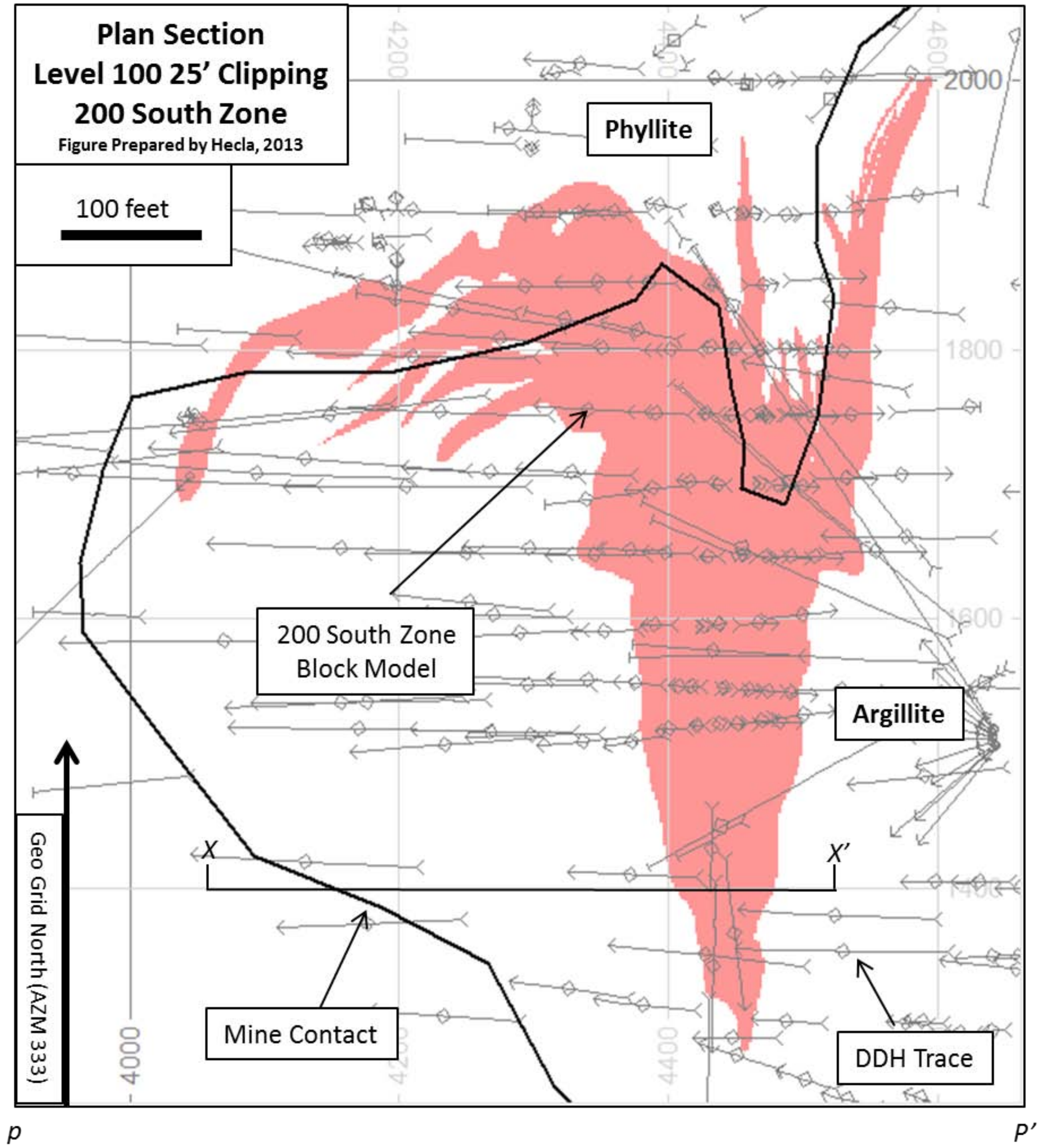


Figure 7-29: 3D Model, Deep 200 South Zone

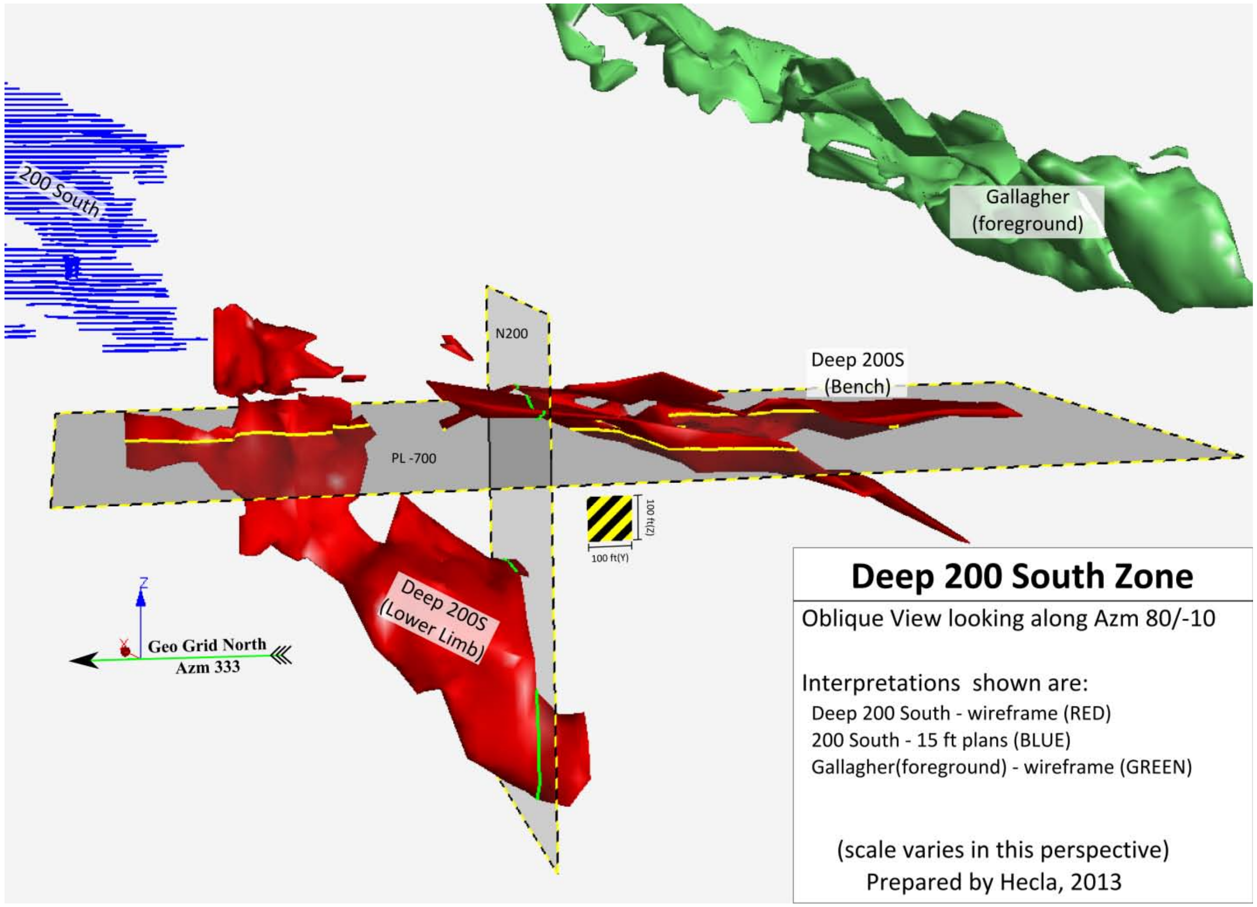


Figure 7-30: Cross Section 200, Deep 200 South

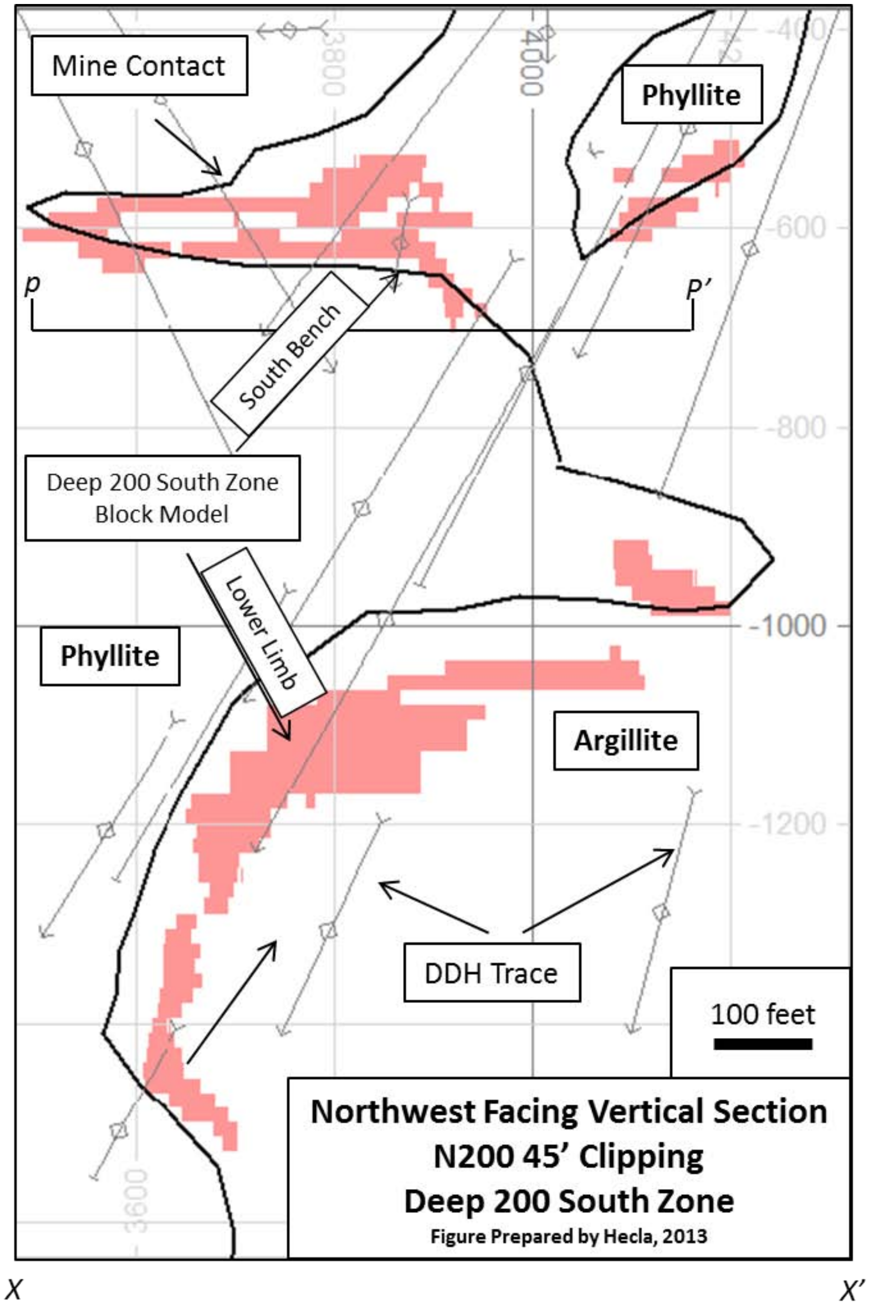
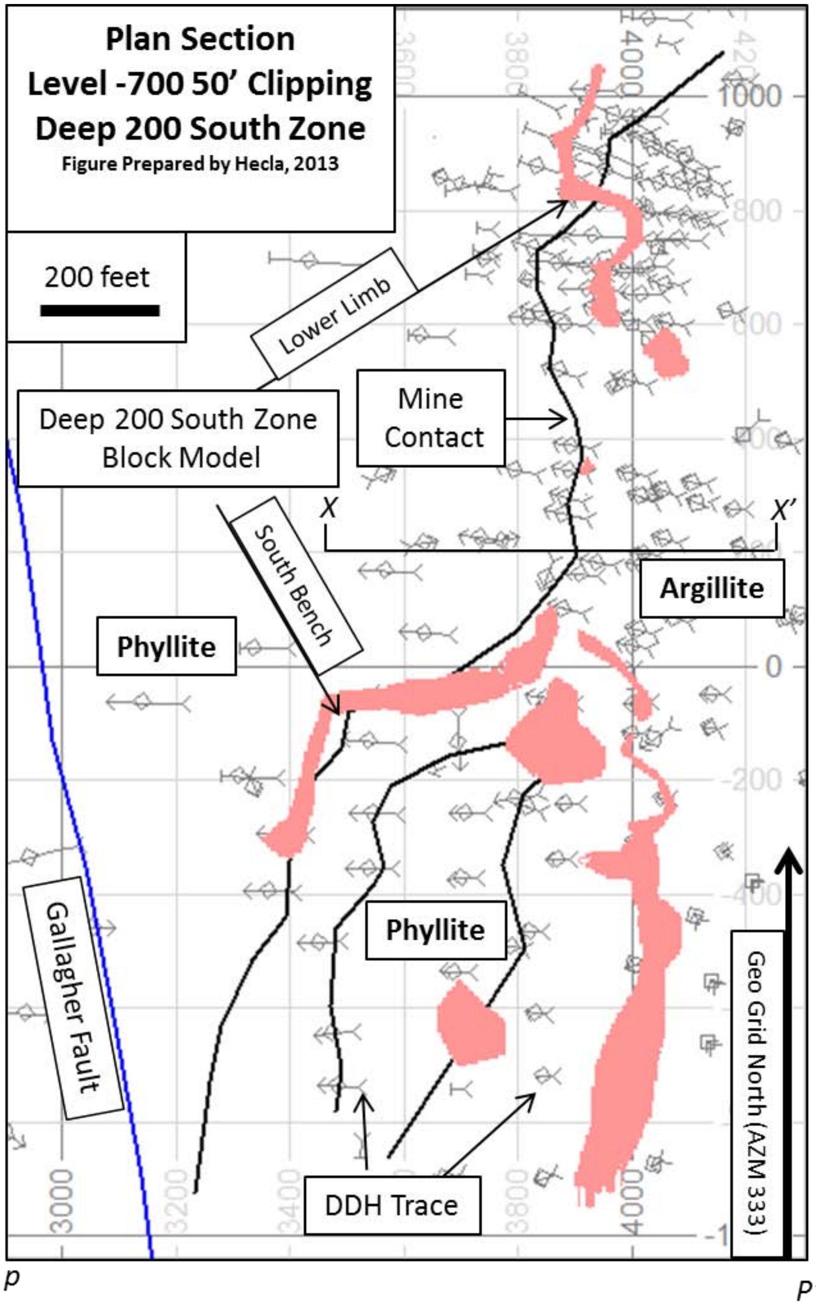


Figure 7-31: Level Plan 700, 200 South



7.4.9 Gallagher Zone

The Gallagher zone is located west of the Gallagher Fault and is the westernmost of the known Greens Creek zones (refer to Figure 7-3). The zone extends from -900N to 400N, 1900E to 3000E and between levels -350 to 350. The overall Gallagher trend strikes 0° N, dips 30° W, and plunges to the south at 30°.

The thickness of the mineralized horizon is highly variable. In the northwest portion of the zone where the horizon is sub-horizontal the true thickness ranges for less than 5 ft (1.5 m) up to a maximum of 15 ft (4.6 m). In the central portion of the zone, the mineralized horizon appears to be an overturned antiform cored by an altered argillite on the west and capped by an un-altered argillite on the east. In this area, thickness ranges from 5 ft (1.5 m) in the limbs to an apparent thickness of up to 180 ft (55 m) in the core the fold. To the south, where the mineralized horizon becomes conformable to the phyllite/argillite contact the thicknesses typically range from 10 ft (3.0) to 20 ft (6.1 m).

Mineralization occurs along the phyllite/argillite contact in the deeper/southern portions but appears to become attendant in the argillites in the central portions of the zone. Above and to the north and western edge the mineralization again occurs at the phyllite/argillite contact but portions of this area may be offset along a D3-style shear.

The Gallagher zone does show some broad-scale zonation patterns with Fe-rich massive mineralization dominate in the lower southern sections, a middle barite-rich relatively metal-poor central section, and a more typical mixture of white and massive mineralization types in the northern sections.

Figure 7-32 is an illustration of the block model. Figure 7-33 is a cross section through the Gallagher zone and Figure 7-34 is a level plan illustration.

7.5 Prospects/Exploration Targets

A number of prospects have been discovered during ongoing surface and underground exploration efforts in the Greens Creek district. The geology and mineralization setting of the major prospects are outlined below. Prospect locations referred to in this section are shown in Figure 6-1.

7.5.1 Gallagher Creek

The mineralization exposed in lower Gallagher Creek consists of pyrite–pyrrhotite–sphalerite-impregnated mine phyllite. This is interpreted as footwall alteration to the Greens Creek mineralized horizon. Polymetallic sulfide mineralization occurs within the isoclinal F_2 infold of mine argillite overlying a substantial thickness of basal Hyd debriite. This is identified as a structural repeat of the Greens Creek ore horizon.

Figure 7-32: 3D Model, Gallagher Zone

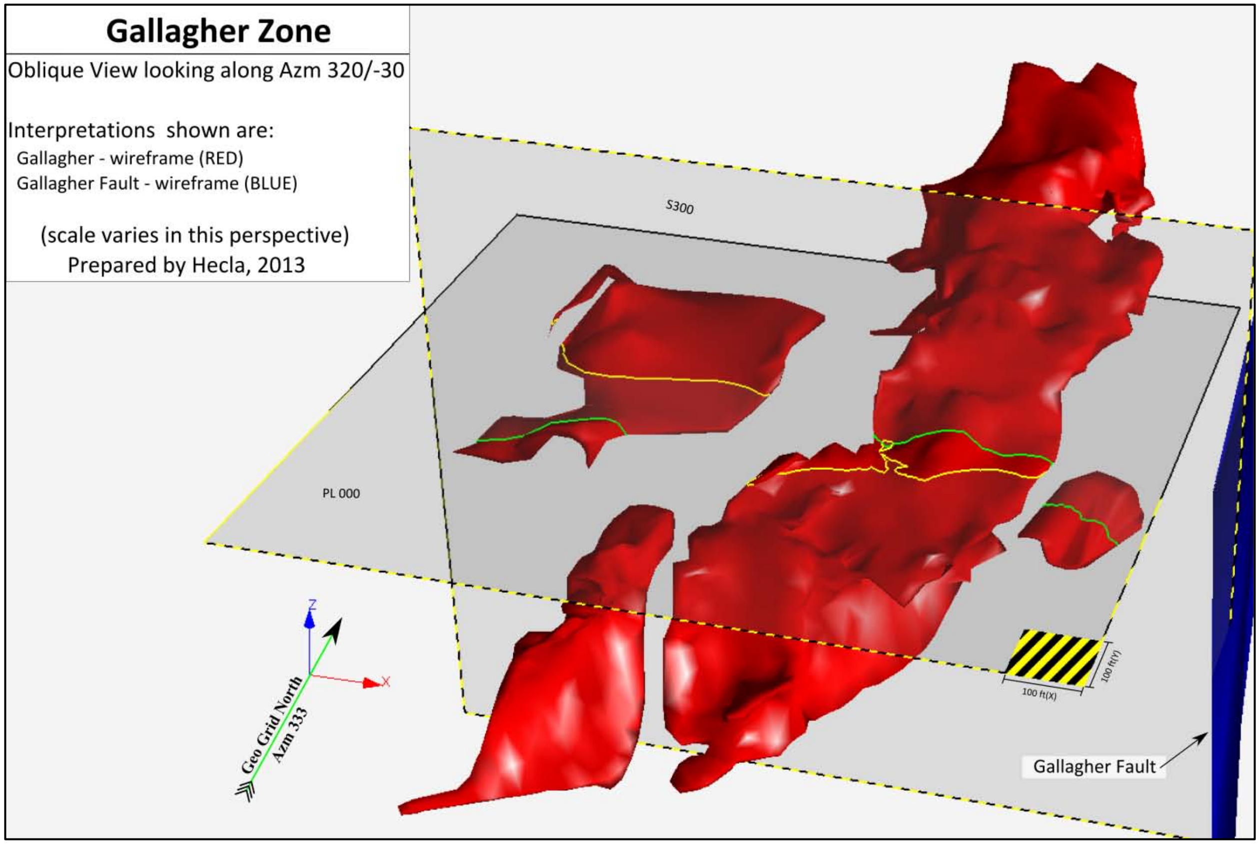


Figure 7-33: Cross Section 2700, Gallagher Zone

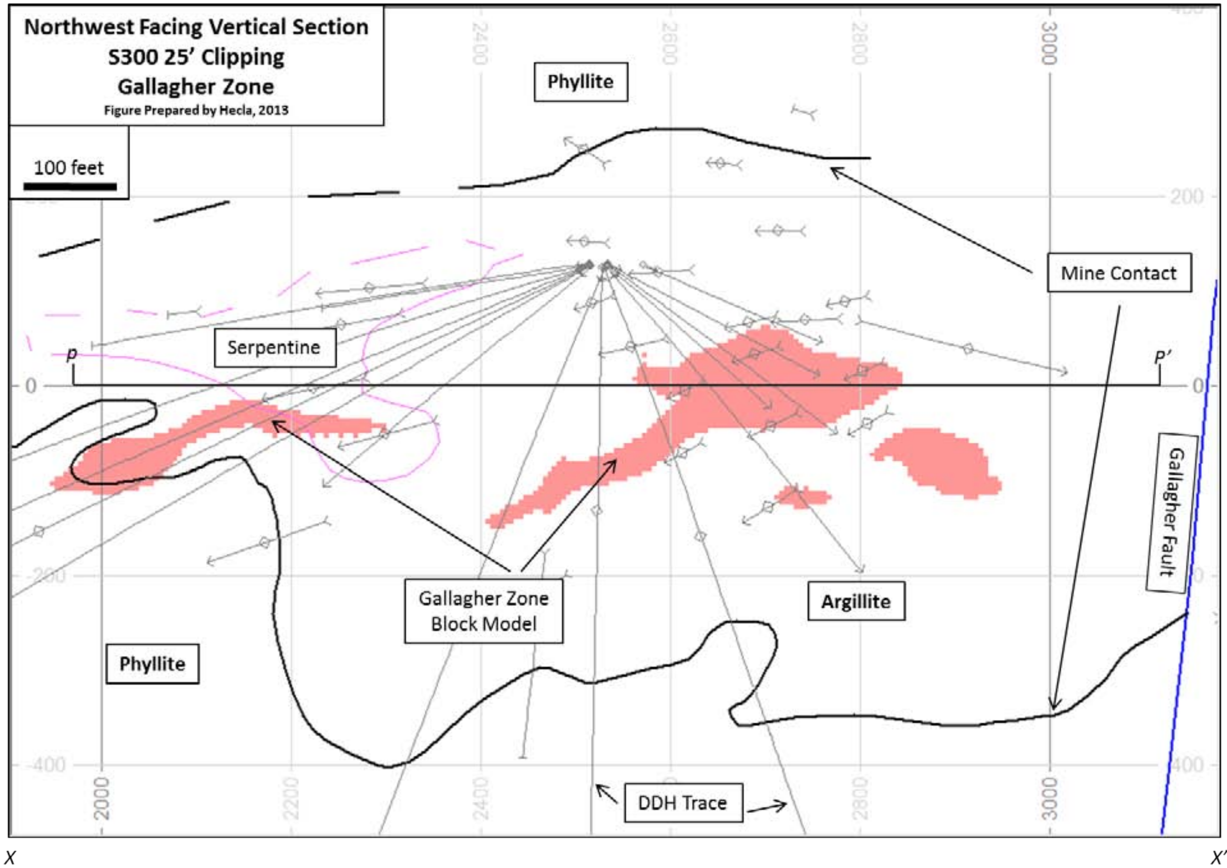
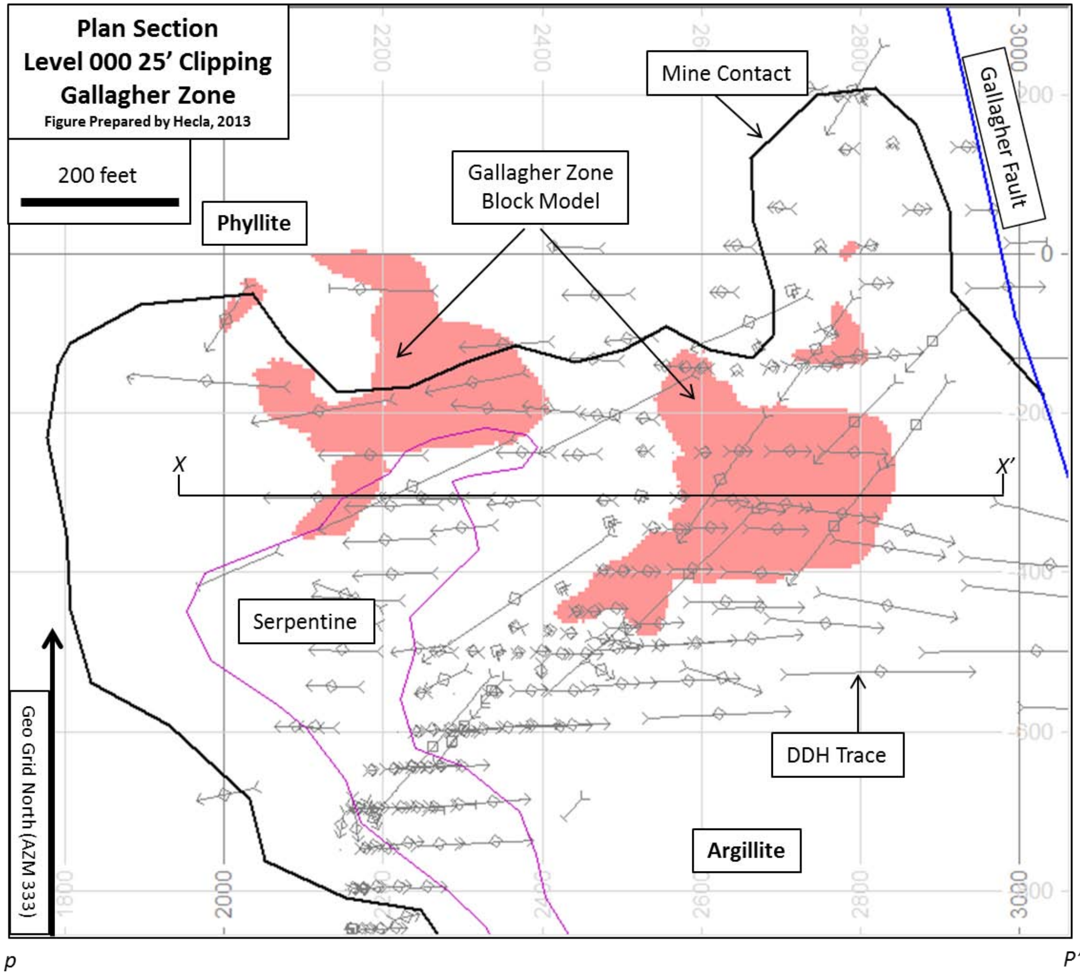


Figure 7-34: Level Plan 000, Gallagher Zone



7.5.2 Killer Creek

Local zones of sericite–talc phyllite with irregular but anomalous silver values are developed along the contact between the south-dipping Killer Creek serpentinite sheet and strongly sulfidized chlorite phyllite developed from Retreat greenstone. Exploratory work suggests a footwall feeder system may be responsible for the mineralization seen.

7.5.3 Lakes District

Extensive stockwork mineralization occurs in strongly brecciated quartz-graphite schist below gabbro-silled mine argillite at the northwest termination of the Killer Creek serpentinite in the Lakes District. Mineralization includes veinlets of pyrite–sphalerite–chalcopyrite and patchy, semi-massive, coarsely granular aggregates cemented by galena–sphalerite–tetrahedrite. Anomalous zinc–lead–silver is also associated with overlying gabbro sill/argillite contacts. The Lakes District mineralization may represent preservation of a satellite Greens Creek-type deposit.

7.5.4 Cascade Creek

The Cascade Creek drainage hosts a number of small, patchy disseminations of sphalerite along phyllite/greenstone contacts. These contacts tend to be strongly carbonatized, silicified and, more locally, sulfidized.

7.5.5 Zinc Creek

In lower Zinc Creek, thick phyllite breccia capped by heterolithic debriite underlies strongly sulfidic mine argillite, with meter-scale intervals containing 30–40% laminated pyrite with associated barite. The argillite shows lithological similarities to the mineralized slaty argillite in the mine stratigraphy. The debriite is also sulfidic, with trace to minor disseminated chalcopyrite. In places, the debriite is wholly replaced by crystalline carbonate–barite that has similarities to the dolomitic massive argillite that hosts the white ores at Greens Creek.

7.5.6 Lil Sore Creek

The Lil Sore Creek drainage runs along the basal argillite/debriite contact and has returned anomalous zinc and silver values. Geochemical sampling surveys carried out over the Lil Sore mine argillite trough also identify weak sulfide mineralization related to gabbro sills in argillite well above the basal contact.

7.5.7 Northeast Contact

The Northeast Contact represents two packages of isoclinally-folded footwall rocks which dip to the west, are truncated by the Maki fault on the west, and close to the east. This structure has been identified over 8,800 ft (2,682 m) in strike length and up to 2,500 ft (762 m) along dip from surface and underground drilling and remains open to the north, south, west, with a possible fault offset to the east. The target has been systematically drilled over several years and drill density currently varies over the defined area from as close as 300 ft (91 m) spacings to as wide as 1,200 ft (366 m) spacings. Figure 7-35 provides an overview of this prospect.

The target occurs approximately 1,000 feet below the East Ore contact to the east of the Maki fault and has been interpreted as the Maki fault offset of a portion of the Mine Contact horizon.

The upper footwall package is generally characterized by a polymictic conglomerate near the initial contact. This unit is interpreted as the basal conglomerate of the Hyd package and therefore as a marker of the mineralized horizon. The package quickly becomes dominated by serpentine chlorite and quartz–carbonate–mariposite rock types. A thin body of argillite separates the two footwall packages.

The lower package is a progressive sequence of increasingly chloritic phyllites into chloritic rock with depth. Generally the lower parts of the lower package often have intervals of graphitic and tan sericitic phyllites proximal to the lower contact. Figure 7-36 shows the general Northeast Contact geometry in relation to the Maki fault and the Mine Contact.

Anomalous results have been encountered within the middle argillite. Along XS3100 anomalous Ag was found within siliceous argillite rocks. Along the same section, an interval of massive coarse-grained pyrite was also encountered. Drilling along XS1200 intercepted 2.4 ft (0.73 m) of high-grade mineralization within the faulted intersection of the upper package and the Maki fault.

7.5.8 Mine Contact Down Dip

This target embodies exploration tenet number one, testing of the Mine Contact down dip of existing ore zones. Current drilling generally defines mineralization and tests several hundred feet down dip, but rarely does it explore much further. As a result the Mine Contact, uninterrupted by major faulting, and continuous down dip from producing ore zones, has been largely unexplored at depth down dip to the west–northwest.

Figure 7-35: Prospect Plan, Northeast Contact

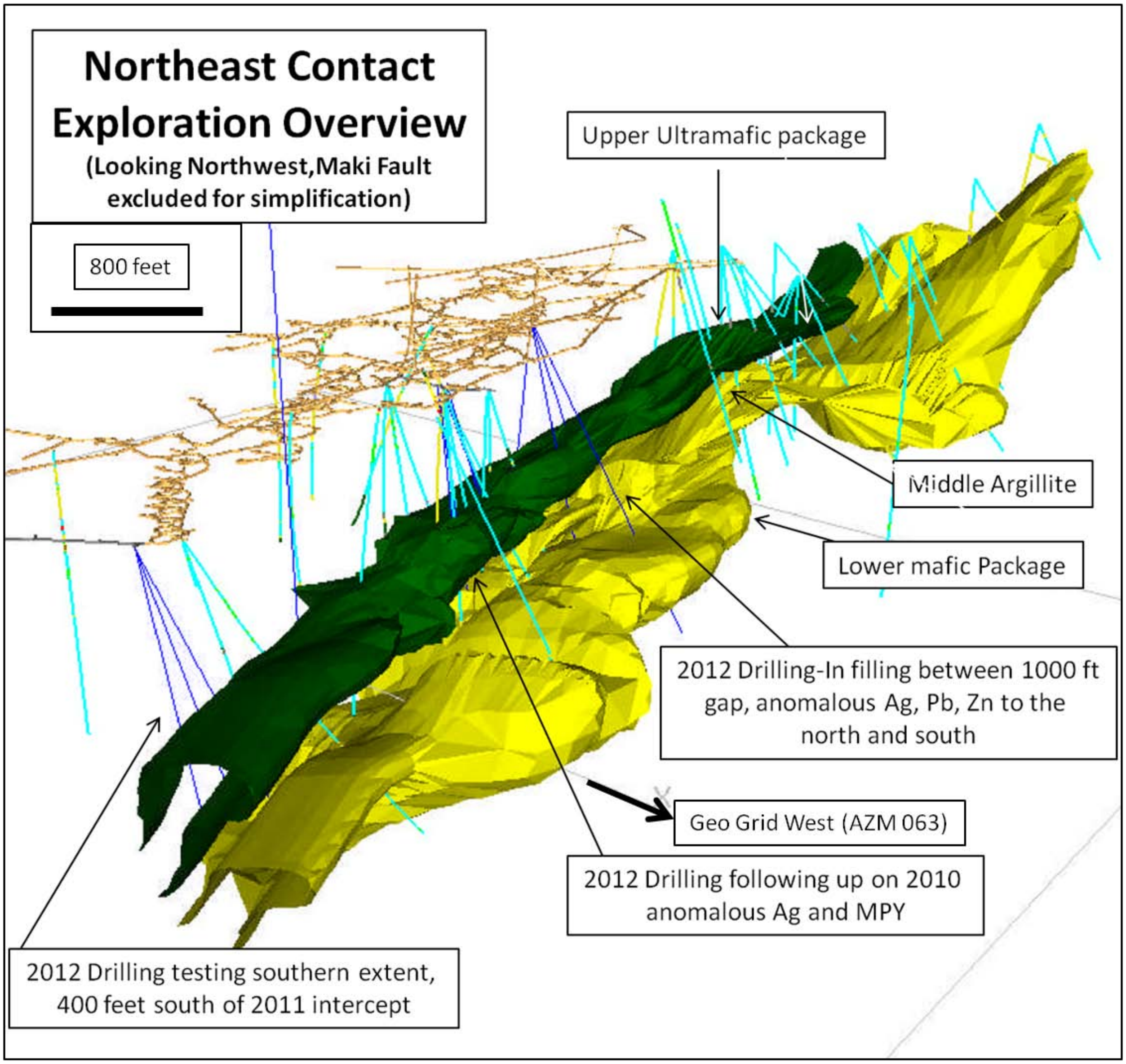
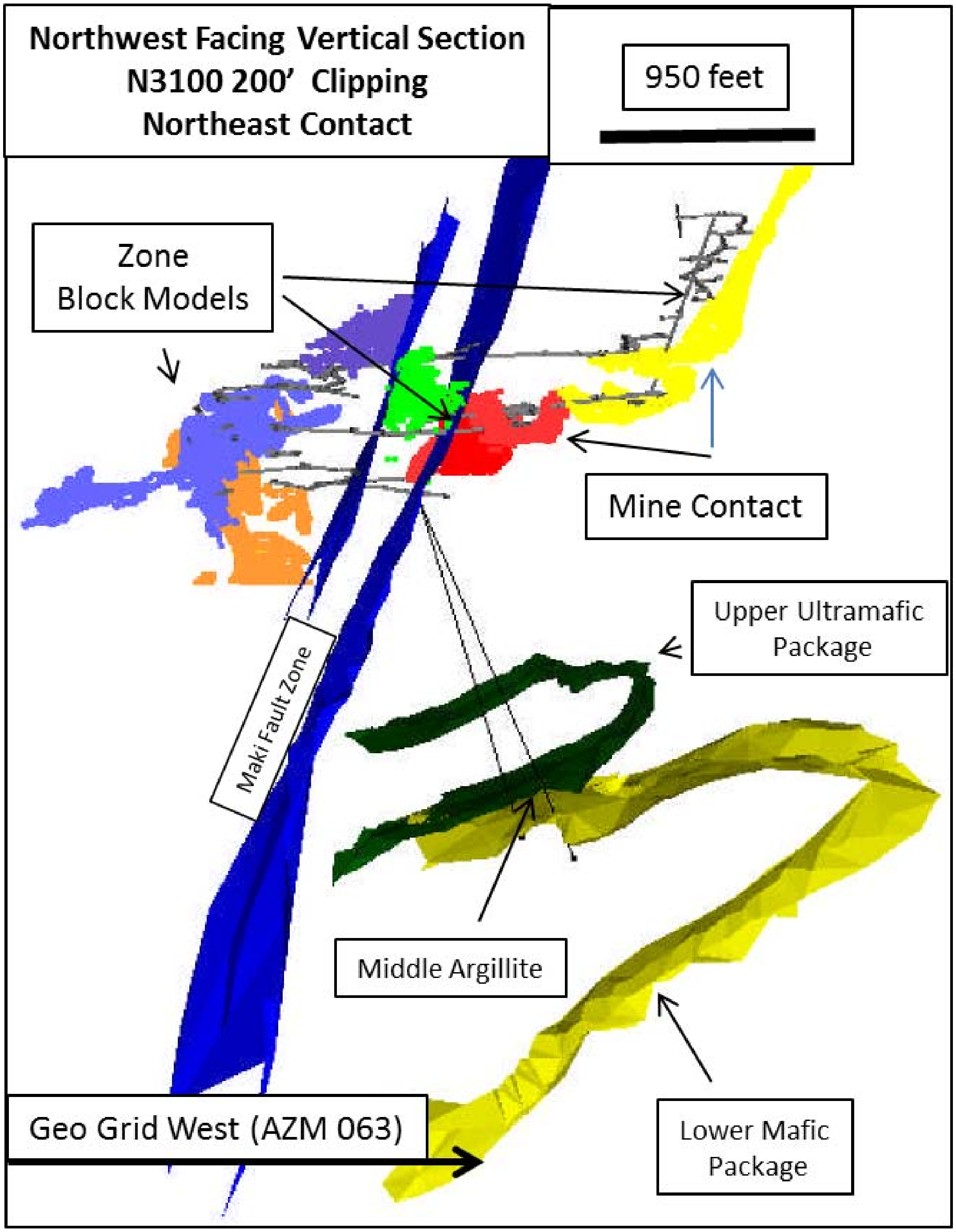


Figure 7-36: Cross Section, Northeast Contact



Several historic (PS0106, GC1297, GC1214, GC1476, GC2592) and recent (GC3315, GC3319, GC3334, GC3341) drill holes have intercepted footwall lithologies below the defined Mine Contact. Continued testing of this target will follow up on those intercepts as well as characterize the Mine Contact below existing information. Figure 7-37 shows the relationship between holes testing this target and the limits of current drilling and interpretation.

It is important to note that these holes explore the Mine Contact within the mine block, where the mine block is the stratigraphy bounded by the Maki and Gallagher fault systems, and which is not known to host significant fault systems of the scale of the Maki and Gallagher faults. Therefore, this target represents the continuous down-dip extension of the Mine Contact from producing ore zones. Figure 7-38 shows planned drill testing of this target in relation with the Gallagher and Maki faults, existing drilling, and mining in the Northwest West zone.

7.5.9 Deep 200 South – Down Plunge

This target represents the down-plunge projection of the Deep 200 South mineralization. Drill testing of this target has historically occurred from the 1147 exploration drift and has steadily and systematically extended the known mineralization to the south. Due to its distance to target (1,200 to 1,800 feet), in 2011, the 1147 drift was no longer deemed a practical platform from which further definition or exploration drilling of the Deep 200 South could be conducted.

A new exploration drift, CDM390, entailing over 3,000 feet of drifting, was completed in early 2013 and will serve as the primary platform from which the drill hole density intersecting the Deep 200 South mineralization will be increased, and from where the down plunge projection of the Deep 200 South will be tested.

Exploration drilling has encountered mineralization as far south as geo-grid section 1400S; the CDM390 ends at section 500S.

After an initial drill campaign to increase the drill hole density in the area for which Mineral Resources will be estimated, a drift-and-drill cycle will be developed and the down plunge continuation of the Deep 200 South zone will continue to be explored.

Figure 7-39 is an overview of the Deep 200 South zone and extensions.

Figure 7-37: Prospect Plan, Mine Contact Down Dip

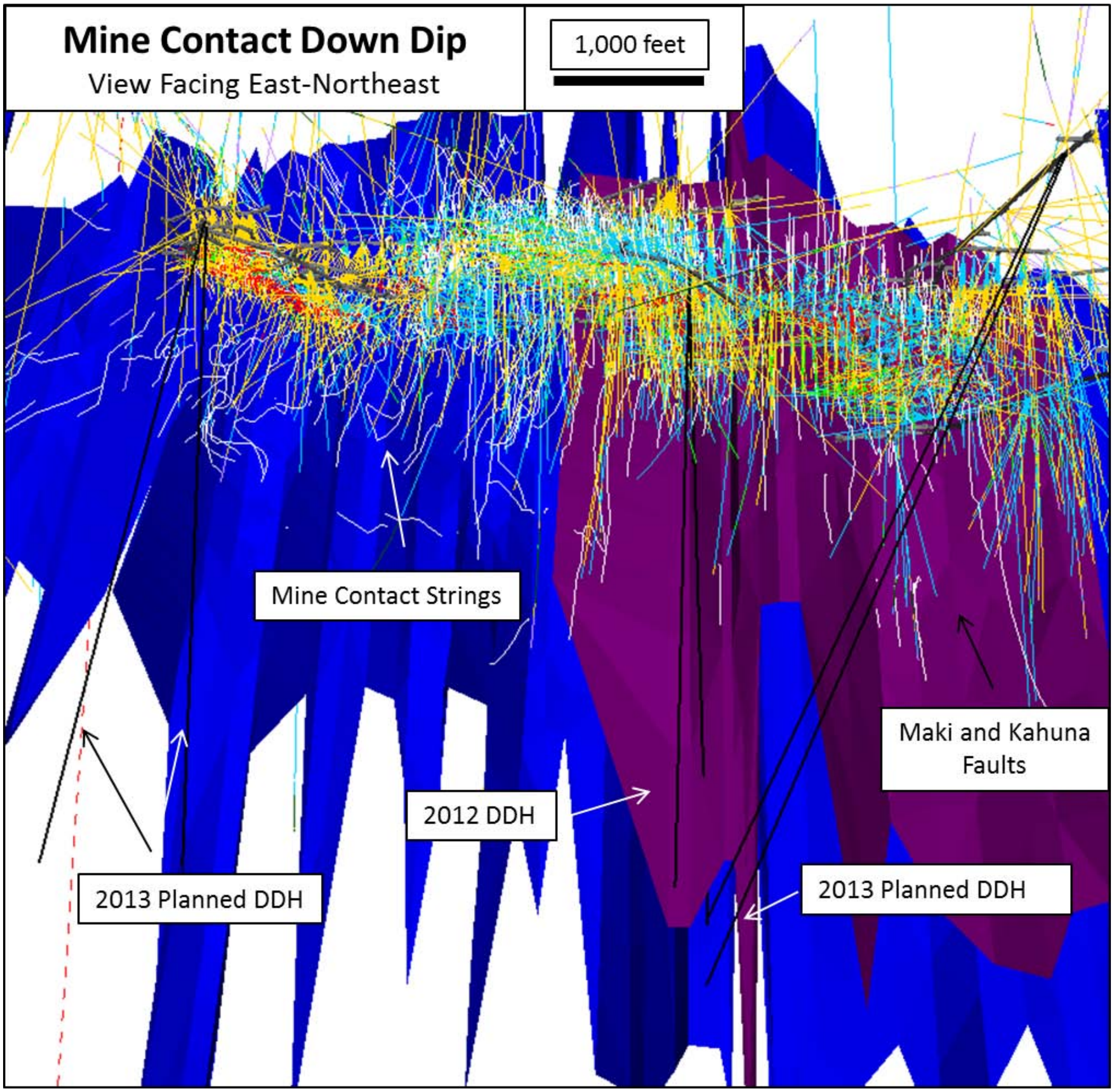


Figure 7-38: Cross Section 4700, Mine Contact Down Dip

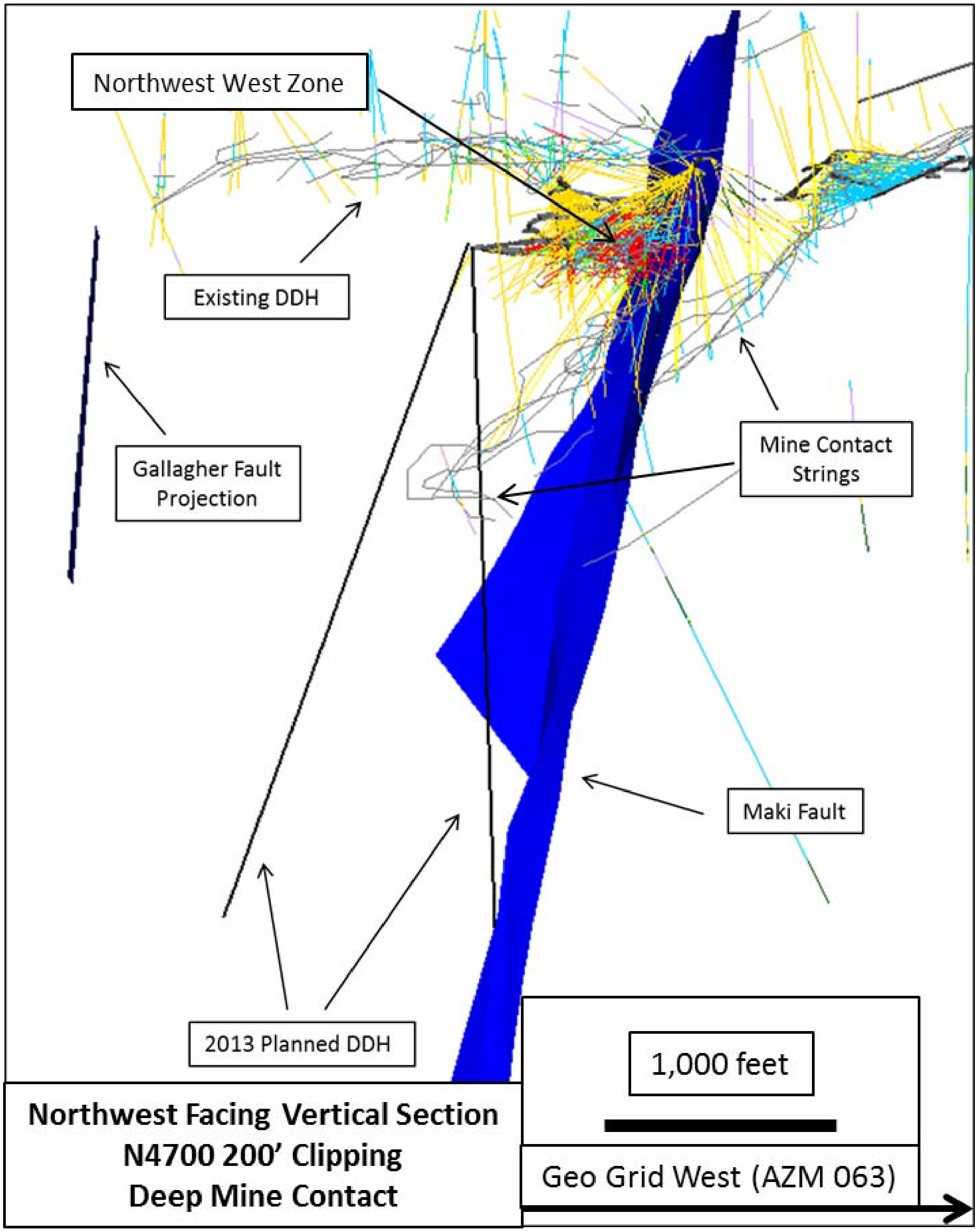
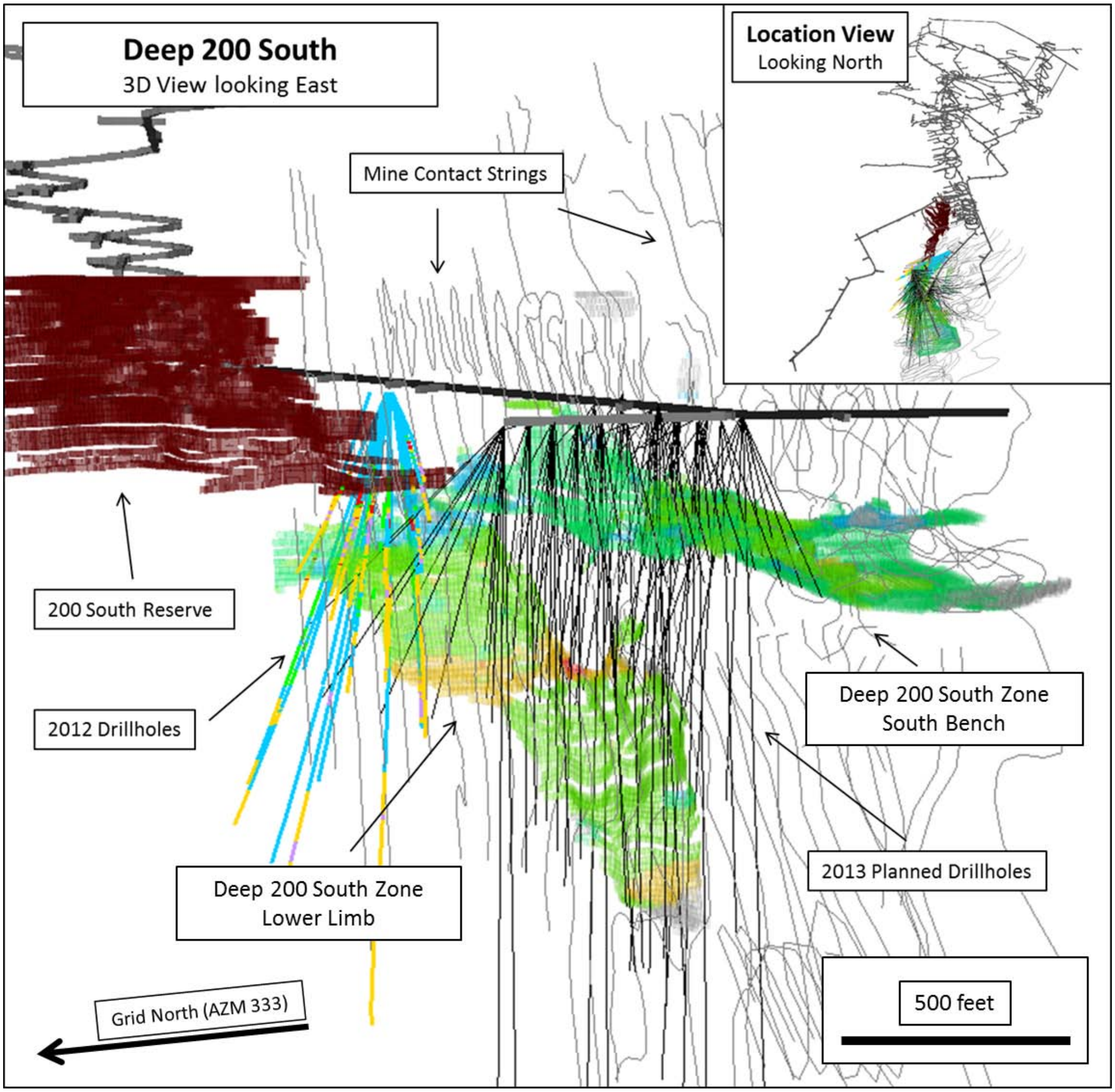


Figure 7-39: Prospect Plan, Deep 200 South Zone and Extensions



7.5.10 Gallagher – Down Plunge

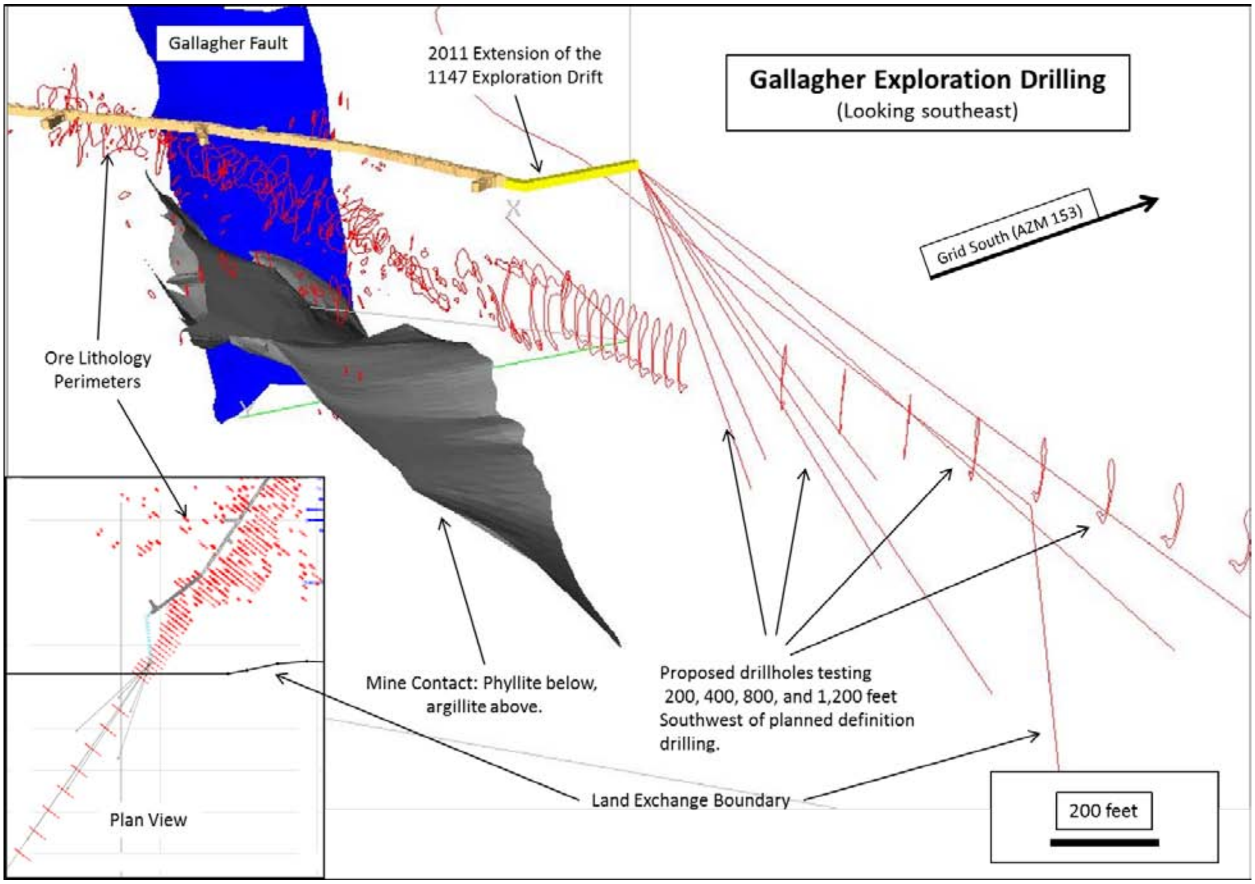
The Gallagher zone has been systematically drilled from the 4211 exploration drift. The mineralization is open down plunge. Drift-and-drill cycles from the 4211 drift have steadily extended the known mineralization extent to the south. Because the mineralization is situated across a major structural boundary, the Gallagher fault, from mineralization continuous with the patented claims, Greens Creek does not have the right to mine across the Land Exchange boundary, which hampers the efforts to explore the mineralization extent. Figure 7-40 provides an overview of the Gallagher zone and down plunge exploration potential.

7.6 Comments on Geological Setting and Mineralization

In the QPs' opinion, the geological understanding of the settings, lithologies, structural and alteration controls on mineralization, and mineralization continuity and geometry in the different zones is sufficient to support estimation of Mineral Resources and Mineral Reserves. The geological knowledge of the area is also considered sufficiently acceptable to reliably inform mine planning. The mineralization style and setting is well understood and can also support declaration of Mineral Resources and Mineral Reserves.

Prospects identified within the Project area are at an earlier stage of exploration, and the lithologies, structural, and alteration controls on mineralization, as well as the mineralization continuity and geometry, are currently insufficiently understood to support estimation of Mineral Resources.

Figure 7-40: Prospect Plan, Gallagher Zone and Extensions



8.0 DEPOSIT TYPES

No single deposit model is considered applicable to the Greens Creek deposit. Recent work by Taylor and Johnson (2010) in the USGS Professional Paper 1763 indicated that the deposit displays a range of syngenetic, diagenetic, and epigenetic features that are typical of volcanic-hosted massive sulfide deposits (VHMS), sedimentary exhalative (SEDEX), and Mississippi Valley-type (MVT) genetic models.

Key features of each of these models are summarized in Table 8-1. The model description for the VHMS deposit type is sourced from Hoy (1995), the source for the information on SEDEX deposits is MacIntyre (1995), and the source for the MVT description is Lefebure (1996).

8.1 Comments on Deposit Types

Characteristics that are displayed at Greens Creek that fit each model include:

- VHMS characteristics:
  - A zinc–lead–silver–gold–copper metal endowment similar to the Kuroko-type,;
  - A mafic volcanic footwall;
  - A zoned alteration profile;
  - Mineralogy similar to that of white smoker systems of the southwestern Pacific Ocean.
- SEDEX characteristics:
  - A metal assemblage dominated by zinc, lead, and silver;
  - The absence of felsic igneous rocks;
  - The presence of altered mafic–ultramafic intrusive rocks in the footwall;
  - Lack of a focused feeder system;
  - Presence of a large alteration envelope containing chromium and barium-rich silicates and complex carbonate alteration mineralogy;
  - A hanging wall consisting of graphitic, pyritic argillites;
  - Geochronologic isotopic evidence suggesting that ore formation occurred during and after deposition of the shale cap;
  - Location in an intra-arc setting;
  - Crosscutting relationships and ore textures are consistent with growth by inflation beneath, and syndiagenetic replacement of, the shales during sedimentation.

Table 8-1: Deposit Model Characteristics

Characteristic	VHMS	SEDEX	MVT
Tectonic setting	Oceanic extensional environments, such back-arc basins, oceanic ridges close to continental margins, or rift basins in the early stages of continental separation	Intracratonic or continental margin environments in fault-controlled basins and troughs. Troughs are typically half grabens developed by extension along continental margins or within back-arc basins	Stable interior cratonic platform or continental shelf. Some deposits are incorporated in foreland thrust belts.
Geological setting	Terrigenous clastic rocks associated with marine volcanic rocks and sometimes carbonate rocks; these may overlie platformal carbonate or clastic rocks	Restricted second and third order basins within linear, fault-controlled marine, epicratonic troughs and basins. There is often evidence of penecontemporaneous movement on faults bounding sites of sulfide deposition. The depositional environment varies from deep, starved marine to shallow water restricted shelf	Host rocks form in shallow water, particularly tidal and subtidal marine environments. Reef complexes may be developed on or near paleotopographic basement highs. The majority of deposits are found around the margins of deep-water shale basins; some are located within or near rifts.
Deposit form	Typically a concordant sheet of massive sulfides up to a few meters thick and up to kilometers in strike length and down dip; can be stacked lenses	Stratabound, tabular to lens shaped and are typically comprised of many beds of laminae of sulfide and/or barite. Frequently the lenses are stacked and more than one horizon is economic. Ore lenses and mineralized beds often are part of a sedimentary succession up to hundreds of meters thick. Horizontal extent is usually much greater than vertical extent. Individual laminae or beds may persist over tens of kilometers within the depositional basin	May be peneconcordant as planar, braided or linear replacement bodies. May be discordant in roughly cylindrical collapse breccias. Individual ore bodies range from a few tens to a few hundreds of meters in the two dimensions parallel with bedding. Perpendicular to bedding, dimensions are usually a few tens of meters. Deposits tend to be interconnected thereby blurring deposit boundaries.
Structure	Massive to well-layered, fine to medium-grained sulfides; gneissic sulfide textures common in metamorphosed and deformed deposits; durchbewegung textures; associated stringer ore is uncommon. Crosscutting pyrite, chalcopyrite and/or sphalerite veins with chlorite, quartz and carbonate are common	Sulfide and barite laminae are usually very finely crystalline where deformation is minor. In intensely folded deposits, coarser grained, recrystallized zones are common. Sulfide laminae are typically monomineralic	Most commonly as sulfide cement to chaotic collapse breccia. Sulfide minerals may be disseminated between breccia fragments, deposited as layers atop fragments ("snow-on-roof"), or completely filling the intra-fragment space. Sphalerite commonly displays banding, either as colloform cement or as detrital layers ("internal sediments") between host-rock fragments. Sulfide stalactites are abundant in some deposits. Both extremely fine-grained and extremely coarse-grained textured sulfides minerals may be found in the same deposit. Precipitation is usually in the order pyrite (marcasite) → sphalerite → galena
Sulfide mineralogy	Pyrite, pyrrhotite, chalcopyrite, sphalerite, cobaltite, magnetite, galena, bornite, tetrahedrite, cubanite, stannite, molybdenite, arsenopyrite, marcasite	The principal sulfide minerals are pyrite, pyrrhotite, sphalerite and galena. Some deposits contain significant amounts of chalcopyrite, but most do not. Barite may or may not be a major component of the ore zone. Trace amounts of marcasite, arsenopyrite, bismuthinite, molybdenite, enargite, millerite, freibergite, cobaltite, cassiterite, valleriite and melnikovite have been reported from these deposits. These minerals are usually present in very minor amounts	Galena, sphalerite, barite, fluorite. Some ores contain up to 30ppm Ag. Although some MVT districts display metal zoning, this is not a common feature. The Southeast Missouri district and small portions of the Upper Mississippi Valley district are unusual in containing significant amounts of Ni-, Co-, and Cu-sulfides
Gangue mineralogy	Quartz, calcite, ankerite, siderite, albite, tourmaline, graphite, biotite	Carbonates, chert, barite, apatite, tourmaline, carbonate, albite, chlorite and dolomite	Dolomite (can be pinkish), pyrite, marcasite, quartz, calcite, gypsum
Capsule	Deposits typically comprise	Beds and laminations of sphalerite,	Epigenetic, low-temperature, stratabound

Characteristic	VHMS	SEDEX	MVT
description	thin sheets of massive to well layered pyrrhotite, chalcopyrite, sphalerite, pyrite and minor galena within interlayered, terrigenous clastic rocks and calcalkaline basaltic to andesitic tuffs and flows	galena, pyrite, pyrrhotite and rare chalcopyrite, with or without barite, in euxinic clastic marine sedimentary strata. Deposits are typically tabular to lensoidal in shape and range from centimeters to tens of meters thick. Multiple horizons may occur over stratigraphic intervals of 1,000 m or more	deposits of galena, sphalerite, pyrite and marcasite, with associated dolomite, calcite and quartz gangue in platformal carbonate sequences having primary and secondary porosity

- Mississippi Valley-type characteristics:
  - MVT mineral-forming processes are suggested by the presence of a thin, discontinuous, platform carbonate unit in the footwall;
  - The footwall carbonate is host to an epigenetic ore and gangue mineral assemblage that occurs in veins, replacements, and open space fillings similar to the carbonate-hosted deposits of the Irish Midlands and the U.S. Midcontinent regions;
  - Sulfur isotope values are unusually low and are unlike sulfur isotope compositions typical of either VHMS or SEDEX deposits; they most closely resemble the range of values exhibited by a subset of deposits in the Irish Midlands.

Taylor and Johnson (2010) concluded that Greens Creek represents a transitional type of deposit that formed as a result of its evolving metallogenic setting in a propagating intra-arc rift. It is therefore a hybrid deposit within a spectrum of exhalative to replacement-style deposits.

Based on Professional Paper 1763, the current paragenesis and genetic model for Greens Creek has the following elements, from earliest to latest:

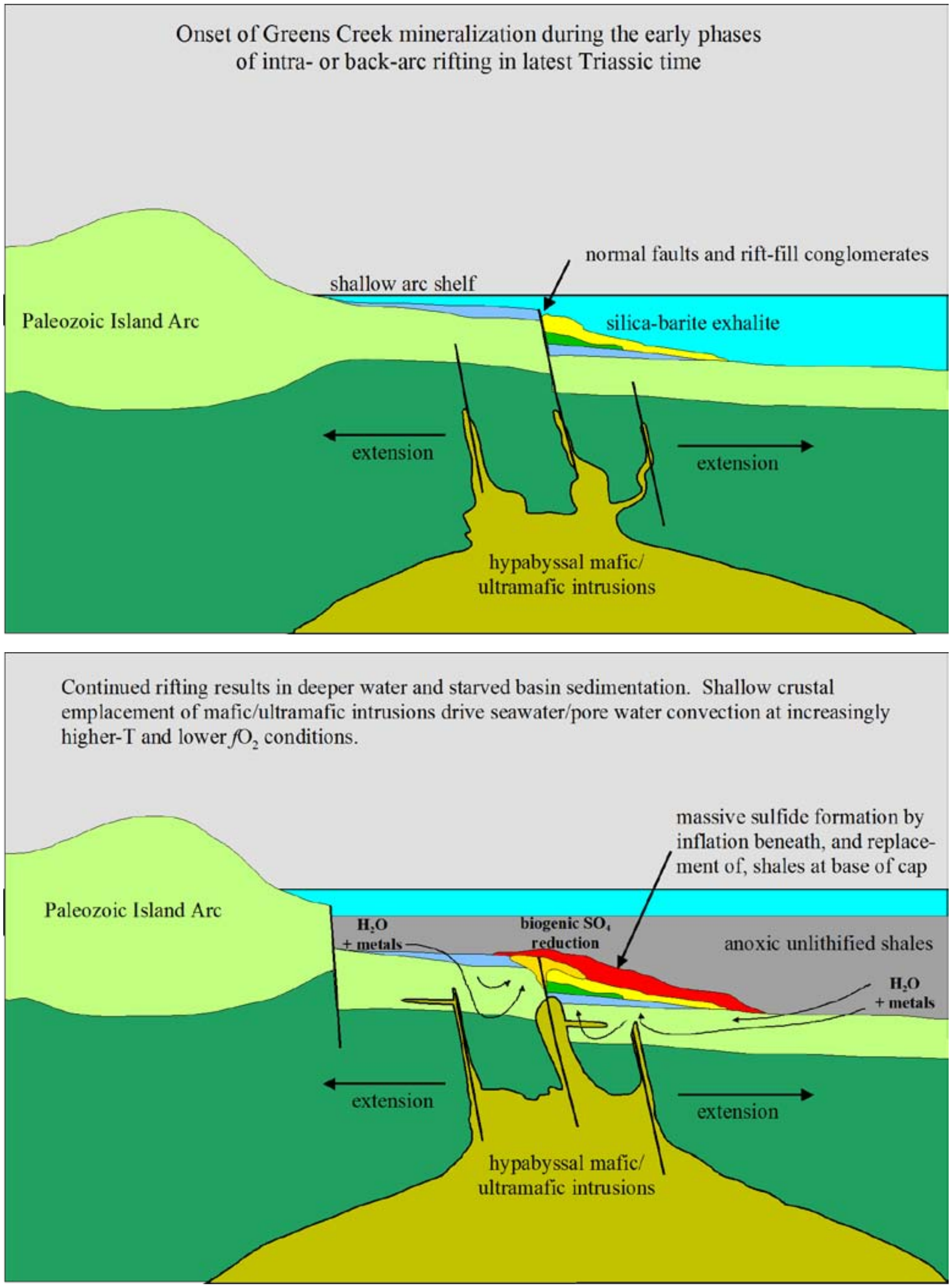
- Formation of precious-metal-rich silica-barite-carbonate white ores in earliest rifting phase; low-temperatures of formation; shallow, subaqueous setting, probably a thin carbonate shelf on the flanks of the Alexander landmass;
- Subsequent down-faulting of carbonate shelf; shelf isolated as a graben structure;
- Onset of shale sedimentation; concurrent emplacement of mafic–ultramafic intrusions at shallow levels in the rift; formation of higher-temperature and anoxic environment;
- Commencement of formation of massive sulfide ores due to increasing accumulations of bacterially reduced sulfur in the shale package;
- Shale sedimentation overwhelms the hydrothermal system, forming a cap to mineralization;

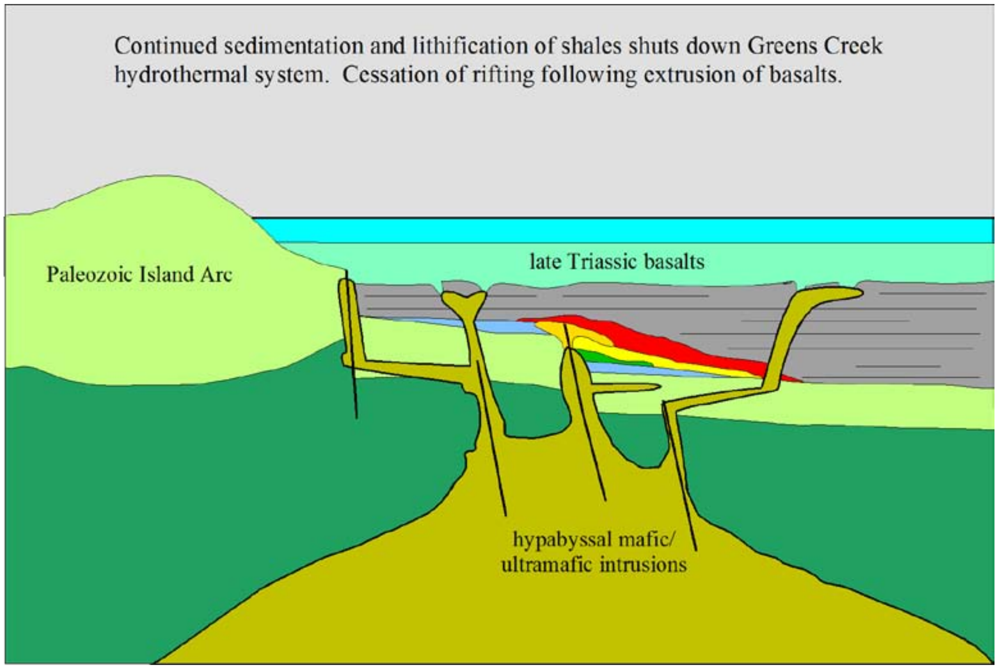
- Under this cap, reduced sulfur mixes with hot, base-metal-rich hydrothermal fluids; ore deposition continues by destruction and epigenetic replacement of the early white ores in proximal areas and by inflation and diagenetic replacement of unlithified shale at the interface between the white ores and the base of the shale cap;
- Lithification of the shales accompanies a decrease in ore deposition, and reduction in available bacterially-reduced sulfur;
- Emplacement of mafic–ultramafic intrusive rocks into the Greens Creek system and extrusion of voluminous basaltic flows at the top of the Triassic section accompanies the last stage of rifting;
- Greenschist facies metamorphism results from the Jurassic-Cretaceous accretion of the Alexander terrane to the continental margin;
- Mineralization is recrystallized, remobilized and upgraded during the metamorphic event.

Figure 8-1 illustrates the current understanding of the likely deposit genesis.

The QPs concur with the interpretation of a hybrid model style and consider the model and interpreted deposit genesis to be appropriate to support exploration activities.

Figure 8-1: Greens Creek Hybrid Deposit Model





Note: Figure from Taylor and Johnson, (2010)

9.0 EXPLORATION

Greens Creek's historical exploration activities, prior to Hecla's acquisition of the land package in March 2008, are extensive. Exploration commenced in 1973. A complete overview of the Greens Creek exploration history prior to Hecla acquiring a 100% interest in the Project in 2008 is included in Table 6-1.

This section focuses mainly on exploration activities since Hecla acquired sole possession of the property. Hecla's exploration targeting and activities have been built upon refined historical exploration data combined with more recent systematic exploration data.

Since 2008, Hecla exploration has included reconnaissance and detailed scale geologic mapping by Dr. Norm Duke, Dr. John Proffett, and various Hecla staff geologists, auger and MMI soil geochemistry, ground and borehole pulse electromagnetic (EM) geophysical surveys and historic survey compilation, and surface and underground core drilling. These exploration programs are summarized in Table 9-1.

9.1 Grids and Surveys

The original regional identification of the Greens Creek deposit was likely done with USGS topographic maps. The USGS quadrangle maps from this period use the horizontal North American Datum of 1927 (NAD27).

By 1977 an assumed or local plane grid was developed for the immediate area surrounding the Big Sore. This grid is orthogonal to true north, and is still in use for all current underground surveying and is referred to as the "mine grid".

A second assumed grid was also developed prior to commencement of the underground drill program in 1978. This grid was rotated 26° 33' 54'' W (counter-clockwise) of the mine grid to parallel the average strike of the East zone. The origin was offset to the southwest of the East zone. This grid, known as the "geo-grid", is still in use for planning drill hole layouts, sectional geologic interpretations and resource modeling. All grid coordinates are in U.S. Survey Feet. The coordinate transform coefficients for conversion from/to mine grid to geo-grid are shown in Table 9-2.

Beginning in 1983 the horizontal datum was changed from NAD27 to North American Datum of 1983 (NAD83). All surface exploration mapping, geochemistry grids, drill collars and geophysical surveys exist in both NAD27 and the NAD83 datum. Affine transform parameters used for coordinate transformation of mine grid to Alaska State Plane Zone 1, NAD83 are shown in Figure 9-3.

Table 9-1: Summary Table of Hecla Greens Creek Exploration Activities 2008-2012

Year	Exploration Activity	Contractor	Exploration Activity Completed	Purpose	Results
2008	Geologic Mapping	John Proffett, Norm Duke, Greens Creek Exploration Staff	Reconnaissance and detailed geologic mapping.	Reconnaissance mapping for extensions of mine contact, originating from a known favorable target area into unknown areas. Detailed mapping for refining targets, identified from regional mapping and geochemical anomalies	Reconnaissance mapping resulted in expansion of the known mine contact. Detailed mapping began to bring an understanding of the Killer Creek target area
	Soil Geochemistry	Greens Creek Exploration Staff	658 auger soil geochemical samples and 658 MMI soil geochemical samples along 67,800 ft (20,665 m) of gridlines in the Young Bay area.	Begin to identify geochemical anomalies in the Young Bay area	Minor soil anomalies identified
	Core Drilling	Connors Drilling	15 underground core holes totaling 9,935 ft (3,028 m). 18 surface core holes totaling 20,649 ft (6,294 m).	Surface drilling in North Big Sore, East Ridge, East Lil Sore, Cub, and Young Bay targets. Underground drilling to support updated Mineral Resource estimates	Surface drilling advanced geologic and geochemical knowledge of the target areas. Underground drilling supported updated Mineral Resource estimates
2009	Geologic Mapping	John Proffett, Norm Duke, Greens Creek Exploration Staff	Reconnaissance and detailed geologic mapping.	Reconnaissance mapping for extensions of mine contact, originating from a known favorable target area into unknown areas. Detailed mapping for refining targets, identified from regional mapping and geochemical anomalies.	Reconnaissance mapping resulted in expansion of the known mine contact. Detailed mapping included interpretation of cross-section in the area of the Northeast Contact.
	Core Drilling	Connors Drilling	20 underground core holes totaling 18,064 ft (5,506 m). 4 surface core holes totaling 8,292 ft (2,527 m).	Surface drilling to test the Northeast Contact. Underground drilling to support updated Mineral Resource estimates.	Surface drilling intersected repeated folds of the Northeast Contact as expected. Underground drilling expanded resources.

Year	Exploration Activity	Contractor	Exploration Activity Completed	Purpose	Results
	Geologic Mapping	John Proffett, Norm Duke, Greens Creek Exploration Staff	Reconnaissance and detailed geologic mapping	Reconnaissance mapping for extensions of mine contact, originating from a known favorable target area into unknown areas. Detailed mapping for refining targets, identified from regional mapping and geochemical anomalies.	Reconnaissance mapping resulted in expansion of the known mine contact. Detailed mapping focused in the Killer Creek target area and assisted in definition of the geologic interpretation for drilling in 2011 and 2012.
	Soil Geochemistry	Greens Creek Exploration Staff	580 auger soil geochemical samples and 580 MMI soil geochemical samples taken in the North Young Bay area.	To identify geochemical anomalies in the Young Bay area.	Minor soil anomalies identified.
2010	Core Drilling	Connors Drilling	25 underground core holes totaling 31,464 ft (9,590 m). 17 surface core holes totaling 21,217 ft (6,467 m).	Surface drilling continued testing the Northeast Contact, Killer Creek, and East Ridge targets. Underground drilling to expand mineralization).	Surface drilling continued to define the Northeast Contact and the one hole in the Killer Creek target intersected anomalous silver and zinc mineralization. Underground drilling supported updated Mineral Resource estimates.
	Geophysics	Ken Robertson	Compilation of Historic Geophysical Data	To identify geophysical survey methods that could be effective in future work	Results from this compilation re-defied the Killer Creek target area as a priority for exploration. This target had been drilled by Noranda Exploration in the late 1970s, then abandoned when the Greens Creek deposit was discovered.
2011	Geologic Mapping	John Proffett, Norm Duke, Greens Creek Exploration Staff	Reconnaissance and detailed geologic mapping	Reconnaissance mapping for extensions of mine contact, originating from a known favorable target area into unknown areas. Detailed mapping for refining targets, identified from regional mapping and geochemical anomalies.	Reconnaissance mapping resulted in expansion of the known Mine Contact. Detailed mapping focused in the Killer Creek and upper Bruin Creek target area and assisted in definition of the geologic interpretation for drilling in 2011 and 2012.

Year	Exploration Activity	Contractor	Exploration Activity Completed	Purpose	Results
	Soil Geochemistry	Greens Creek Exploration Staff	818 auger soil geochemical samples taken in the North Young Bay area.	To identify geochemical anomalies in the Young Bay area.	Minor soil anomalies identified.
	Core Drilling	Connors Drilling	28 underground core holes totaling 38,098 ft (11,612 m). 14 surface core holes totaling 27,384 ft (8,347 m).	Surface drilling continued testing the Northeast Contact, West Bruin Contact, and East Ore targets. Underground drilling to support updated Mineral Resource estimates.	Surface drilling continued to define the Northeast Contact and began to define the West Bruin Contact and the East Ore target. Underground drilling supported updated Mineral Resource estimates.
	Geophysics	Ken Robertson, Techno Imaging, and Crone Geophysics & Exploration Limited	3D Inversion of 211 line miles (340 line kilometers) subset of the 762 line miles (1,227 line kilometers) from the 1996 Aerodat Ltd frequency domain electromagnetics survey. Killer Creek Surface and Borehole Pulse Electromagnetic Surveys	3D Inversion analysis on a portion of the historic Aerodat data was completed to identify overlooked anomalies. Surface and Borehole Pulse EM surveys were used to define EM anomalies identified from the 3D Inversion	3D Inversion re-identified the Killer Creek conductor. Pulse EM defined the re-identified conductor in sufficient detail for exploration drilling.
2012	Geologic Mapping	John Proffett, Norm Duke, Greens Creek Exploration Staff	Reconnaissance and detailed geologic mapping	Reconnaissance mapping for extensions of Mine Contact, originating from a known favorable target area into unknown areas. Detailed mapping for refining targets, identified from regional mapping and geochemical anomalies.	Reconnaissance mapping resulted in expansion of the known Mine Contact. Detailed mapping focused in the Killer Creek target area and assisted in definition of the geologic interpretation for drilling in 2012.
	Soil Geochemistry	Greens Creek Exploration Staff	253 auger soil geochemical samples taken in the North Young Bay area.	To identify geochemical anomalies in the Young Bay area.	Minor soil anomalies identified.
	Core Drilling	Connors Drilling	24 underground core holes totaling 20,817 ft (6,345 m). 8 surface core holes totaling 17,710 ft (5,398 m).	Surface drilling to test the Killer Creek and West Gallagher target areas. Underground drilling to support updated Mineral Resource estimates.	Surface drilling in the Killer Creek target identified a broad copper-rich vein zone varying from 2.1 to 7.0 feet that had anomalous copper and silver values. This area is interpreted

Year	Exploration Activity	Contractor	Exploration Activity Completed	Purpose	Results
					to be the center of a mineralizing vent. Underground drilling supported updated Mineral Resource estimates.
	Geophysics	Ken Robertson	Review of 2011 geophysical survey results	To propose additional geophysical survey if needed.	Still in review.

Table 9-2: **Coordinate Transform Coefficients for Conversion from/to Mine Grid to Geo-Grid**

Origin Offset in US Survey Feet		
	Mine grid	**Geo-grid**
X (Easting)	0.00	17438.42
Y (Northing)	0.00	12635.93
Z (Elevation)	0.00	0.00
Rotation Angle (deg)		
ATAN(1/2)=	-26.56505	

Table 9-3: **Affine Transform Parameters Used for Coordinate Transformation of Mine Grid to Alaska State Plane Zone 1, NAD83.**

Horizontal Conversions: State Plane to Mine Grid		
Formulas	**Coeff.**	**Value**
	a	1.000097656
X' = ax + by + c	b	-0.010449167
Y' = dx + ey + f	c	-2455614.471
x,y (state plane)	d	0.010566122
(X',Y') calc mine grid	e	1.000969256
	f	-2290833.4
Horizontal Conversions: Mine Grid to State Plane		
Formulas	**Coeff.**	**Value**
	a	0.999792212
X' = ax + by + c	b	0.010435993
Y' = dx + ey + f	c	2479013.084
x,y (mine grid)	d	-0.010553352
(X',Y') calc state plane	e	0.998919067
	f	2262447.0
Vertical Conversions		
Grid to MLLW	-61.11	
MLLW to Ortho	-3.742	

9.2 Geological Mapping

Mapping at Greens Creek has been ongoing since 1976. A basic understanding of the lithologic units was first gathered from early drill holes in the Big Sore Creek area (Figure 6.1 in Section 6). In 1977, a Noranda geologist, John Dunbier, realized that the mineralized zone was at a lithologic contact between argillite and tuffites (the tuffites were later recognized as phyllites). This lithologic contact has been dubbed the "Mine Contact". To date, over 30 miles (48 km) of Mine Contact have been identified through mapping efforts and less than 10 miles (16 km) have been tested by diamond drilling.

Figure 7-3 in Section 7 displays a compilation of mapping undertaken from 1974 through to the present day. The map has been compiled from different sources and has changed over time as new data are available. The major contributors to this regional geology map are Paul A. Lindberg, Norman A. Duke, John M. Proffett, and Andrew W. West.

Dr. Paul Lindberg made mapping contributions from 1995–2000. His efforts are reflected in the current geological understanding of the deposit and through numerous cross-section interpretations. On the regional map, Dr. Lindberg's mapping is visible in the Mariposite Ridge prospect area, Upper Gallagher, East Lil' Sore and Upper Big Sore Basin; his maps range from a very detailed 1:200 scale to 1:10,000 metric scale.

Dr. Norm Duke has been responsible for the regional (1:10,000) metric scale mapping of the geology at Greens Creek since 1995. His regional mapping sheets are usually the first observations made in an unknown area, and influence future decisions for follow-up efforts. It is in part through Dr. Duke's efforts that the Mine Contact has been extended for the distance it has. Dr. Duke has covered most of the land package north of Greens Creek.

Dr. John Proffett conducts detailed mapping at 1:24,000 scale. His contributions have been in both underground and surface mapping with structural interpretations. Dr. Proffett started with a month of mapping in 1987, with the 1350 drift mapping in the underground. After 1987, Dr. Proffett did not return to the Greens Creek property until 1996. Since that time he has mapped at Greens Creek every year to present. His areas of focus have been Big Sore Basin, Upper Big Sore Ridge, Upper Big Sore, Lakes District, High Sore, Cliff Creek, Big Boil, Killer Creek and the underground mine.

Andrew West, Greens Creek's exploration superintendent from 1998 to January 2011, contributed to the map shown in Figure 7-3 in portions of the Upper and Lower Zinc Creek areas as well as in the Cub Creek, Bruin Creek, Little Sore, and Gallagher prospects. His mapping was also performed at 1:24,000 scale.

9.3 Geochemical Sampling

Table 9-4 summarizes the soil sampling programs since 1974. The auger and MMI soil geochemistry maps shown in Figures 9-1 and 9-2 are contours of the silver in auger drilling and silver in MMI data respectively. Additional maps reflecting contoured values for gold, lead, zinc, and copper have also been developed.

The auger soil sampling grids cover every prospect from the southern to the northern boundaries within the Greens Creek's land package. Within each prospect, the grid spacing of samples is 100 ft (30 m) apart along grid lines spaced 300 ft (90 m) apart, which originate from an established baseline. Standard auger soil samples are taken at each station. All soil campaigns were successful in delineating geochemical anomalies within many of the prospects.

Since 2008, Hecla has continued investigating the land package for economic mineral potential by compiling historical rock and soil geochemistry into comprehensive maps.

Most recent efforts focus on developing soil geochemistry from within the North Young claim group. Prior to 2008, Mine Contact lithologies were identified by regional scale mapping within this area. This mapping successfully extended the contact 9,500 ft (2,896 m) in the district, warranting further follow-up exploration. This included establishing a soil-sampling grid over the contacts' location and flanks. So far, the sampling has revealed some small anomalies which will be followed-up by in-fill sampling in order to develop targets. Hecla has mostly employed the use of inductively coupled plasma mass spectrometry (ICP-MS) analyses for 53 elements within this area. However, in 2010–2011 the use of MMI analysis was used on samples taken within the Greens Creek land boundary.

A total of 1,443 MMI and 2,309 auger soil samples have been collected since 2008. Results of the exercise suggested several single point anomalies within the soil data. Overall, the soil data points to the East Lil' Sore, Killer Creek, Gallagher Creek, and Bruin Creek target areas as the best surface geochemical targets. The soil geochemical data also appears to identify the two main structural trends dominated by the northwest-trending Maki and Gallagher fault systems. The data also indicate that precious metals appear to favor the Maki fault system and the base metals have a stronger relationship with the Gallagher fault system.

Table 9-4: Summary Table of Greens Creek Sampling Activities 1974-2012

Year	Exploration Activity	Contractor	Exploration Activity Completed	Purpose	Results
1974	Soil geochemistry	Watts, Griffis and McQuat, Inc.	Initial soil geochemical sampling in Big Sore	Define anomalies in the Big Sore target	Defined numerous silver-zinc anomalies.
1975	Soil geochemistry	Watts, Griffis and McQuat, Inc.	Expansion of the soil geochemical sampling grid at Big Sore	Expansion of the previous Big Sore soil grid	Expanded soil anomalies in the Big Sore area.
1976	Soil geochemistry	Noranda	Soil geochemical sampling at Gallagher and Killer Creeks	Expand soil sampling coverage in Gallaher and Killer Creek areas	
1977	Soil geochemistry	Noranda	Soil geochemical sampling at Big Sore, Gallagher, Killer Creek, Zinc Creek, and Mariposite Ridge.	Expand soil sampling coverage in all of the target areas at the time.	Local silver and zinc anomalies along the contact zone at Big Sore were identified. The expanded Killer Creek soil results identified 16 primary soil anomalies. Weak soil anomalies identified in Zinc Creek. The Mariposite soil results identified 9 soil anomalies associated with mineralization located along the contacts of a mariposite-carbonate contact.
1988	Soil geochemistry	Noranda	Soil geochemical sampling at Lil Sore and Mariposite claims	Define anomalies in the Lil Sore and Mariposite target areas.	Six anomalous soil geochemical zones were outlined.
1997	Soil geochemistry	Kennecott	Soil sampling along seven new grids totaling 230,000 linear feet in the High Sore, Bruin, Lower Zinc, Upper Zinc, "A" Road, and Gallagher target areas.	Define anomalies in these target areas	Soil sampling and geologic mapping outlined drill targets or areas for detailed follow-up work in the Bruin, Gallagher, and Lower Zinc Creek target areas.
1988	Soil geochemistry	Kennecott	One new soil grid in the Upper Big Sore target and extensions to three of the 1997 grids in Lower Zinc, Bruin, and the "A" Road target areas.	Define additional anomalies in these target areas	Outlined numerous soil anomalies but none significant enough to warrant drill testing.
1999	Soil geochemistry	Kennecott	Large Killer Creek soil survey and a new survey in the Cub Creek target areas.	Define additional anomalies in these target areas	Numerous multi-element soil anomalies were defined.
2000	Soil geochemistry	Kennecott	904 soil samples collected in the Bruin, High Sore, Killer Creek, Upper Gallagher, and Upper Zinc Creek target areas.	Define additional anomalies in these target areas	Numerous multi-element soil anomalies were defined.
2002	Soil geochemistry	Kennecott	583 Soil samples collected in the Gallagher, Lil Sore, and Lower Zinc Creek target areas.	Define additional anomalies in these target areas	Identified numerous multi-element soil anomalies of which the most significant occurred at the southern end of the Zinc Creek target.
2003	Soil geochemistry	Kennecott	757 soil samples collected in the Gallagher, Killer, and Lil Sore target	Expand and fill in previous soil sampling in these target areas	Identified numerous multi-element soil anomalies of which the most significant occurring within the Lil Sore target area. The 2003 Gallagher soil

Year	Exploration Activity	Contractor	Exploration Activity Completed	Purpose	Results
			areas.	to follow up on the anomalies identified in 2002.	results, when combined with the 2002 soil results, outlined two significant multi-element anomalies coincident with the mine contact zone.
2004	Soil geochemistry	Kennecott	238 soil samples collected in the High Sore and Lil Sore target areas.	Further define previous anomalies in these target areas.	In combination with the 1997 High Sore sampling, the 2004 results identified 11 multi-element soil anomalies.
2005	Soil geochemistry	Kennecott	486 soil samples collected in the Cliff Creek, High Sore, and Killer Creek target areas.	Define additional anomalies in these target areas	Eight multi-element soil anomalies identified in the Cliff Creek target area. Five multi-element anomalies identified in the Killer Creek target area.
2006	Soil geochemistry	Kennecott	586 soil samples collected in the Cliff Creek, High Sore, Upper Zinc, and Young Bay target areas.	Define additional anomalies in these target areas	Minor soil anomalies identified.
2008	Soil geochemistry	Greens Creek Exploration Staff	658 auger soil geochemical samples and 658 MMI soil geochemical samples along 67,800 ft (20,665 m) of gridlines in the Young Bay area.	Begin to identify geochemical anomalies in the Young Bay area.	Minor soil anomalies identified.
2010	Soil geochemistry	Greens Creek Exploration Staff	580 auger soil geochemical samples and 580 MMI soil geochemical samples taken in the North Young Bay area.	To identify geochemical anomalies in the Young Bay area.	Minor soil anomalies identified.
2011	Soil geochemistry	Greens Creek Exploration Staff	818 auger soil geochemical samples taken in the North Young Bay area.	To identify geochemical anomalies in the Young Bay area.	Minor soil anomalies identified.
2012	Soil geochemistry	Greens Creek Exploration Staff	253 auger soil geochemical samples taken in the North Young Bay area.	To identify geochemical anomalies in the Young Bay area.	Minor soil anomalies identified.

Figure 9-1: Greens Creek Soil Auger Geochemical Sample Location and Silver Contour Map

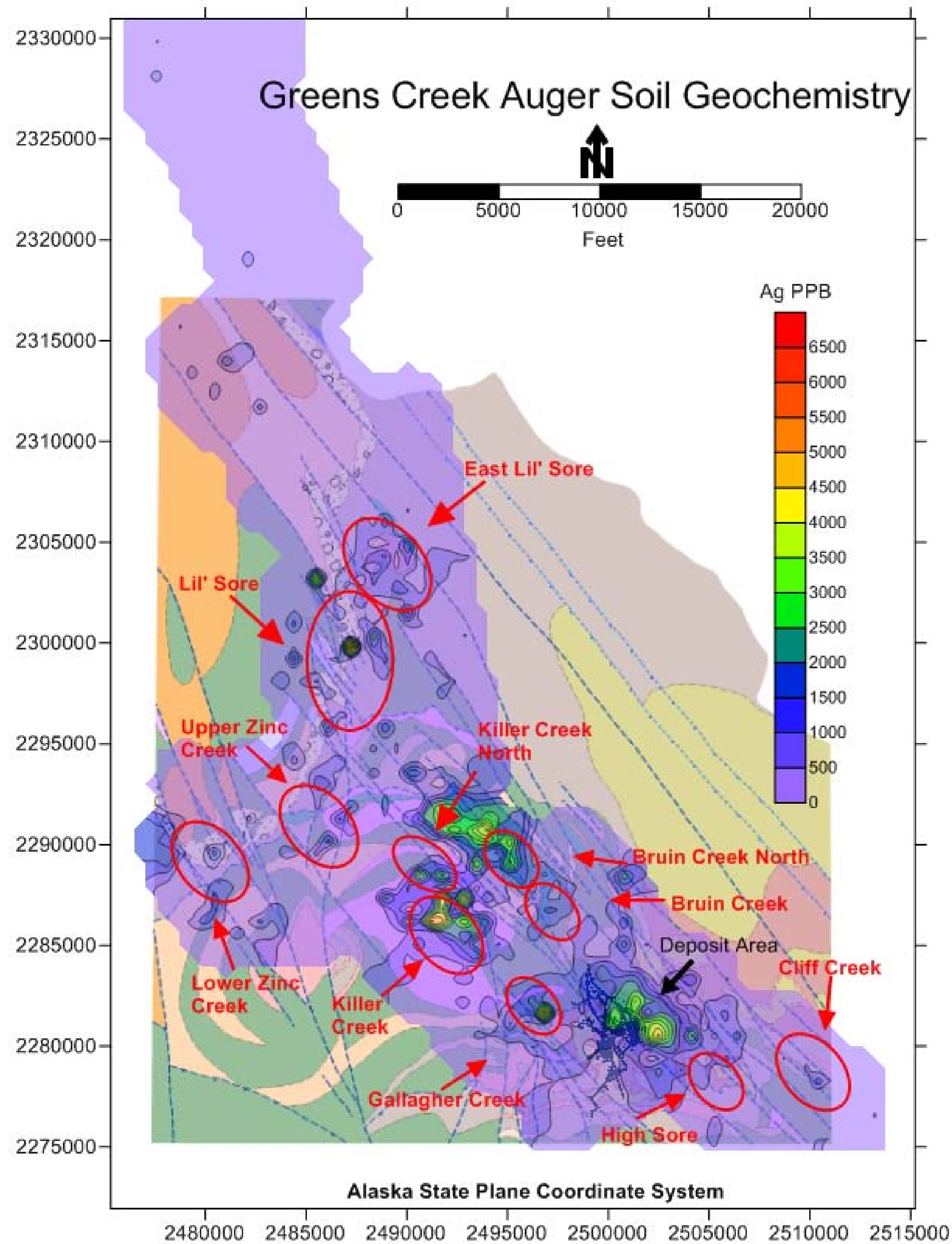
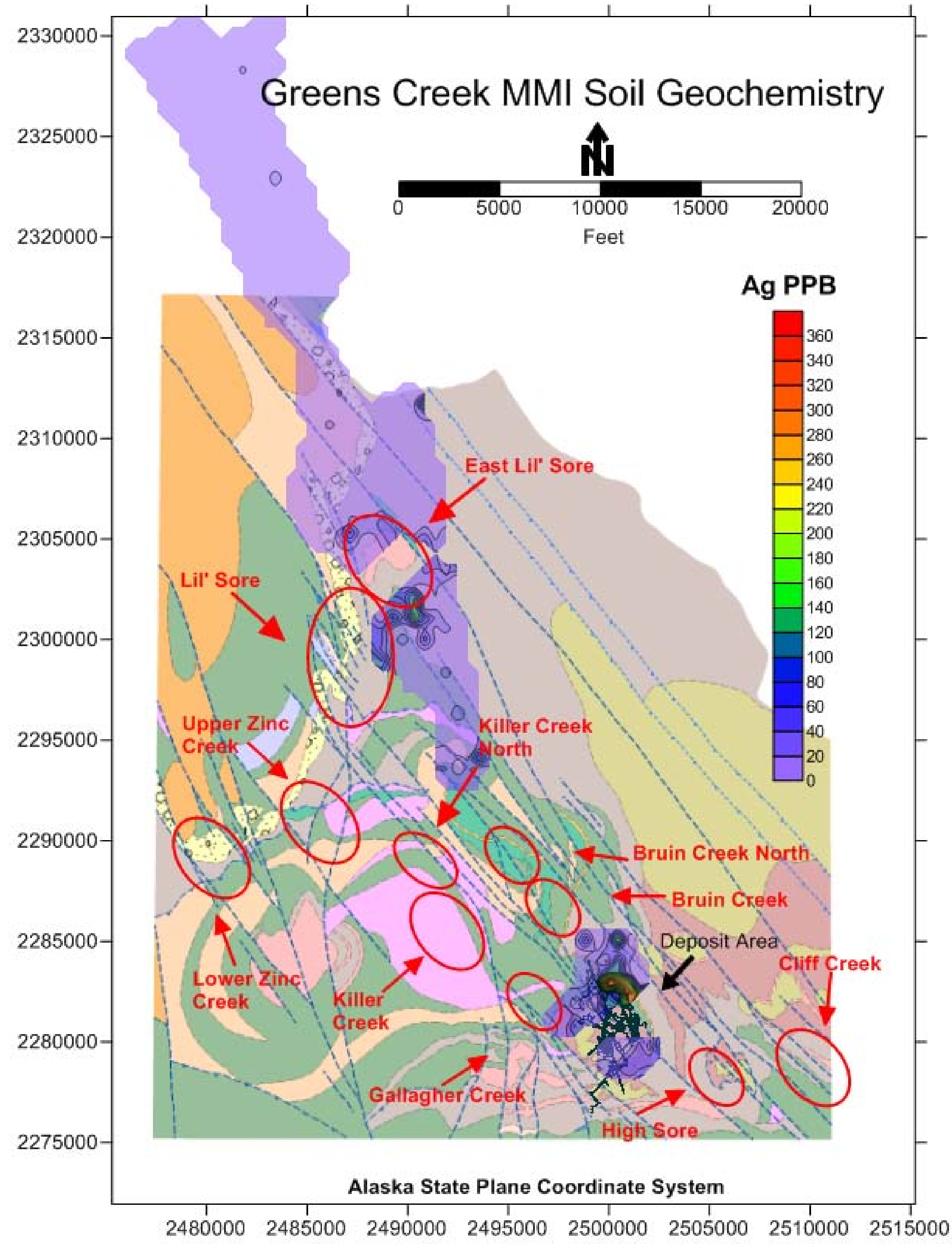


Figure 9-2: Greens Creek Soil MMI Geochemical Sample Location and Silver Contour Map



9.4 Geophysics

Various geophysical surveys have been conducted at Greens Creek since 1996 by several geophysical contractors and the previous Greens Creek owners.

Historic geophysical surveys prior to Hecla's acquisition of the property in March 2008 include airborne, ground and bore-hole surveys. Details of these geophysical surveys are summarized in Table 9-5 and Section 6 of this report. Table 9-5 also summarises the surveys undertaken between 1996 and 2007 including 1,227 line kilometers of AeroDat airborne frequency-domain electromagnetic, magnetic, and radiometric surveys (1996), ground pulse EM (1998-99), gravity (1996–98), magnetic (1997–2003), controlled-source audio-frequency magneto-telluric (1996–2007), and audio-frequency magneto-telluric (2004–05) surveys, and bore hole TEM and UTEM3 surveys (1996–2004).

The results from the ground gravity surveys are summarized in Figure 9-3, those of the ground magnetic surveys in Figure 9-4, and the AeroDat geophysical survey results are included as Figure 9-5.

VOX Geoscience Ltd. based out of Vancouver BC, Canada, was contracted in 2010 to assist in the compilation of the historical geophysical surveys completed on the property and to recommend geophysical survey methods that could be effective in future exploration work. Data from the 1996 AeroDat airborne survey was high quality but in the 15 years since the survey was flown; geophysical software and processing methods have steadily improved.

Beginning in late 2010 and early 2011, Hecla began a program of re-processing the survey results. The first step involved micro-levelling the aeromagnetic data to remove the effects of line offsets and line corrugation. The survey was studied line by line and any spurious readings that could be attributed to man-made cultural interference were removed by hand. The resulting, cleaned, grid was then filtered. Figure 9-6 shows a close up of the Greens Creek mine and Big Sore areas with the re-processed tilt derivative contouring. A very good fit between the mapped northeastern Mine Contact and the western edge of the strong magnetic low (blue) can be observed.

Techno Imaging of Salt Lake City was contracted in late 2010 to use their 3D EM Inversion software on a 211 linear mile (340 line kilometer) subset of the 1996 AeroDat EM survey. The inversions showed little more than draping the AeroDat low and mid-frequency resistivity grids over Lidar did. The remaining 551 line miles (887 line kilometers) of data were not inverted.

Table 9-5: Greens Creek Geophysical Surveys 1996 through 2007

Survey Type	Year	Contractor	Survey Location(s)	Spacing	Purpose	Results
Fixed Loop TEM	1996	Zonge Engineering	Gallagher Gridlines 3800N to 5400N	50 ft (15 m) spacings	Orientation survey over the western-most extent of the Greens Creek ore body to see what geophysical method may provide useful data and help optimize future surveys	Able to detect the West Ore as a large 400 by 200 ft (122 x 61 m) 0.1 ohm-m conductor at depth of 800 ft (243 m)
Downhole TEM	1996	Zonge Engineering	Drill Holes PS-111, PS-112, GC1530	16 ft (5 m) intervals	Test DH-TEM	GC1350 detected the West Ore body and the PS-holes had an anomalous response coincident with a narrow sulfide band.
CSAMT	1996	Zonge Engineering	Gallagher Gridlines 5000N and 4600N	100 ft (30 m) spacings, all scalar measurements	Underground orientation survey over the Northwest West ore zone to determine if gravity could detect a Greens Creek ore zone	Sub-surface conductors coincide with the west projection of the Upper plate Northwest West zone, suggests taking east-filed measurements parallel to strike.
Gravity (UG)	1996	Greens Creek personnel, data processed by James Fueg, KEX geophysics	59 Drift,36 Decline,33 X-Cut and 52 X-Cut over the West Ore zone	95 stations over 6,400 line feet (1,951 line meters) at 50 to 100 foot spacings (15 to 30 m)	Orientation survey over the western-most extent of the Greens Creek ore body.	Detected a 1.5 mgal high over the West Ore Zone.
Surface Gravity	1996	Greens Creek personnel, data processed by James Fueg, KEX geophysics	Gallagher Gridlines 5000N and 4600N	50 ft (15 m) spacings	Test surface gravity over the West Ore zone and Maki Fault	Only a minor to non-existent response over the West Ore, ore body may be too deep to detect.
Aerial Magnetics, EM, and radiometrics (K, Th, U)	1996	AeroDAT	Over entire Land Package and much of Mansfield Peninsula	656 ft (200 m) line spacings, 328 ft (100 m) spacings near mine	Provide property wide geophysical maps for regional geologic mapping and 1st order targeting	EM survey outlined the Mine Contact very well through-out the property, magnetic data shows the ultramafic bodies also very well. Was very useful to the regional geologic map. Selected EM anomalies not rigorously evaluated.
Pulse EM Grid	1997	Crone	Gallagher, Bruin, Lower	100 ft (30 m) station	Provide ground EM data	Agrees well within existing

Survey Type	Year	Contractor	Survey Location(s)	Spacing	Purpose	Results
Surveys		Geophysics	Zn, Upper Zn (East), 'A' Road, and High Sore grids	spacings with 400 ft (122 m) line spacings (800 ft or 244 m spacings in the 'A' Road grid)	on recently cut and sampled gridlines to map geology and outline possible conductive anomalies	known trend of lithologic units and aerial EM.
3D Downhole Pulse EM	1997	Crone Geophysics	Drill Holes PS-120, PS-121, and PS-122	16 ft (5 m) intervals	Test for any off hole conductive horizons that may represent mineralization, also map project intersected sulfide bands away from the hole.	Conductor 200 ft (61 m) below the TD of PS-120 was identified, hole was re-entered in 1998 and intersected a 24 ft interval (3 m) of graphic phyllite at the conductor target.
Ground Magnetometer	1997	KGCMC Personnel	New extensions of the Gallagher, Bruin (north-end), Lower Zn, 'A' Road Grids, Upper Big Sore grid and other KEX grids.	~ every 10 ft (3 m), was run in walking magnetic mode along lines, 400 ft (122 m) line spacings (800 ft or 244 m in 'A' Road grid)	Aid in geologic mapping of the newly emplaced grids.	Ground magnetics data generally replicates the trends seen in the aeromagnetic data. Highlights exposed and suspected ultramafic bodies
Ground Gravity	1997	Tony Newman Clarke Jorgenson	Gallagher, Bruin, Lower Zn, Upper Zn (East), 'A' Road, and High Sore grids	100 ft (30 m) station spacings with 400 ft (122 m) line spacings (800 ft or 244 m spacings in the 'A' Road grid)	Detect possible massive sulfide or baritic bodies at depth	No significant anomalies found that do not correlate with topography
Pulse EM Grid Surveys	1998	Crone Geophysics	New extensions of the Gallagher, Bruin (north-end), Lower Zn, 'A' Road Grids, Upper Big Sore grid and other KEX grids.	100 ft (30 m) station spacings with 400 ft (122 m) line spacings (800 ft or 244 m spacings in the 'A' Road grid)	Provide ground EM data on recently cut and sampled gridlines and extensions to map geology and outline possible conductive anomalies	Agrees well within existing known trend of lithologic units and aerial EM.
Downhole Pulse EM	1998	Crone Geophysics	PS-123, PS-124, PS-125, PS-126, and PS-127	16 ft (5 m) intervals	Test for any off hole conductive horizons that may represent mineralization, also map project intersected sulfide bands away from the hole.	All significant responses are due to lithologic changes at footwall-argillite contacts, West Bruin contact could be seen off hole with increasing conductivity to the south and/or west in PS-126 and Zn-Pb mineralization 1,312

Survey Type	Year	Contractor	Survey Location(s)	Spacing	Purpose	Results
						ft (400 m) down in PS-123 correlates with conductive body centered to the south of hole.
Ground Magnetometer	1998	KGCMC Personnel	Bruin (north-end), Upper Big Sore, Lower Zn, and 'A' Road grids.	~ every 10 ft (3 m), was run in walking magnetic mode along lines, 400 ft (122 m) line spacings (800 ft or 244 m in 'A' Road grid)	Aid in geologic mapping of the newly emplaced grids.	Ground magnetic data generally replicates the trends seen in the aeromagnetic data. Highlights exposed and suspected ultramafic bodies
Ground Gravity	1998	Clarke Jorgenson	Bruin (north-end), Upper Big Sore, Lower Zn, and 'A' Road grids.	100 ft (30 m) station spacings with 400 ft (122 m) line spacings (800 ft or 244 m spacings in the 'A' Road grid)	Detect possible massive sulfide or baritic bodies at depth	Generally correlates well with topography. High along Bruin line 2400N and another within the 'A' Road grid that is coincident with a PEM anomaly are features of interest.
Downhole 3-Component TEM	1999	Zonge Engineering	Drill Holes PS-130 through PS-137	10 ft (3 m) intervals	Detect possible off-hole conductive anomalies	All but PS-135 had indicated conductive anomalies correlateable with conductive lithologic units.
Ground Magnetometer	2000	KGCMC Personnel	Killer Creek, Cub Creek, and Lakes District grids	20 ft (6 m) spacings	Aid in geologic mapping of the newly emplaced grids.	Ground magnetics data generally replicates the trends seen in the aeromagnetic data. Highlights exposed and suspected ultramafic bodies
CSAMT	2000	Zonge Engineering	Bruin and Cub Creek lines 2400N, 2800N, and 3200N, and Killer Creek lines 800N, 1200N, and 2000N	100 ft (30 m)	Map out the various exposed contacts in the Bruin and Cub Creeks to a greater depth, explore for buried argillite contact in Killer Creek where no argillite is exposed	Detected the buried East Bruin contact (argillite syncline), defined the geometry of the exposed Bruin contact. Steep conductors on the west side of Killer Creek remain unexplained.
CSAMT	2002	Zonge Engineering	Killer line 2800N, Bruin lines 800N and 4400N, Lower Zn lines CSAMT1, CSAMT2, and CSAMT3	100 ft (30 m) spacing along selected lines. Mostly vector measurements	Provide sub-surface resistivity mapping for determining contact (target) geometry for drill hole orientation.	The three lines in Lower Zn defined the geometry of the argillite and graphitic phyllite units. Bruin line 4400N shows a deep conductor that may be the northern extensions of the East

Survey Type	Year	Contractor	Survey Location(s)	Spacing	Purpose	Results
						Bruin Contact. Deep conductor along Killer 2800N was attributed as the West Bruin Contact; however drilling did not intersect any conductive units.
CSAMT	2003	Zonge Engineering	Killer line 2000S, Bruin lines 2000N and 3200N, Upper Zn lines line 2000N, and Gallagher Line 4400N and 5200N	100 ft (30 m) spacing, mostly vector measurements	Provide sub-surface resistivity mapping for determining contact (target) geometry for drill hole orientation. Killer line (2000S) was exploring for the north projection of the West Gallagher argillite.	All lines surveyed showed conductive units that conform with surface mapping and adding greatly in understanding the subsurface geology.
Ground Magnetometer	2003	KGCMC Personnel	West Gallagher, East Lower Zn extension, South Lil' Sore, NW Mammoth	50 ft (15 m) spacings	Aid in geologic mapping of the newly emplaced grids.	Maps out geology, especially the ultramafics that outcrop in the South Lil Sore and NW Mammoth grids
AMT	2004	Phoenix Geophysics	Upper Gallagher Lines XS200b and LS2000	150 ft (36 m) spacings	Test the AMT technique at Greens Creek and explore for the Gallagher Resource Zone and conductive argillite on west side of Gallagher Fault at a depth of >2,000 feet from surface	Two conductive bodies were mapped the correlates with the Gallagher argillite and an upper argillite unit intersected in PS-223
Complex Resistivity Bench Tests	2004	Zonge Engineering	Selected UG and surface drill core	N.A.	Provide resistivity data for modeling the MT/AMT survey in upper Gallagher. Most core samples were from Gallagher drill holes.	CR results from representative lithology shows a wide range of resitivities.
Downhole UTEM3	2004	SJ Geophysics	Drill Holes GC2459, GC2463, GC2551, PS0153, PS0161, PS0166, PS0169, PS0203, PS0210, PS0219, and PS0223	16 ft (5 m) intervals (uncertain)	Original aim was to down hole survey GC2551 and PS0223 which intersect or comes close to the new Gallagher Mineralized zone to determine its possible extent and structural	GC2551 could not be surveyed and only half of PS0223, thus other holes were surveyed. The survey of PS-210

Survey Type	Year	Contractor	Survey Location(s)	Spacing	Purpose	Results
					orientation.	
MT/AMT	2005	Phoenix Geophysics	Upper Gallagher, 12 XS and 11 LS lines spaced 100 to 200 ft (30 to 60 m) apart.	150 ft (45 m) spacings	Expand on the 2004 AMT survey in Upper Gallagher to determine the possible extend of the Gallagher resource and use MT frequencies to model deeper.	Four anomalies were identified, most related to known and drilled argillite horizon near surface.
Gravity re-modeling	2005	Big Sky Geophysics	Gallagher, Bruin, Upper Zn (East), Upper Big Sore, Lower Zn, and 'A' Road and High Sore grids	100 ft (30 m) spacing	Remodel the gravity data from the 1997 and 1998 surveys using the greatly improved Lidar terrain data for the terrain corrections.	Forward modeling shows much better resolution with Lidar data as opposed to inclinometer measurements at stations. Gravity highs in High Sore and 'A' Road grids need further investigation.
MT 3D Model	2007	GeoSystems	Upper Gallagher grid	used data from MT/AMT survey	Use the closed spaced grid data from the 2004 and 2005 MT/AMT to create a 3D model below Upper Gallagher	Upper argillite is well modeled across the entire survey area, lowest conductor that can be modeled is at 2, 296 ft (700 m) depth above the Gallagher zone). Modeled only down to sea-level.
CSAMT	2007	Zonge Engineering	East Lil Sore lines 2000N, 4400N, 4800N, and 5600N, Young Bay lines 5600S, 6400S, and 8000S, and NW Mammoth 6000N.	100 ft (30 m) spacing, mostly vector	Survey above the East Ridge prospect and it projection of the north to determine the geometry of the contact.	East Ridge contact well mapped out by conductive units. Young Bay gridlines define graphitic phyllite over conglomerate contact much better than the conglomerate over argillite (Mine) contact.
Downhole 3-Component TEM	1999	Zonge Engineering	Drill Holes PS-130 through PS-137	10 ft (3 m) intervals	Detect possible off-hole conductive anomalies	All but PS-135 had indicated conductive anomalies correlateable with conductive lithologic units.
Ground Magnetometer	2000	KGCMC Personnel	Killer Creek, Cub Creek, and Lakes District grids	20 ft (6 m) spacings	Aid in geologic mapping of the newly emplaced grids.	Ground magnetic data generally replicates the trends seen in the aeromagnetic data. Highlights exposed and suspected ultramafic bodies
CSAMT	2000	Zonge	Bruin and Cub Creek	100 ft (30 m)	Map out the various	Detected the buried East Bruin

Survey Type	Year	Contractor	Survey Location(s)	Spacing	Purpose	Results
		Engineering	lines 2400N, 2800N, and 3200N, and Killer Creek lines 800N, 1200N, and 2000N	spacings	exposed contacts in the Bruin and Cub Creeks to a greater depth, explore for buried argillite contact in Killer Creek where no argillite is exposed	contact (argillite syncline), defined the geometry of the exposed Bruin Contact. Steep conductors on the west side of Killer Creek remain unexplained.
CSAMT	2002	Zonge Engineering	Killer line 2800N, Bruin lines 800N and 4400N, Lower Zn lines CSAMT1, CSAMT2, and CSAMT3	100 ft (30 m) spacing along selected lines. Mostly vector measurements	Provide sub-surface resistivity mapping for determining contact (target) geometry for drill hole orientation.	The three lines in Lower Zn defined the geometry of the argillite and graphitic phyllite units. Bruin line 4400N shows a deep conductor that may be the northern extensions of the East Bruin Contact. Deep conductor along Killer 2800N was attributed as the West Bruin Contact; however drilling did not intersect any conductive units.
CSAMT	2003	Zonge Engineering	Killer line 2000S, Bruin lines 2000N and 3200N, Upper Zn lines line 2000N, and Gallagher Line 4400N and 5200N	100 ft (30 m), mostly vector measurements	Provide sub-surface resistivity mapping for determining contact (target) geometry for drill hole orientation. Killer line (2000S) was exploring for the north projection of the West Gallagher argillite.	All lines surveyed showed conductive units that conform with surface mapping and adding greatly in understanding the subsurface geology.
Ground Magnetometer	2003	KGCMC Personnel	West Gallagher, East Lower Zn extension, South Lil' Sore, NW Mammoth	50 ft (15 m) spacings	Aid in geologic mapping of the newly emplaced grids.	Maps out geology, especially the ultramafics that outcrop in the South Lil Sore and NW Mammoth grids
AMT	2004	Phoenix Geophysics	Upper Gallagher Lines XS200b and LS2000	150 ft (45 m) spacings	Test the (audio-magneto telluric) AMT technique at Greens Creek and explore for the Gallagher Resource Zone and conductive argillite on west side of Gallagher Fault at a depth of >2,000 ft (600 m) from surface	Two conductive bodies were mapped the correlates with the Gallagher argillite and an upper argillite unit intersected in PS-223

Survey Type	Year	Contractor	Survey Location(s)	Spacing	Purpose	Results
Complex Resistivity Bench Tests	2004	Zonge Engineering	Selected UG and surface drill core	N.A.	Provide resistivity data for modeling the MT/AMT survey in upper Gallagher. Most core samples were from Gallagher drill holes.	CR results from representative lithology shows a wide range of resitivities.
Downhole UTEM3	2004	SJ Geophysics	Drill Holes GC2459, GC2463, GC2551, PS0153, PS0161, PS0166, PS0169, PS0203, PS0210, PS0219, and PS0223	16 ft (5 m) intervals (uncertain)	Original aim was to down hole survey GC2551 and PS0223 which intersect or comes close to the new Gallagher Mineralized zone to determine its possible extent and structural orientation.	GC2551 could not be surveyed and only half of PS0223, thus other holes were surveyed. The survey of PS-210
MT/AMT	2005	Phoenix Geophysics	Upper Gallagher, 12 XS and 11 LS lines spaced 100 to 200 ft (30 to 60 m) apart.	150 ft (45 m) spacings	Expand on the 2004 AMT survey in Upper Gallagher to determine the possible extend of the Gallagher resource and use MT frequencies to model deeper.	Four anomalies were identified, most related to known and drilled argillite horizon near surface.
Gravity re-modeling	2005	Big Sky Geophysics	Gallagher, Bruin, Upper Zn (East), Upper Big Sore, Lower Zn, and 'A' Road and High Sore grids	100 ft (30 m) spacings	Remodel the gravity data from the 1997 and 1998 surveys using the greatly improved Lidar terrain data for the terrain corrections.	Forward modeling shows much better resolution with Lidar data as opposed to inclinometer measurements at stations. Gravity highs in High Sore and 'A' Road grids need further investigation.
MT 3D Model	2007	GeoSystems	Upper Gallagher grid	used data from MT/AMT survey	Use the closed spaced grid data from the 2004 and 2005 MT/AMT to create a 3D model below Upper Gallagher	Upper argillite is well modeled across the entire survey area, lowest conductor that can be modeled is at 700 meter depth (Above the Gallagher zone). Modeled only down to sea-level.
CSAMT	2007	Zonge Engineering	East Lil Sore lines 2000N, 4400N, 4800N, and 5600N, Young Bay lines 5600S, 6400S, and 8000S, and NW	100 ft (30 m) spacings, mostly vector	Survey above the East Ridge prospect and it projection of the north to determine the geometry	East Ridge contact well mapped out by conductive units. Young Bay gridlines define graphitic phyllite over conglomerate contact much better than the

Survey Type	Year	Contractor	Survey Location(s)	Spacing	Purpose	Results
			Mammoth 6000N.		of the contact.	conglomerate over argillite (Mine) contact.

Figure 9-3: Greens Creek Ground Gravity Surveys

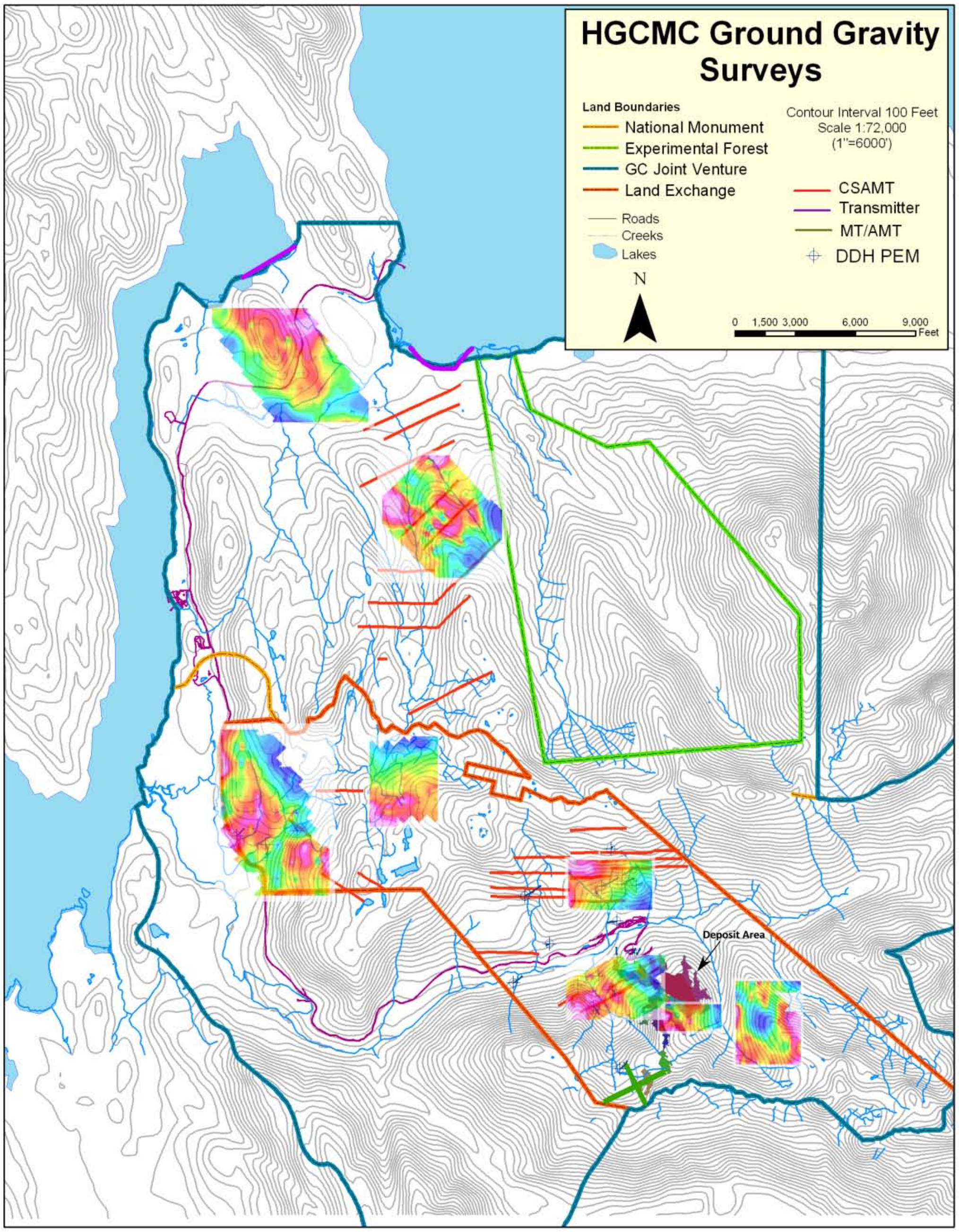


Figure 9-4: Greens Creek Ground Magnetic Surveys

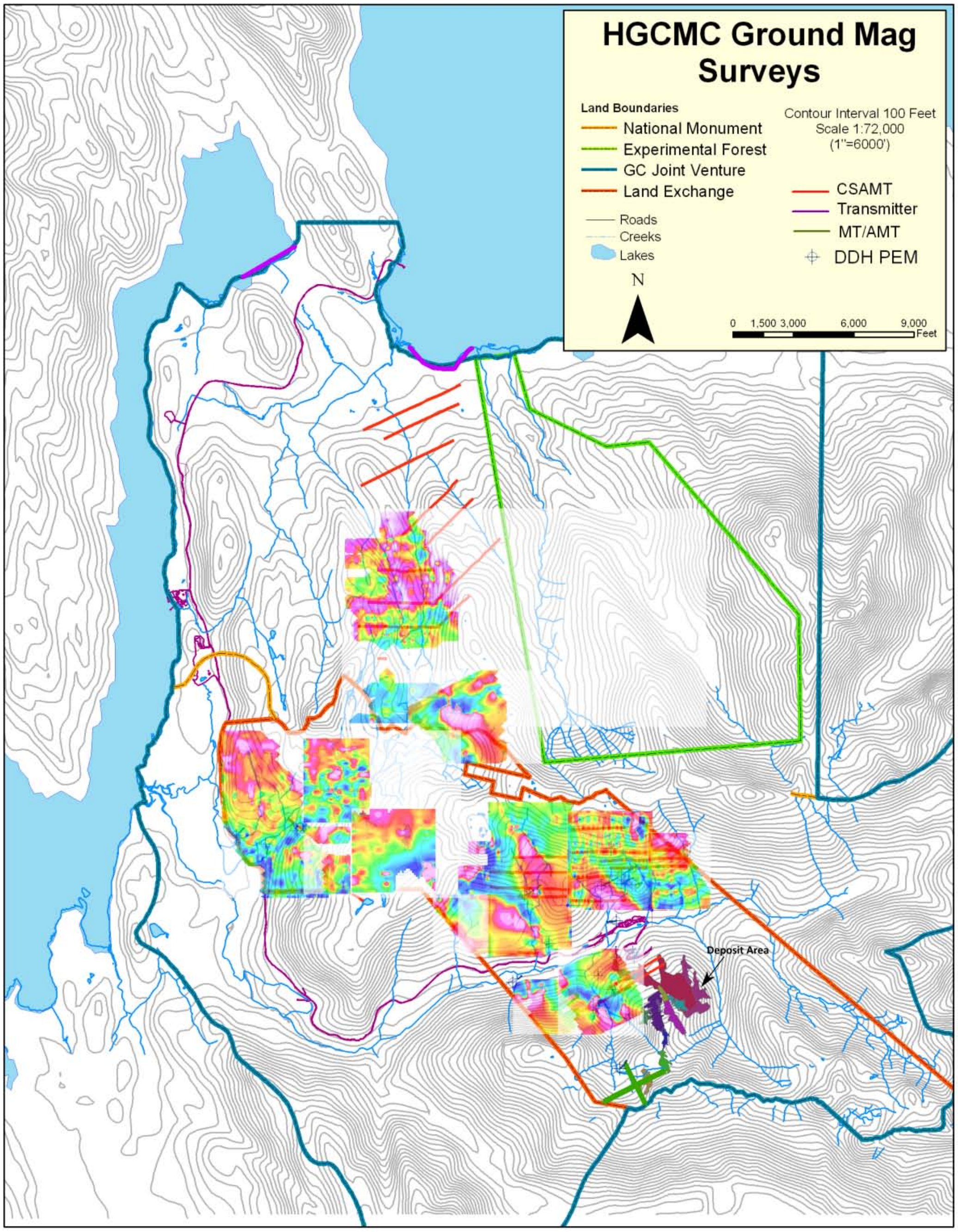


Figure 9-5: Greens Creek AeroDat Surveys Total Radiometrics

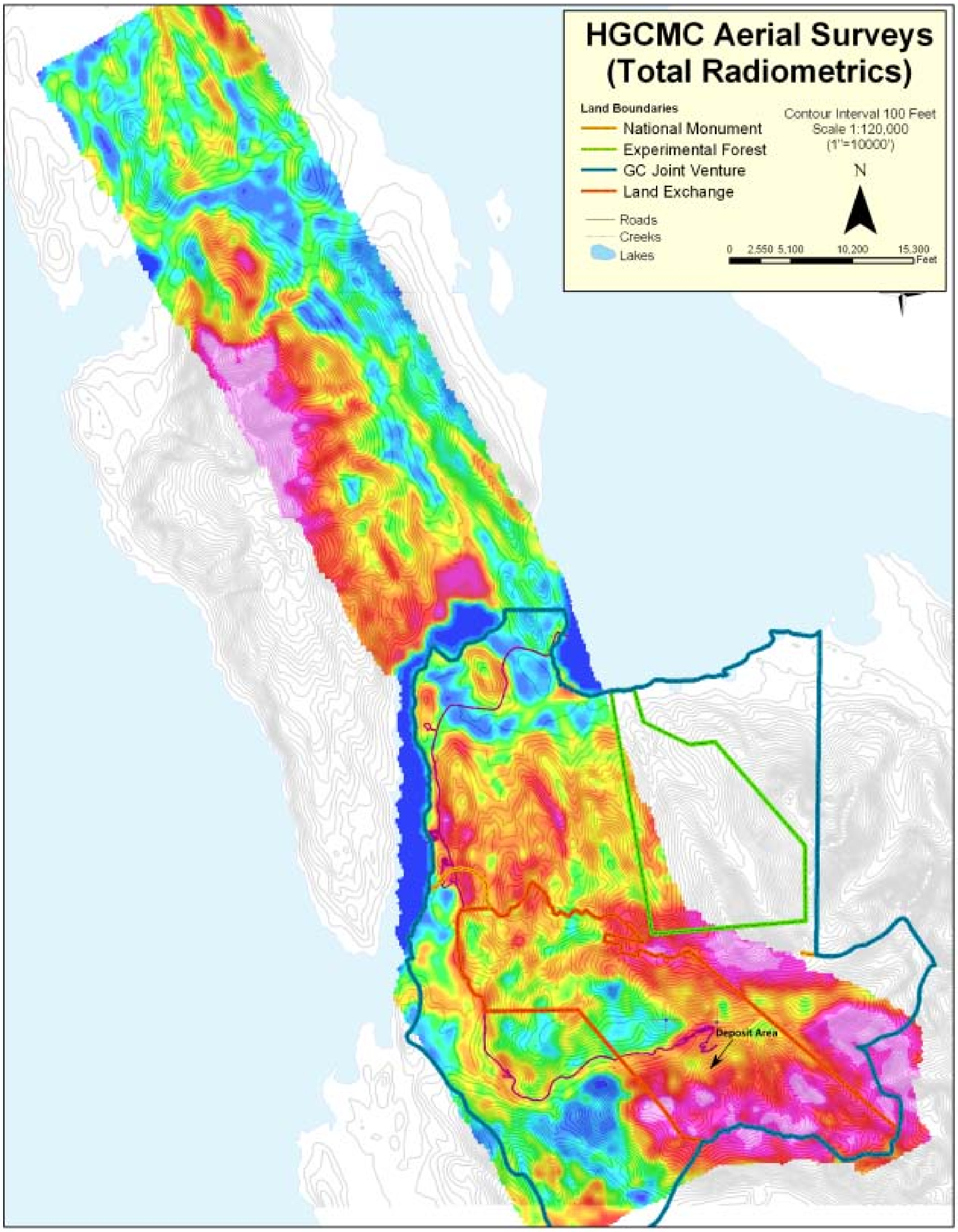
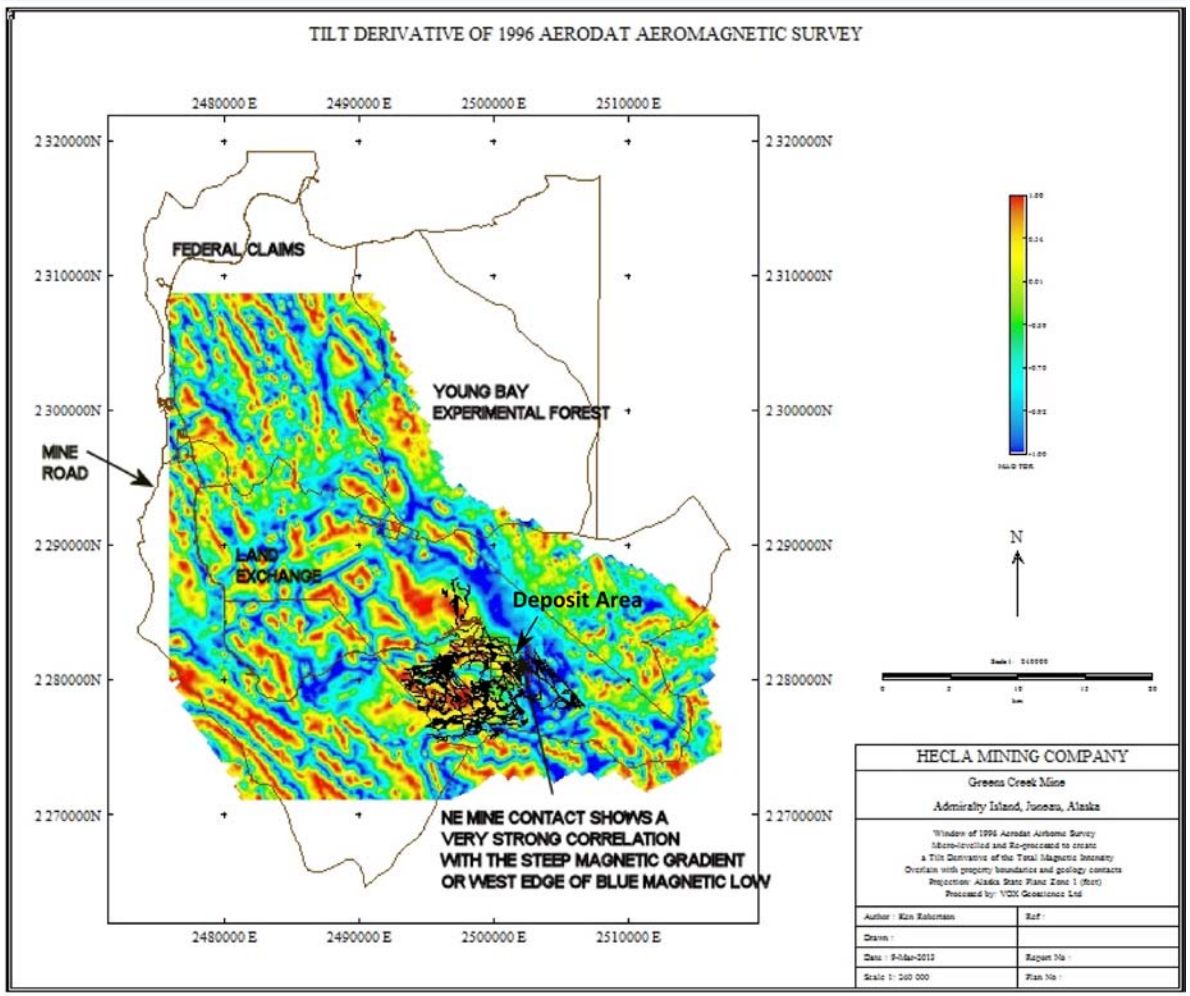


Figure 9-6: Greens Creek 2010-2011 Tilt Derivative Reprocessing of the AeroDat Survey Magnetics Data



In 2011, Crone Geophysics & Exploration Limited based in Mississauga, Ontario, Canada, was contracted by Hecla to conduct surface and borehole pulse electromagnetic surveys on the Killer Creek target area. Twelve surface lines utilizing two surface loops and two boreholes were surveyed form one transmitter loop. The surface surveys were carried out using a time base of 100.00 msec (2.5Hz) with a 1.5 m/sec shut-off ramp time. Vertical and in-line data were collected at a nominal station spacing of 82 ft (25 m).

Some interesting but confusing data were acquired as the host lithologies in the area can be very conductive and discriminating graphitic sediments from sulfides is problematic. However, the Crone Pulse Electro Magnetic data was modelled with Electromagnetic Imaging Technology Maxwell software, which resulted in the isolation of a small conductor from the background conductivity. This small conductor was drill tested in 2012 and copper-rich sulfide mineralization was intersected in a vein zone varying from 2.1 to 7.0 ft (0.6–2.1 m) with anomalous copper and silver values.

9.5 Petrology, Mineralogy, and Research Studies

A number of professional papers and research studies have been completed on the Greens Creek deposit and surrounding area, including:

- USGS Professional Paper 1763: Geology, Geochemistry, and Genesis of the Greens Creek Massive Sulfide Deposit, Admiralty Island, Southeastern Alaska;
- Anderson, V.M., and Taylor, C.D., 2000: Alteration Mineralogy and Zonation in Host Rocks to the Greens Creek Deposit, Southeastern Alaska: Geological Society of American Cordilleran Section Meeting, Abstracts with Programs, v. 32. no. 6, p. A-2;
- Dressler, J.S., and Dunbire, J.C., 1981: The Greens Creek ore deposit, Admiralty Island, Alaska: Canadian Institute of Mining and Metallurgy Bulletin, v. 74, no. 833, p. 57;
- Taylor, D.D., Newkirk, S.R., Hall, T.E., Lear, K.G., Premo, W.R., Leventhal, J.S., Meier, A.L., Johnson, C.A., and Harris, A.G., 1999: The Greens Creek Deposit Southeastern Alaska – A VMS-SEDEX Hybrid: *in* Stanley, D.J., and others, *eds*., Mineral Deposits – Processes to Processing, Rotterdam, Balkema, v. 1, p. 597–600;
- Taylor, D.D., Premo, B.R., and Lear, K.G., 2000: The Greens Creek Massive Sulfide Deposit – Premier Example of the Late Triassic Metallogeny of the Alexander Terrane, Southeastern Alaska and British Columbia [abs.]: Geological Society of America Abstracts with Programs, v. 32, no. 6, p. A-71;

- Freitag, K., 2000: Geology and Structure of the Lower Southwest Orebody, Greens Creek Mine, Alaska: Colorado School of Mines Thesis;
- Sack, P., 2009: Characterization of Footwall Lithologies to the Greens Creek Volcanic-Hosted Massive Sulfide (VHMS) deposit, Alaska, USA: PhD thesis, Univ. of Tasmania;
- Fulton, R: Geology and Geochemistry of the Hanging Wall Argillite, Greens Creek VHMS Deposit, Alaska: Implications for Ore Genesis and Exploration: unfinished PhD thesis. Univ., of Tasmania;
- Franklin, J.M., and McRoberts, S., 2009: Report on Analytical Reliability and Method Selection for Hecla Greens Creek Mining Company.

Hecla and its predecessor companies also commissioned specialist petrographic and mineralogic reports in support of elucidation of mineral species and lithological determinations.

9.6 Exploration Potential

In 1977, it was recognized that the mineralization at Greens Creek is associated with the lithologic contact between argillite and phyllite. This was dubbed the Mine Contact. To date, more than 16,000 acres (6,475 ha) of land in the Project area that may host the Mine Contact remains to be fully explored.

Historical to current exploration programs have actively explored along the Mine Contact away from existing mine workings, while focusing on opportunities to expand the extent of the known Greens Creek deposit and/or discover another Greens Creek-style deposit and mineralizing center.

Greens Creek exploration programs are designed to continually develop prospective target areas, evaluate emerging prospects, and test potential economic targets. Development of favorable areas includes regional mapping, followed by geochemical sampling and/or geophysical surveys. Evaluation activities include detailed geologic mapping and the incorporation of refined historical data with new exploration data to establish target potential. Testing involves diamond core drilling with the assessment of new information.

Since Hecla assumed proprietorship of Greens Creek in 2008, surface exploration programs have ranged in testing from as low as three to, as high as, seven prospects in one season.

Underground exploration at Greens Creek has historically followed the Mine Contact down dip and down plunge. When the contact is interrupted by major structural boundaries such as the Klaus Shear or the Maki and Gallagher Fault systems, exploration strategy concentrates on locating the Mine Contact across the structure, then continuing to follow it down plunge. After the initial discovery of the East zone, the implementation of this strategy has led to the discovery the West, Northwest West, 9A, 5250, Southwest, 200 South, and most recently the Deep 200 South and Gallagher zones.

Exploration targets underground are categorized as emerging or advanced based upon the amount of drill testing that has been applied to that target. Currently there are four major exploration targets being tested concurrently underground at Greens Creek, three have been developed to the advanced stage, while the fourth is emerging. The advanced targets are the Deep 200 South Down Plunge, the Gallagher Down Plunge, and the Northeast Contact, while the emerging target is the down dip projection of the Mine Contact, called Deep Mine Contact.

These targets in relationship to the mineralized zones and major structures of the mine are shown in Figure 9-7.

In the opinion of the QPs, with two trends of mineralization (Deep 200 South and Gallagher) open to the south, and advanced and emerging targets such as the Northeast Contact and the down dip testing of the Mine Contact, the underground exploration potential at Greens Creek remains very good. When combining the underground exploration potential with the surface exploration potential, the potential to discover new mineralizing centers on the property remains strong.

9.6.1 Deep 200 South Down Plunge

The Deep 200 South zone consists of the Lower Limb and the South Bench. The down plunge projection of each represents a distinct target for exploration. Both are categorized as advanced targets as significant delineation drilling has been undertaken.

For the Lower Limb, additional work is planned to test the down plunge projection of the zone, with some drilling planned to continue through the down plunge projection to test for down dip fold repeats of the Mine Contact.

The South Bench mineralization extent is currently limited only by the practicalities associated with drilling down-plunge. A drift designed solely for the purpose of providing a drilling platform for increasing drill hole density of this zone was completed in early 2013, and testing is underway.

An overview of the zone is included as Figure 7-39

9.6.2 Gallagher Zone Down Plunge

The Gallagher zone is interpreted as the fault offset of the Deep 200 South trend. Based on this interpretation, the zone represents the down plunge continuation of the main trend of mineralization at Greens Creek. The mineralization is open down plunge, and retains potential up plunge, at depth, and within the Gallagher fault.

In 2012, the 1147 exploration drift was extended as far south as allowed under existing permits. Down-plunge exploration remains to be done from this drift.

In addition to the down plunge aspect of this target, the up-plunge extent is also relatively poorly defined and will need additional drilling. Several mineralized intercepts have been encountered within the Gallagher fault zone and will need further definition. The definition of both of these targets has the potential to locate additional mineralization.

An overview of the zone is included as Figure 7-40.

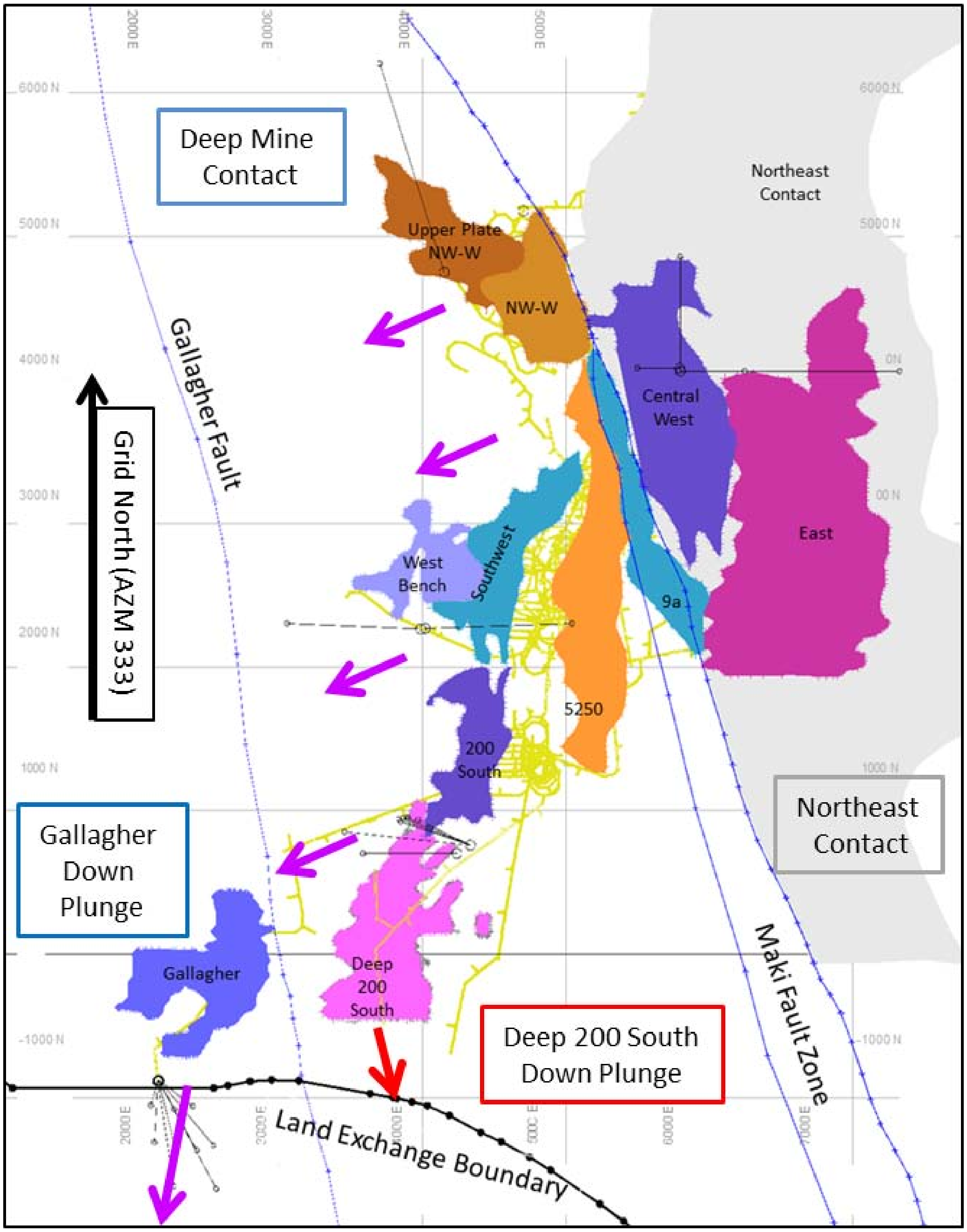
As the 4211 exploration drift advanced to the south, it advanced through the Mine Contact, which led to interpretations that the Mine Contact folds back over the drift, and is in fact present above the drift for hundreds of feet. There has been very little up-hole drilling in this area, and as a result interpretations above the drift are based on the drilling from below and from several surface drill holes to the north. This highlights the fact that, with the exception of the detailed drilling within the area of the Mineral Resource estimate, there has been little drilling done to test the surrounding rocks west of the Gallagher fault.

9.6.3 Northeast Contact

The Northeast Contact is an advanced exploration target as it has been tested over several years and its geology and geometry are fairly well understood. Exploration potential of this target remains highest within the middle argillite unit, which has, on multiple sections, intercepted anomalous base and precious metals mineralization in drilling. While an effort has been made to systematically test this target, the strike length is quite extensive, such that gaps ranging from 300 to 1,200 ft (91–366 m) remain; these are large enough to contain a Greens Creek-sized zone of mineralization. In 2011, drilling intercepted 2.4 ft (0.7 m) of mineralized material at the very southern end of this target. The intercept occurred where the Maki fault truncates the upper package. Hecla will follow-up on possible fault offsets to the north and south of this material. The Northeast Contact stratigraphy is projected to continue down plunge to the south. Drilling is planned to follow-up on 2010 intercepts of massive coarse-grained pyrite and anomalous silver within the middle argillite.

An overview of the zone is included as Figure 7-35.

Figure 9-7: Plan View showing Underground Exploration Targets (Boxes) in Relation to the Ore Zones



9.6.4 Deep Mine Contact

The Mine Contact down dip is a target of similar scale to that of the Northeast Contact. The target runs the entire length of known mineralization, from the Northwest West zone in the north to the Deep 200 South zone in the south, and aims to test the down dip projection of the Mine Contact as it rolls down and to the west out of currently-producing ore zones (Figure 9-8).

While drilling tests the Mine Contact proximal to the existing ore zones, there can be instances where it fails to test significantly down dip of the zones. Several historic and recent drill holes have intercepted footwall lithologies below the defined Mine Contact. Testing of this target is aimed at following up on these intercepts with a goal of characterizing the geometry of the Mine Contact at depth down dip of existing zones. It is also important to note that this target tests a block of stratigraphy located between the Maki and Gallagher fault zones.

Drill hole testing of this target began in late 2012 with two deep drill holes along cross section XS2250. Both holes intercepted a deep argillite over phyllite contact indicating that there is a fold closure of the Mine Contact to the east. One hole was lost within ultramafic rocks of the Maki fault; the other was lost within phyllite without encountering another contact.

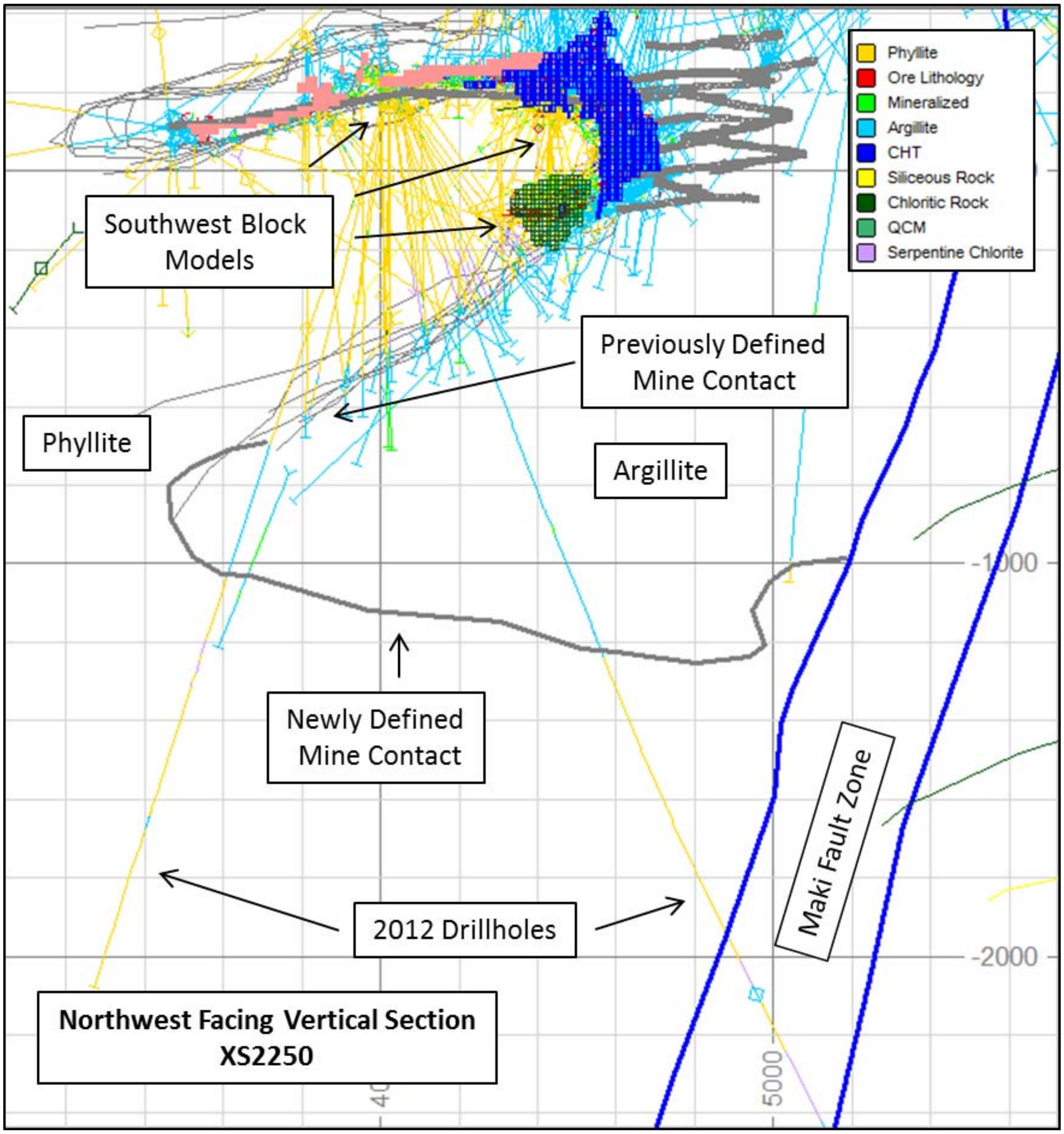
Testing of this target in 2013 will consist of four drill holes, two along cross section XS1400 and two along cross section XS4700. With the completion of these six drill holes an interpretation of the Mine Contact at depth and spanning the length of the mineralized trend between the Maki and Gallagher faults will be generated. This target has the potential to greatly increase the known extent of the Mine Contact, and therefore open a large unexplored area for additional exploration.

9.7 Comments on Exploration

In the QPs' opinion:

- The exploration programs completed to date are appropriate to the style of the deposit and prospects;
- The research work supports Hecla's genetic and affinity interpretations for the deposits;
- Additional exploration has a likelihood of generating further exploration successes particularly down-dip of known zones.

Figure 9-8: 3D View of the Mine Contact Down Dip Target



10.0 DRILLING

A total of 5,541 drill holes (2,722,950 ft or 829,955 m) have been completed over the entire Project area in the period 1975 to 2012 (Figure 10-1). Of these drill holes, 365 (403,279 ft or 122,919 m) are surface holes drilled for exploration or resource development purposes, 3,487 (1,967,811 ft or 599,789 m) are underground resource definition drill holes, which are typically drilled on 50 to 200 ft (15 to 60 m) spaced vertical sections, and 1,689 (351,860 ft or 107,247 m) are underground pre-production drill holes that are drilled on cross- and plan-sections spaced from 20 to 50 ft (15 to 60 m).

All bedrock drilling has been completed using core methods. Surface drill holes collared in unconsolidated sediments utilize RC methods until bedrock is encountered (typically less than 100 ft or 30 m), and are then completed using core methods.

10.1 Pre-2008 Legacy Drilling

Prior to 2008, a total of 4,792 drill holes (2,196,695 ft or 669,553 m) have been completed (Table 10-1). Of these drill holes, 307 (305,887 ft or 93,234 m) are surface holes drilled for exploration or resource development, 2,963 (1,590,079 ft or 484,656 m) are underground resource definition drill holes, and 1,522 (300,728 ft or 91,662 m) are underground pre-production.

10.2 Hecla Drilling

Since 2008, a total of 749 drill holes (526,256 ft or 160,403 m) have been completed (Table 10-2). Of these drill holes, 58 (97,392 ft or 29,685 m) are surface holes drilled for exploration or resource development, 524 (377,732 ft or 115,133 m) are underground resource definition drill holes, and 167 (51,132 ft or 15,585 m) are underground pre-production.

Figure 10-1: Drill Hole Location Map

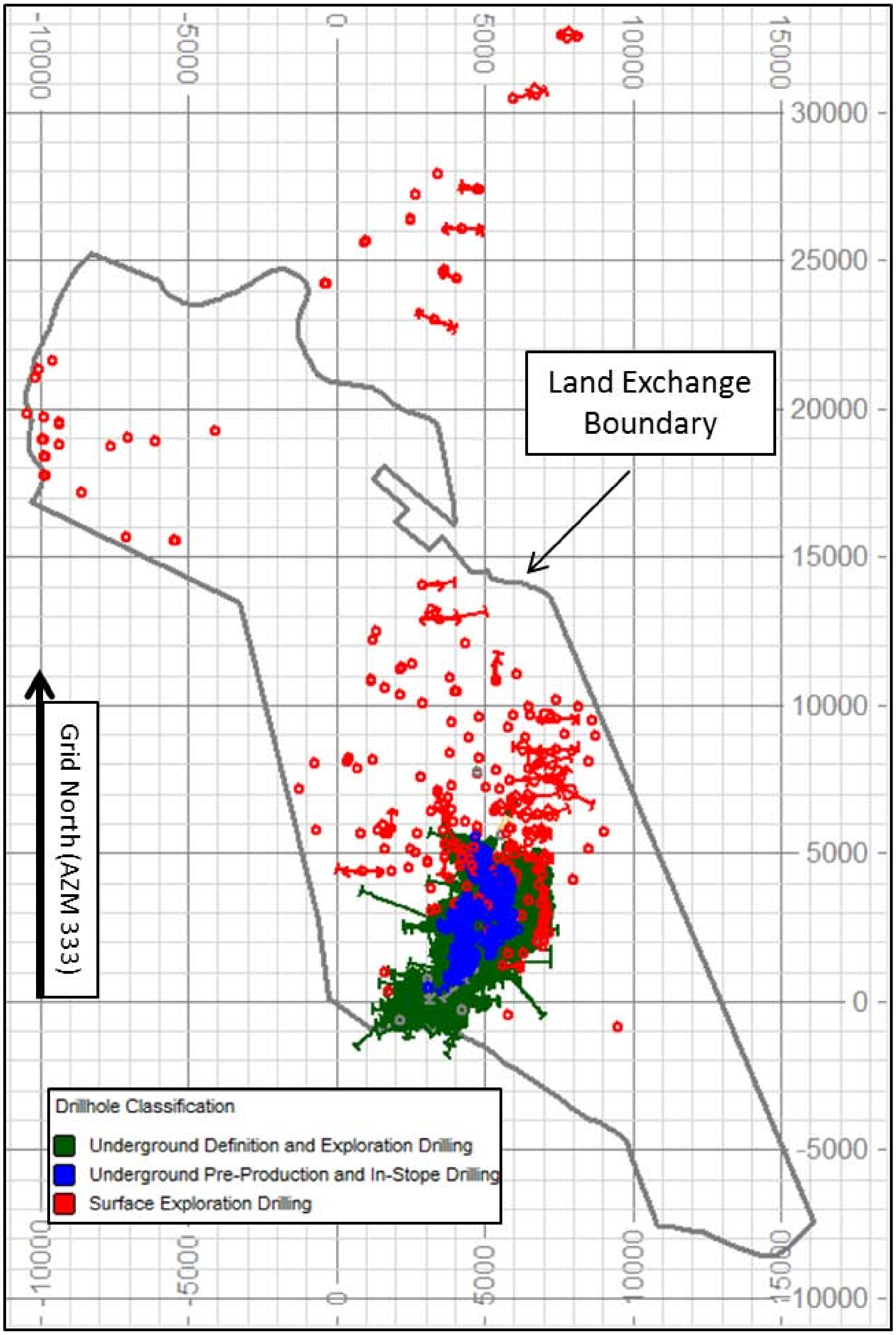


Table 10-1: Summary of Annual Drill Hole Footage Totals by Type 1975–2007 (legacy drilling)

Year	Surface Exploration (PS series)		Underground Definition & Exploration (GC-series)		Pre-production / Stope Planning (PP+ST-series)		Annual Totals		Drill Contractor
	Holes	Feet	Holes	Feet	Holes	Feet	Holes	Feet	
1975	3	997					3	997	Wink Brothers
1976	16	5,350					16	5,350	
1977	19	7,901					19	7,901	
1978			4	1,427			4	1,427	Unknown
1979			40	17,094			40	17,094	
1980			34	13,528			34	13,528	
1981							0	0	
1982	13	12,220					13	12,220	Diamond Drill Contracting Co
1983	17	7,438					17	7,438	
1984	15	12,424	10	8,970			25	21,393	
1985	10	11,721	44	33,760			54	45,482	
1986	3	4,692	7	2,068			10	6,760	
1987			12	3,426			12	3,426	
1988			164	47,011			164	47,011	Greens Creek (Underground) Surface (Unknown)
1989	2	2,562	98	27,676			100	30,238	
1990	9	21,053	139	68,488			148	89,541	
1991			247	138,613			247	138,613	
1992			226	74,899			226	74,899	
1993			17	17,856			17	17,856	
1994			200	132,998			200	132,998	NANA Dyantech
1995			184	96,787	103	21,118	287	117,905	Connors Drilling, LLC
1996	8	7,420	127	83,694	101	30,880	236	121,994	
1997	4	7,071	166	111,381	242	39,474	412	157,926	
1998	5	8,484	157	92,651	224	30,567	386	131,702	
1999	11	12,148	127	78,285	144	28,425	282	118,858	
2000	15	15,812	206	90,333	83	22,430	304	128,575	
2001			98	87,278	43	8,991	141	96,269	
2002	20	17,258	109	73,212	73	14,109	202	104,579	
2003	25	27,743	85	60,598	87	13,830	197	102,171	
2004	45	52,174	95	54,923	89	18,957	229	126,054	
2005	34	35,920	158	82,807	108	18,552	300	137,279	

Year	Surface Exploration (PS series)		Underground Definition & Exploration (GC-series)		Pre-production / Stope Planning (PP+ST-series)		Annual Totals		Drill Contractor
	Holes	Feet	Holes	Feet	Holes	Feet	Holes	Feet	
2006	19	16,555	78	40,893	106	17,744	203	75,192	
2007	14	18,946	131	49,425	119	35,652	264	104,023	
Grand Total	***307***	***305,887***	***2,963***	***1,590,079***	***1,522***	***300,728***	***4,792***	***2,196,694***	

Table 10-2: Summary of Annual Drill Hole Footage Totals by Type 2008–2012 (Hecla drilling)

	Surface Exploration (PS series)		Underground Definition & Exploration (GC-series)		Pre-production / Stope Planning (PP+ST-series)		Annual Total		
Year	Holes	Feet	Holes	Feet	Holes	Feet	Holes	Feet	Drill Contractor
2008	16	20,041	132	54,530	23	2,822	171	77,392	Connors Drilling, LLC
2009	4	8,292	51	39,556	55	12,830	110	60,678	
2010	17	21,805	67	89,373	29	9,677	113	120,854	
2011	14	27,397	88	88,345	25	6,210	127	121,952	
2012	7	19,858	186	105,929	35	19,593	228	145,380	
Grand Total	***58***	***97,392***	***524***	***377,732***	***167***	***51,132***	***749***	***526,256***	

10.3 Drill Methods

10.3.1 Pre-2008 or Legacy Drilling

The drilling methods of prior operators were similar to the practices employed by Hecla. Underground core was mostly NQ or NQTK diameter, and minor amounts of BQ and BQTK diameter core was used for longer holes, or ones in difficult ground conditions. In some drill holes, the drill core diameter was reduced from NQ/NQTK to BQ/BQTK (telescoping) due to problematic ground conditions problems, typically as a result of faulting.

Surface legacy exploration drilling also utilized methods similar to current Hecla practices. Drilling in the overburden (unconsolidated sediments) utilized HQ as casing and drill core was typically reduced to NQ or NQTK once bedrock was encountered. In some drill holes, the drill core diameter was reduced from NQ to BQ due to problematic ground conditions.

Legacy drilling methods, where known, are summarized in Table 10-3.

Table 10-3: Summary of Legacy Drill Methods 1975–2007 (legacy drilling)

Core Type	Diameter (in)	Diameter (mm)	Typical Use
BQ	1.44	36.5	Legacy(pre-2000) - used to extend drilling in difficult ground conditions
BQTK	1.61	40.9	Legacy - when required to extend holes in difficult ground conditions and some legacy ST holes.
NQ	1.87	47.6	Legacy (pre-2000) - standard surface and underground core size
NQTK (NQ2)	2.00	50.8	Standard surface and underground core size
HQ	2.50	63.5	Typically used on surface for overburden drilling and underground for long holes

Information concerning the number and types of drill rigs utilized for the legacy underground and surface drill programs are not available.

10.3.2 Hecla Drilling

Hecla has explored Greens Creek deposits since 2008 with core holes spaced at various intervals depending on the stage of exploration and development.

Surface exploration holes (PS-prefix series drill holes) are drilled primarily with NQTK tools. To drill through the unconsolidated overburden HQ-diameter tri-cone methods are utilized. Typically one to six holes are drilled from remote, helicopter accessible, sites and more rarely from the existing mine road system. All sites require USFS approval prior to construction of a 24 ft x 24 ft (7.3 x 7.3 m) wooden drill platform. A typical remote site requires a 60 ft x 60 ft (18 x 18 m) clearing to ensure safe access by helicopter.

All remote drilling is supported by one Greens Creek dedicated helicopter (Hughes 500D) based at Hawk Inlet. Drill moves are accomplished using an A-Star B2 or B3, which is mobilized from Juneau as needed. During the active drill season one to two drills are active on a 24-hour basis, 7-days per week. Drill plans are laid out parallel to geo-grid sections (refer to Section 9.1 for an explanation of the Project grids).

Definition holes (GC-prefix series drill holes) are drilled with NQTK or NQ tools. Holes are drilled in fans principally from underground drill stations spaced from 50–100 ft (15.2–30 m) along strike of mineralization (Table 10-4). Depending on the availability of drill stations, the vertical spacing of holes within mineralization in individual sections may range from 12 to 100 ft (3.6–30 m).

Table 10-4: Summary of Current Drill Methods 2008 – 2012

Core Type	Diameter (in)	Diameter (mm)	Typical Use
BQTK	1.61	40.9	ST-series holes and when required to extend holes in difficult ground conditions.
NQTK(NQ2)	2.00	50.8	Standard surface and underground core size
HQ	2.50	63.5	Typically used on surface for overburden drilling and underground for long holes

Pre-production holes (PP-prefix series) and stope holes (ST-prefix series) are drilled with NQTK and BQTK tools respectively. PP drill fans are drilled at 50 ft (15.2 m) intervals along strike of mineralization and on 60 ft (18 m) vertical intervals. Most PP drill holes are planned to produce a final drill hole spacing in mineralized zones of 50 ft (15.2 m) or less. ST-prefix series drill holes are drilled in areas of complex mineralized shapes to aid mine designs and mine planning.

Drill core for exploration, in-fill and definition purposes is NQ in diameter. In some drill holes, the drill core diameter is reduced from HQ to NQ to BQ (telescoping) due to problematic ground conditions problems, typically as a result of faulting.

Once retrieved from the core barrel, the core is placed in sequential order in core boxes labeled with the drill hole number. Each successive section of core drilled, usually 10 ft (3 m) long, is identified by a wood block marked with the depth of the interval. At the end of each shift, core boxes are transported by the drillers to the logging area which is located at the 860 Area on surface.

Since 2008, Connors Drilling LLC has been the sole contractor drill company utilized by Greens Creek for all surface and underground geologic core drilling. Connors has brought a variety of drills to the site; the make, model, and length of service at Greens Creek are shown in Table 10-5. Typically the surface drill program utilizes one to two rigs, and the underground program utilizes between one and three active rigs depending upon need.

Table 10-5: Summary of Make/Model of Drill Equipment Utilized for Geologic Core Drilling, 2008 – 2012

Make	Model	Description
Christensen	CS14	Surface Drilling, 2009 & 2011
Atlas Copco	CS1000	Surface Drilling 2008,2010-2012
Atlas Copco	U6	Underground Drilling 2008-2009
Atlas Copco	U8	Underground Drilling 2009-2012
Connors Drilling	20HH	Underground Drilling 2009-2012

10.4 Geological Logging

10.4.1 Legacy Drilling

The current system of logging employed by Hecla has been used with minor modifications since 1987 (starting with drill hole GC0150). Prior to 1987, lithological nomenclature differed in the names applied to various units. All of the pre-1987 logging has been translated into the current system based on the descriptive details from the original logs. Over 95% of the logged intervals contained adequate details to unequivocally place intervals into the current lithological system. Where insufficient descriptions did occur, assays and or adjacent holes were utilized to ensure continuity.

Other differences found in the pre-1987 logging include the use of longer maximum sample lengths (up to 10 ft or 3 m) that may span multiple lithologies. Finally, not all of the legacy logs prior to 2000 have consistently recorded RQD and fracture counts.

The majority of the legacy core was photographed wet with either 35 mm slides or digitally.

10.4.2 Hecla Drilling

Underground drill core is logged for recovery,RQD, lithology, alteration, mineralization, structure and fabric. Lithologies can be subdivided into non-mineralized/non-ore (generally not mineralized but may contain erratic high-grade values that can be mined) and mineralized/ore categories.

All logs are recorded on paper at scales ranging from 1 in = 20 ft to 1 in = 5 ft, depending on observed complexity.

Surface core is logged for recovery, lithology, alteration, mineralization, structure and fabric. The surface lithologies use the same classification system as the underground. Typically surface core logs contain a higher level of descriptive details than underground logs. All logs are recorded on paper at a 1 in = 10 ft scale.

All core is photographed wet.

10.5 Recovery

Core recovery is generally high because of the compact nature of the greenschist metamorphic rocks. Approximately 80% of drilled intervals have core recovery greater than 95%. Poor recovery (less than 50%) occurs in approximately 2% of intervals. Poor recovery is generally localized to within heavily-faulted areas in the argillite.

10.6 Collar Surveys

10.6.1 Legacy Drilling

The majority of the legacy underground drill collars were surveyed with conventional mine survey equipment by the mine staff. In rare cases (~ 2%), collar locations were mapped by Brunton compass and tape methods from known survey points.

All collar points were recorded in the database utilizing the mine grid coordinate system.

10.6.2 Hecla Drilling

Drill holes are planned (azimuth, dip, length) by geologists on vertical cross-sections and on vertical longitudinal sections orthogonal to the geo-grid.

For surface drill holes a 2 in x 4 in (5 x 10 cm) tack board is aligned with the geo-grid sectional line (333° azimuth) during pad construction. When the rig is slung into place the skid frame is aligned with the tack board. If drill holes are planned that are not parallel with the geo-grid section line, an arrow pointing in the planned direction is painted onto the deck.

After drill hole completion, surface drill collars are located using a Trimble Geo XH 600 handheld GPS instrument. Coordinates are recorded into UTM-NAD83 coordinates; accuracy is generally ±10 ft (3 m) for northing and easting coordinates. Elevations are adjusted to match the local light detection and ranging (LiDAR) topographic survey.

Underground drill lines are marked (front sight and back sight) by the mine surveyors. After completion, underground drill hole collars are surveyed with conventional mine surveying equipment by Hecla staff. All collar locations are recorded in the database utilizing the mine grid coordinate system.

10.7 Down-hole Surveys

10.7.1 Legacy Drilling

Prior to 1996, down-hole surveys were done by magnetic single-shot cameras. The majority used a Sperry-Sun single-shot camera with a few using a Well-Nav single-shot. Usually a shot was taken at the collar, at 50 ft (15 m), and approximately every 100 to 200 ft (30 to 60 m) thereafter. If the azimuth and inclination at the collar were more than a few degrees different from that of the shot at 50 ft (15 m), the collar azimuth and inclination were regarded as suspect (affected by steel in the equipment) and replaced by the azimuth and inclination at 50 ft (15 m). Magnetic azimuths were corrected for magnetic declination and, for the Sperry-Sun, had a high-latitude correction applied.

Between 1996 and 2000 a combination of Sperry-Sun and MAXIBOR instruments were used. The MAXIBOR system determines drill hole deviation optically relative to a survey measurement of the drill hole collar. The Sperry-Sun was replaced with a Reflex© EZ-shot survey tool in 2000. The EZ-Shot is a solid-state electronic, single-shot instrument with stated accuracy of ±0.5° azimuth and ±0.2° dip. Between 2000 and 2004, the EZ-Shot and MAXIBOR system were used in tandem. Since 2005 the EZ-Shot has been the only system used for down-hole surveys at Greens Creek.

10.7.2 Hecla Drilling

Since 2008 all surface and underground drill holes have been surveyed using an EZ-Shot system.

For underground drill holes an initial shot at 50 ft (15 m) depth is taken and compared to the planned drill hole azimuth and dip. If the hole alignment is off by more than ±3° in azimuth or ±1° in dip the hole is typically stopped and re-collared. After the initial 50 ft (15 m) shot, surveys are typically taken every 200 ft (60 m) and at the end of the drill hole. Surveys are taken as the drill hole advances. Readings that show anomalous magnetic field strength are flagged as suspect during database entry.

For surface drill holes, an initial survey is first shot below the casing and then every 100 ft (30 m) down hole thereafter as the drill hole progress. A final shot is taken at the end of the drill hole upon completion.

10.8 Geotechnical and Hydrological Drilling

10.8.1 Legacy Drilling

Surface-based drilling methods of prior operators were similar to the practices employed by Hecla. Prior to 2008, a significant number of geotechnical and hydrological drill holes were completed in support of construction and operations of the Greens Creek surface facilities. Areas covered by these holes include the 920 Area, Site 23-D, Site E, and the TSF. An accurate tally of the number of holes and footage for this period is not currently available.

Underground geologic core drilling methods of prior operators were similar to the practices employed by Hecla. However, the portion of the legacy Ingres database that contained core recoveries and RQD data was not successfully recovered with the transfer to acQuire in 2008 (see Section 12.2 for details). These data are still available on the paper logs.

10.8.2 Hecla Drilling

Since 2008, a total of 60 holes (2672.4 ft or 1,119.3 m) have been completed (Table 10-6). The geotechnical and hydrological drill campaign in 2009 was focused on investigating existing pile conditions at the TSF. A uniaxial hydraulic jab was used to push a 3.0 in (7.6 cm) diameter Shelby sample tube into the tailings facility for collection. Sample depths ranged from 20 to 45 ft (6–13.7 m).

Drilling investigations in 2010 and 2011 were in support of a proposed TSF expansion. Additionally, in 2010, Site 23, the mill back slope area, and 1350 Area were drill tested to support stability and groundwater monitoring programs. The 2010 program utilized a CME-75 track-mounted rig operated by Cascade Drilling of Woodinville, Washington; the 2011 program utilized a heli-portable CME-45C drill rig operated by Denali Drilling Inc. of Alaska.

The typical methodology for foundation and hydrogeological investigations in 2010 and 2011 included using hollow-stem auger drilling for peat, tri-cone mud rotary (water/bentonite-based) for sand/gravel/till, and HQ3 coring for bedrock lithology. Data collection included standard penetration testing typically at 5 ft (1.5 m) intervals and sample collection using a SPT split spoon for index testing. Core samples were also taken where bedrock was encountered. Where clays were encountered, Shelby tube samples were typically collected.

For drill rigs with auto-hammer capability (2010), energy transfer efficiency measurements were taken utilizing a pile driving analyzer at initiation of the drill program to verify correlation. For drill rigs without auto-hammer capability (2011), energy transfer efficiency measurements were taken throughout the duration of the field program for blow count correction.

During the 2011 drill program, a vane borer was also utilized for in-situ shear strength data collection.

Table 10-6: Summary of Surface Geotechnical and Hydrological Drilling 2008 – 2012

Year	Area	Driller	Holes	Footage
2008	No drilling.		0	0
2009	Tailings	Unknown	5	152.6
	1350 Area	Cascade Drilling	4	381.5
2010	Tailings	Cascade Drilling	8	595.7
	Tailings	Cascade Drilling	11	780.8
	A-Road	Denali Drilling	3	345.5
2011	Tailings	Cascade Drilling	11	568.3
	Tailings	Denali Drilling	18	848.0
		Total	**60**	**3,672.4**

Hecla logs geotechnical data on all standard underground drill core, and data are stored in the acQuire® database. The dataset includes core recovery (all core), RQD data and fracture count (sampled intervals and all ST holes). The data set is used in conjunction with the lithologic rock type to classify the mining areas based on the Greens Creek Ground Support Management Plan (GCMP). The GCMP is audited and validated by outside consultants.

10.9 Metallurgical Drilling

Current metallurgical testing is based on actual mill feed or composite samples collected from underground faces.

10.10 Sample Length/True Thickness

Drill holes are designed to intersect the mineralization as perpendicular as possible; reported mineralized intercepts are typically longer than the true thickness of the mineralization.

A series of section and plan maps for each mineralized zone are included in Section 7.5. These maps include drill hole traces, block model outlines, and an interpretation of major geologic contacts and faults. These plans and figures show that drill orientations are generally appropriate for the mineralization style, and have been drilled at orientations that are optimal for the orientation of mineralization for the bulk of the deposit areas.

10.11 Comments on Drilling

In the opinion of the QPs, the quantity and quality of the logging, geotechnical, collar and down-hole survey data collected in the exploration and infill drill programs are sufficient to support Mineral Resource and Mineral Reserve estimation as follows:

- Core logging performed by Hecla staff meets industry standards for exploration on polymetallic deposits;
- Core logging performed prior to Hecla acquiring 100% Project ownership met industry standards at the time of logging;
- Collar surveys for Hecla core holes have been performed using industry-standard instrumentation;
- Collar surveys for legacy drill holes were performed using methods that were industry-standard for the time;
- Down-hole surveys performed after 2008 were performed using industry-standard instrumentation;
- Prior to 1996, magnetic single-shot cameras were used for down-hole surveys. Although standard for the time, these readings can be affected by magnetic rocks and drill casings. From 1996 to 2006, industry-standard instrumentation was used;
- Drilling practices, logging, collar surveys and down-hole surveys have been periodically reviewed by independent auditors (refer to Section 12);
- Recovery data from core drill programs are acceptable;
- Geotechnical logging of drill core meets industry standards for planned open pit and underground operations;
- Drilling is normally perpendicular to the strike of the mineralization. Depending on the dip of the drill hole, and the dip of the mineralization, drill intercept widths are typically greater than true widths;
- Drill orientations are generally appropriate for the mineralization style, and have been drilled at orientations that are optimal for the orientation of mineralization for the bulk of the deposit areas;
- Drill orientations are shown in the example cross-sections in Section 7, and can be considered to appropriately test the mineralization;
- No factors were identified with the data collection from the drill programs that could affect Mineral Resource or Mineral Reserve estimation.

11.0 SAMPLE PREPARATION, ANALYSES, AND SECURITY

11.1 Sampling Methods

11.1.1 Face Samples

Nearly every ore face is marked with paint to delineate the ore subtypes, plus argillite and phyllite wall rocks, low-grade mineralized material, and occasional high-grade precious metals zones. Usually a single face sample is taken from each ore type (Mineral Resource Development Inc. (MRDI), 1998); where the area represented by an ore type is greater than 50 ft^2 (4.6 m^2), multiple face samples are taken. These samples are taken by chipping the face on an irregular grid.

The locations of stope-face samples are initially recorded in the grade control geologist's field book, wherein the geologist records the distance to the face, typically the center, from a spad, rib or other reference object/feature. On the surface, the geologist utilizes an Autolisp program within AutoCAD to insert a "stope-face" block at the appropriate measured distance from the reference object into an as-built drawing for the appropriate bench elevation. The orientation of the stope-face (relative to the drift/drive) is determined by the geologist. The geologist adjusts the stope-face block positions manually based upon detailed stope surveys.

The area of each sampled face is calculated using two different methods. The first method is the traditional cross sectional area (width by height). The second method relies upon photographing the face with a digital camera and then on-screen digitizing of distinct sample areas on the digital photo. The individual sample areas are electronically summed and then compared with the first method. Hecla tolerates up to a 20% difference between the two area methods; differences larger than this are not permitted by the data-entry procedure, which requires the data entry person to modify the input data.

A detailed survey is performed in active stopes at least every five days and preferably after every three rounds. The elevation is initially based on the mid-rib elevation and is more accurately "back determined" at the end of the month through the Datamine® wire-framing of the back and floor survey points.

The survey crew consists of a single individual utilizing a special Geodimeter total station equipped with a visible red laser. The instrument calculates the distance to an object by reading the reflected laser beam. This makes for very efficient single-person surveying, although erroneous distance readings can and do occur. The distance that can be measured is limited/impacted by the reflectivity of the target object, the clarity of the air in the stope/drive, and the angle at which the laser hits the target. The erroneous distances for the detailed survey points are readily identified and removed after loading the survey data into AutoCAD.

11.1.2 Core Samples

Drill core is sampled as half-core by two methods which are dictated by the scope of the drilling.

Exploration and definition drilling are sampled on intervals ranging from 1 to 5 ft (0.3–1.5 m) that do not cross lithological boundaries.

Barren contacts are sampled through 15 ft (4.6 m) lengths into the hanging wall and footwall whereas mineralized contacts are sampled through 15 ft (4.6 m) lengths into the hanging wall and 30 ft (9.2 m) lengths into the footwall.

Narrower (one 2 ft (0.6 m) followed by one 3 ft (1 m)) sample intervals are placed immediately adjacent to lithological contacts with the thicker 5 ft (1.5 m) intervals filling out the rest of the sampled buffer.

Mineralization occurring within veins or as remobilized bands away from contacts are sampled in 5 ft (1.5 m) intervals or less depending on the thickness of mineralization and enclosed by 5 ft (1.5 m) buffer samples.

Geologists are responsible for identifying samples in the core, labeling each sample extent with polyvinyl chloride (PVC) flagging, and documenting them with photographic logs. Sample intervals are also recorded on the paper log sheets and in the drill hole database. Core samples are dispatched to the underground cutting facility where technicians process the sample intervals into half core samples. The half core sample intervals are individually bagged and then delivered to the surface preparation laboratory that is operated by Acme.

Pre-production and stope drill holes are typically sampled through the majority of the drill hole, with sample intervals ranging from 1 to 5 ft (0.3–1.5 m). Samples are documented in an identical method to exploration and definition core.

Pre-production and stope cores are not reduced to half core samples; they are individually bagged by geologists as whole core samples and sent to the mine site laboratory for analysis.

11.2 Metallurgical Sampling

Prior to 2000, composited quarter-cut definition drill core was used for metallurgical test work on an ore zone basis in selective cases. The core was selected from select definition hole intervals that had been previously sampled.

11.3 Density Determinations

Procedure for measuring SG of core at Greens Creek relies on the weight in water versus weight in air method. The weighing takes place after the core has been logged, before the core is cut, and occurs in the underground core cutting facility.

At the start of a sample despatch, the tray being used is weighed in air, then again in water and both weights recorded on the paper SG sheet. Samples of whole core approximately 1 ft to 5 ft (0.3–1.5 m) in length are weighed in air and the weight is recorded on the paper SG sheet. The sample and tray are then placed in water until fully submerged and the weight recorded. Completed sheets are returned to the 860 Area for manual data entry. At the time of data entry the weight of the basket, wet and dry, is subtracted from the recorded weights accordingly and the final values are manually entered into the acQuire® database.

SG measurements are required of all exploration or definition core that is a mineralized or ore-type lithology as well as the associated buffer samples.

Highly fractured or faulted core is measured as best as possible. The holes in the tray used are only several millimeters in diameter. Material deemed at risk for falling or flowing through those holes is generally not weighed in water or in air. This type of material makes up a relatively small percentage of the total samples and is generally related to heavily-faulted intervals.

11.4 Analytical and Test Laboratories

Table 11-1 summarizes the laboratories utilized throughout the Project history and covers legacy and current operations. All laboratories are independent of Hecla and previous operators except for the site laboratory and Kennecott Utah Copper laboratory. Dates of legacy contracts are best estimates and noted as “unclear” where the information was not available.

Bondar Clegg Canada Ltd. (Bondar Clegg), now part of ALS Chemex Laboratories, obtained ISO 9001 certification in 1998; however its accreditation through the period of use at Greens Creek is not known.

Acme was ISO 9001 certified in 1997 and has successfully maintained that certification through the present.

SVL Laboratories accreditation through the period of use at Greens Creek is not known.

McClelland Laboratories is a metallurgical laboratory with extensive experience in precious metals metallurgy and process, and a good reputation with the mining industry; however, it is not a certified laboratory.

Table 11-1: Assay Laboratories used at Greens Creek

Laboratory Name	Location	Period of Use		Comments
Bondar Clegg Canada Ltd.	Vancouver, BC	1976	1982	Primary laboratory for early surface exploration and definition drill core
Acme Analytical Laboratories Ltd.	Vancouver, BC	1987	2012	Primary laboratory for all exploration and definition drill core
SVL Analytical	Kellogg, ID	1987	2002	Primary laboratory for all exploration and definition drill core until Acme, then secondary umpire lab until 2002
McClelland Laboratories, INC	Sparks, NV	1988	Unclear	Gravity concentrates
Site laboratory	Greens Creek Mine Site	1989	2012	Primary laboratory for some exploration and definition drill core in 1989-90 range. Primary laboratory for pre-production and stope drill core and grade control samples since 1994. Secondary laboratory for all exploration and definition drill core since 2002.
Lakefield Research		1992	1994	West Zone tests
Kennecott Utah Copper laboratory	Salt Lake City, UT	1996	2000	Acid rock drainage (ARD) samples 1996–2000
CESL	Vancouver, BC	1998	2008	ARD samples 1996–2000
SGS Canada Inc.	Toronto, On	2006	2010	Surface soil MMI analysis

The accreditation of other metallurgical laboratories, Lakefield Research, company laboratories, Kennecott Utah Copper Labs and CESL, are not known.

SGS is an ISO 9001 certified laboratory. The Greens Creek mine site laboratory has participated in round robin programs to compare its results to other laboratories intermittently throughout its history, but it is not a certified laboratory.

11.5 Sample Preparation and Analysis

11.5.1 Legacy

Sample preparation and analytical methods have been consistent with the current methods (MRDI, 1998). Methods prior to 1998 are not well documented and thus are not known in detail. Where the documentation of the legacy sample preparation and analytical methodology is not complete, the legacy quality assurance data are more complete and consistent for the life of the Project.

11.5.2 Hecla

From 2008 through late 2011 all drill core sample preparation was done at Acme locations in Whitehorse, Yukon or Vancouver, British Columbia. In late 2011 a sample preparation laboratory, purchased by Greens Creek but operated by Acme personnel, was established on the Greens Creek site. From late 2011 on, nearly all exploration and definition core samples were prepared for analysis at this facility onsite then shipped to the Acme facility in Vancouver for analysis. Preparation procedures were the same whether they occurred at the Whitehorse or Vancouver sites, or were prepared at the Greens Creek facility.

The preparation procedure consists of crushing to 80 % passing 10 mesh, riffle splitting approximately 250 g, then ring pulverizing to 85 % passing 200 mesh. Of the pulverized material 115 to 120 g were sent for analysis, and the remaining 115 to 120 g were stored as a master pulp.

Currently, all mineralized definition and exploration drill core is assayed at Acme for Au, Ag, Pb, Zn, Cu, Fe, and Ba. All mineralized samples are also assayed for a 32 element inductively coupled plasma emission spectroscopy (ICP-ES) assay suite.

The standard assay package employed consists of fire assay for Au and Ag on a 30 g sample. Au is finished by AA while Ag is finished by ICP-ES. Gold and Ag are re-assayed by gravimetric finish if the initial fire assay results return values above the upper detection limits. Silver and base metal assays for Pb, Zn, Cu, and Fe are performed using ICP-ES on 1.0 g samples digested in hot aqua regia. Automatic re-analysis is triggered on a smaller sample size if results return above detection limits. Preparation for the 32 element suite involves a 0.25 g sample split digested in an aqua regia solution containing equal parts HCl, HNO_3, and de-ionized H_2O before analysis by ICP-ES.

Analysis for Ba requires that a 0.2 g sample be dissolved in a lithium borate fusion and acid digestion before being analyzed by ICP-ES.

From 2008 onward the onsite laboratory was used as the primary laboratory for pre-production and in-stope drill core as well as the umpire laboratory for definition and exploration drill core. The standard assay package employed consists of fire assay for Au and Ag and ICP-ES for Pb, Zn, Cu, and Fe.

11.6 Quality Assurance and Quality Control

11.6.1 Legacy

Previous (pre-2008) operators have used a similar system to the current QA/QC methodology. Legacy assaying protocols are typical of those employed in the mining industry and have been described in previous AMEC reports (MRDI 1998 and 1999; AMEC, 2005 and 2008). The 1998 MRDI report is referenced as the source of pre-1998 legacy QA/QC procedures by all the subsequent audit reports, with QA/QC of drill holes added since 1998 covered by each subsequent report period (see Section 12).

Standards

Different SRMs were created by the GCJV to reflect the different ore types at Greens Creek, and successor SRMs were created as the stocks of the initial SRMs became exhausted. SRMs were prepared at Hazen Research by ball milling to exceed 95% passing a 150 mesh screen. Ten packets of each SRM were submitted to independent commercial laboratories to determine the recommended values for controlling quality.

Standards B, D, F and G were made from Southwest zone cores. Standards E and H were made from Northwest West and West zone cores. Standard I was made from muck from a stope in the 200S Zone. KGCMC submitted the material to six independent laboratories: Hazen Research, Denver; SVL, Acme, Cone Geochemical Laboratories, Lakefield, CO; Rocky Mountain Geochemical Laboratories (RMG), and Chemex, Mississauga, Ontario. The more recent Standard H was characterized by Acme, CAS, RMG and SVL. The most recent Standard I was submitted to Acme, Hazen, SVL, RMG, and two laboratories not previously used, Actlabs, Wheatridge, CO; and SGS.

Duplicates

Duplicate assays are performed at the same laboratory as the original assays, and are "not blind." Acme performs assay (same pulp) duplicates and coarse reject (second split, second pulp) duplicates on every 10th sample and reports the results on the same assay certificate. Duplicate assay (same pulp) and coarse reject duplicates (second split and second pulp) are performed for one in every 20 samples by the mine site laboratory.

Check Assays

Most of the Greens Creek drill holes have been included in a check assay program where SVL Analytical, formerly Silver Valley Laboratories, of Kellogg, Idaho is the umpire laboratory.

Approximately one in 15 samples were selected for a check assay on the pulp. The checks were selected from intervals logged as massive and white ore in approximately equal amounts. Any interval showing visible gold was also selected for check assay. Selected samples were recorded on the sample submission form, directing Acme to send a split of the pulp to SVL. After receiving Acme assay results, the Hecla geologist examined the results for a reasonable match to geologic observation, requesting additional check assays on samples that reported unreasonably high or low values.

SVL performed a fire assay for Au and Ag using a half-assay ton sample. SVL determined Pb, Zn, and Cu by AA on 1.0 g samples digested in aqua regia. SVL analyzed base metals by AA, except where samples reported above 15 percent Zn or above 20 percent Pb (as determined by AA) because these samples were re-assayed titrametrically.

Acme performed check assays on pulps selected from drill hole samples prepared and assayed by the mine site laboratory, using the protocols described above. The practice of submitting pulps for check assay was discontinued for pre-production drill holes on April 1, 1998.

11.6.2 Hecla

Since 2008, Hecla has used two laboratories for its assaying of drill core: the Hecla mine site laboratory and Acme in Vancouver, Canada. Batches are controlled by a consistently applied system of SRMs, pulp duplicate samples, coarse reject duplicate samples, and check assay submittals.

Standards

Standards used since 2008 have been sourced from underground bulk samples or drill core and prepared and certified by Hazen Research, Inc. of Golden, Colorado. Standards used since 2008 include Standard K, Standard L, Standard N, and Standard P. The years they were used and material from which they were sourced are summarized in Table 11-2.

One standard is submitted as the 10th sample of each drill hole; an additional standard is inserted for every subsequent 20 samples, and as the last sample for every drill hole. Results are reported by Acme along with the primary assay results and are captured by the acQuire® database during the normal importing routine. Upon receipt, the results for the standards are compared with certified values by the project geologist using graphical reports generated by the acQuire® database. Analyses for jobs are rejected if one standard per submittal is outside of three standard deviations from the certified value, or if two standards per submittal are outside of two standard deviations from the certified value. Rejected jobs are re-run for the element or elements that failed. Control charts are generated and reviewed by year, and all four standards have performed with acceptable accuracy and precision for Au, Ag, Pb, and Zn throughout their use.

Table 11-2: Standards used at Greens Creek

Year Source Zone Source Material	STD K 200 S Massive Ore Standard UG Bulk Sample	STD L 5250 Low Grade Ore Standard UG Bulk Sample	STD N Gallagher Low Grade Ore Standard UG Drill Core	STD P NWW Massive Ore Standard UG Bulk Sample
2008	X	X		
2009	X	X	X	
2010	X		X	X
2011	X	X	X	X
2012	X		X	X

Duplicates

Coarse reject duplicate samples are randomly assigned approximately one in every 36 samples by Acme during the preparation stage of the process. These samples are an extra split from the crushed sample that is then treated as a regular sample from that stage onward. Results for these samples are reported by Acme along with the primary assay results and are captured by the acQuire® database during the normal importing routine. AMEC has reviewed performance of these duplicates during various audits.

Pulp duplicate samples are randomly assigned approximately one in every 36 samples by Acme and represent the repeat of a specific analytical run. Results for these samples are reported by Acme on the assay sheets and are imported into the acQuire® database during the normal importing routine. AMEC has reviewed performance of these duplicates during various audits.

Check Assays

Check assays (the Hecla mine site laboratory checks on Acme assays and vice versa) are selected by the project geologist at a rate of approximately one in every ten to fifteen project samples. The project geologist assigns this designation based on lithology, with preference given to ore type lithologies. An extra split is taken after crushing of the sample, and the split is pulverized and returned to the project geologist as a pulp. The project geologist dispatches a group of check samples to the appropriate check laboratory. Results are imported into the acQuire® database. AMEC has reviewed performance of these duplicates during various audits.

11.7 Databases

Drill hole and production face-sampling data are captured in a SQL database at Greens Creek that utilizes acQuire® software. These data include drill hole collars, down hole surveys, assays and geological descriptions. Standard database management techniques are utilized that limit access and user rights to ensure data integrity.

A drill hole data set is created for each zone based on geographic limits. Where drilling pierces multiple zones, caution is exercised to be certain that mineralization in a drill hole is properly assigned to its appropriate zone.

Primary original documents, logs, down-hole surveys, core photographs, and assay certificates are cataloged and stored onsite. Digital copies are stored on networks drives that are routinely backed-up.

11.8 Sample Security

The SRM inventory, coarse rejects, and returned pulps are secured and kept in locations with restricted access. The core is stored within the original boxes in a remote underground drift designated as a core archive. Sampled core is released to the core technicians from the surface core shed for cutting at the underground cutting station and standards are only issued after the dispatch is ready to be processed by the Acme prep facility. Authorized Hecla personnel receive electronic receipts of delivery for each dispatch the prep facility receives and shipment notifications for pulps leaving the mine site for analysis. Acme's chain of custody is initiated once they receive the sample dispatches.

11.9 Comments on Sample Preparation, Analyses, and Security

In the opinion of the QPs, the sample preparation, analyses, and security are acceptable, meet industry-standard practice, and are adequate for Mineral Resource and Mineral Reserve estimation and mine planning purposes, based on the following:

- Face sampling covered sufficient area and was adequately spaced to support mine planning;
- Drill sampling has been adequately spaced to first define, then infill, base metal anomalies to produce prospect-scale and deposit-scale drill data;
- Since 2008, data have been collected following industry-standard sampling protocols (see Section 12 for discussion of third-party reviews);
- Sample collection and handling of core was undertaken in accordance with industry standard practices, with procedures to limit potential sample losses and sampling biases;

- Sample intervals in core, comprising 1 to 5 ft (0.3–1.5 m) intervals, are considered to be adequately representative of the true thicknesses of mineralization. Not all drill material may be sampled depending on location and alteration;
- Sample preparation for samples that support Mineral Resource estimation has followed a similar procedure since 2005. The preparation procedure is in line with industry-standard methods for polymetallic deposits;
- Exploration and infill core programs were analysed by independent laboratories using industry-standard methods for gold, silver, lead, zinc and copper analysis. Current run-of-mine sampling is performed by the mine laboratory, which is staffed by Acme personnel;
- Specific gravity determination procedures are consistent with industry-standard procedures. There are sufficient acceptable specific gravity determinations to support the specific gravity values utilized in tonnage interpolations;
- There is limited information available on the QA/QC employed for the earlier drill programs; however, sufficient programs of reanalysis have been performed that the data can be accepted for use in estimation (refer to Section 12);
- Typically, drill programs included insertion of blank, duplicate and standard samples. The QA/QC program results (see Section 12) do not indicate any problems with the analytical programs, therefore the analyses from the core drilling are suitable for inclusion in Mineral Resource and Mineral Reserve estimation;
- Data that were collected were subject to validation, using in-built program triggers that automatically checked data on upload to the database;
- Verification is performed on all digitally-collected data on upload to the main database, and includes checks on surveys, collar co-ordinates, lithology data, and assay data. The checks are appropriate, and consistent with industry standards;
- Sample security has relied upon the fact that the samples were always attended or locked in the on-site sample preparation facility. Chain-of-custody procedures consist of filling out sample submittal forms that are sent to the laboratory with sample shipments to make certain that all samples are received by the laboratory;
- Current sample storage procedures and storage areas are consistent with industry standards.

12.0 DATA VERIFICATION

12.1 External Reviews

Hecla and the Greens Creek Joint Venture operators have consistently involved third-party consultants in database reviews, Mineral Resource and Mineral Reserve estimates, and mine audits. This work is summarized in the following subsections.

This work is summarized below as legacy (performed for the Greens Creek Joint Venture) and Hecla (performed for Hecla after the company became 100% owner/operator of the Greens Creek mine).

12.1.1 Legacy

Mineral Resource Development Inc., 1997

A face-sampling study was conducted to check for sampling bias, and to determine the level of reproducibility obtainable from face sampling, using a modified sample preparation protocol. Sample preparation and assay protocols were formulated to provide the analytical precision required.

Mineral Resource Development Inc., 1998

A review of the 1994 Southwest Feasibility Study (1994 FS) block models and their reconciliation to production for the Southwest Zone was undertaken.

Principal conclusions were as follows:

- The ores in the Southwest Zone have been deformed by multiple events, to the extent that they can no longer be considered stratiform.
- Overall, the 1994 FS model grade and tonnage have been confirmed by production (1997), with the exception of silver, which has been of lower grade than predicted.
- The 1994 FS model is very inaccurate in terms of predicting the locations and grades of ore types.
- There is a significant amount of over-break and ore loss (particularly high silver zones) occurring which results in a higher tonnage at a lower grade reaching the mill than is predicted by grade-control data. To some extent this over-break is desirable as the value of high-grade ore in the structurally complicated Southwest Zone exceeds the cost of dilution, i.e., it is important to take some dilution to ensure as much as possible of the ore is recovered.

In June 1998, KGCMC contracted MRDI to assist in the preparation of resource models for three zones considered to be major contributors to the five-year production schedule. These zones were the Southwest, Northwest West and 200 South zones. KGCMC prepared all the geologic interpretations and worked under the direction of Dr. Harry Parker to develop appropriate modeling techniques including capping for gold and silver grades, composite length studies, and appropriate model estimation parameters model.

Review of KGCMC's data collection and acquisition procedures showed that it followed industry-standard practices for sampling, assaying, quality-control, and data entry and management. The interpreted mineralization envelopes were reasonable for the Southwest and 200 South. Concerns were expressed with the Northwest West model because the mixture of large, base metal, low-grade areas of white carbonate ore with more massive, base metal-rich ores could result in the over-projection of gold, lead and zinc grades from composites of base metal-rich massive mineralization, and of silver grades from white carbonate ores.

This work has formed the basis for all subsequent modeling techniques.

Mineral Resource Development Inc., 1999

A review was also undertaken on the 5250 model and resource estimate and reported in February 1999. The model was found to acceptable for the purposes of reporting Mineral Resource estimates for the zone. Similar reviews were performed on the Southwest, Northwest West and 200S zone models and estimates. The database was found to be acceptable for use in Mineral Resource estimation, and the resulting estimates were considered adequate for all three zones.

Recommendations relating to modeling and estimation focused on timely QA/QC reviews, data entry and data validation, and appropriate data archiving.

A review of the 1999 operating plan was performed in December 1999 on behalf of the Standard Bank London Limited in support of the Project acquisition by Hecla and Pan American Silver Corporation. The operating plan was found to represent an appropriate response to the ongoing development of the Greens Creek operation, and the assumptions in the proposed operating and development plan were considered to be reasonable. A recommendation was made that documentation supporting mine plans should be collated.

AMEC, 2002

In October 2002, AMEC, the successor company to MRDI, audited the model for the Central Zone. The evaluation compared the updated 2001 block model with that of the 2000, and determined that a new model would be required. Recommendations were proffered in relation to modeling methods and reconciliation evaluations.

A Mineral Resource/Mineral Reserve audit was performed in December 2002 on the 2002 estimates to review supporting data, resource estimates, mine designs and reserve estimates to give an assessment of the reasonableness of the mine reserve statement. Emphasis was given to the 9A, Central West, 5250, Southwest Bench and Deep Southwest deposits. Additionally, reviews of mine designs were conducted for the East, 200 South, Southwest and Northwest West deposits.

The independent review confirmed the 2002 Mineral Resource/Reserve statement.

A number of recommendations were made to address the areas of QA/QC management, consistent reproducibility of Au values at Acme, provision of documentation in relation to Mineral Resource/Mineral Reserve conversion procedures and supporting information, and establishment of grade control procedures in areas mined by long-hole methods.

AMEC, 2003

The Greens Creek Joint Venture produced new resource models in 2003. AMEC reviewed changes and assisted in the completion of new models or model updates for two ore zones, the 9A and Northwest West deposits. In addition, AMEC reviewed the conversion of Mineral Resources to Mineral Reserves for the Northwest West zone.

Drilling, sampling, sample preparation and assaying methods were considered to meet or exceed industry standard practice and results were considered adequate to support Mineral Resource estimates. Density measurements were adequate to support tonnage estimates. Minor errors with the down-hole survey data were not considered to affect estimates and could be remediated. The assay database showed an acceptable low error rate. Mineral Resource estimates for the 9A and Northwest West zones were accepted as reasonable. Conversion of the Mineral Resources at the Northwest West zone to Mineral Reserves was considered to use appropriate modifying factors and the mine plan was achievable in the time-frame contemplated.

Recommendations included change of support analysis for Measured and Indicated Mineral Resources, and evaluation and quantification of dilution percentages to be expected by stope during mining activities.

AMEC, 2005

AMEC reviewed supporting data, resource estimates, mine designs and Mineral Reserve estimates to give an assessment of the reasonableness of the mine Mineral Reserve statement for 2005. The deposits reviewed were Northwest West, 5250, Southwest Bench and 200S.

AMEC found the error rate for the lithology, sampled intervals, assays and down-hole surveys to be acceptable, and considered the database acceptable for use in Mineral

Resource estimation. Assay quality was controlled by a consistently applied system of standard reference materials (SRMs), pulp duplicate samples, coarse reject duplicate samples and check assays. Mineral Resource and Mineral Reserve estimates were considered to be appropriately estimated.

Recommendations included updating the database with missing Ba and ICP assays; checks of the methods whereby down-hole survey data are uploaded; review of potential assay bias at Acme for Ag and Pb; review of density values assigned to high-Ba ores; and quantification of dilution percentages to be expected by stope during drift and fill, primary long-hole, and secondary long-hole mining activities.

12.1.2 Hecla

AMEC, 2008

AMEC audited the databases, data transfer and data storage procedures for 5250N, Northwest West and Gallagher Zones.

AMEC found the error rate for lithology codes within the ore zones, sampled intervals and assays in the Greens Creek databases to be acceptable to support Mineral Resource estimation for the Gallagher and 5250N zones, but found the error rate close to 1% for lithology and greater than 1% for assays in the Northwest West zone. AMEC was unable to make a determination of the precision of Au, Ag, Pb and Zn assays.

Key recommendations included integration of the QA/QC data into the site acQuire database; reviewing of inconsistencies in Ba and ICP data; update procedures should be implemented so that errors identified with the database during the Datamine® modeling can be updated in acQuire®; review of potential high biases in Pb and Ag results at Acme; implementation of incremental checks and additional validation steps in the data collection and model completion process; and checks on the amount of contact dilution allowed for in models.

AMEC also audited the Mineral Reserve and Mineral Resource statement. Scope items included auditing the database, and review of supporting data, resource estimates, mine designs and reserve estimates to give an assessment of the reasonableness of the mine Mineral Reserve statement for 2007. Mineral Resource estimates for the 5250N and Gallagher Zones were reviewed, Mineral Reserve estimates were reviewed for Northwest West and 5250N, and the database was audited for all three zones.

No significant errors that would preclude Mineral Resource or Mineral Reserve estimates were noted.

However, a significant number of recommendations were made to address program improvements and to implement incremental checks and additional validation steps in the data collection, QA/QC verification, modeling and estimation processes.

AMEC, 2009

AMEC was requested to provide technical assistance with auditing the Project database and building of wireframe models for five zones, (Northwest West Upper Plate, Northwest-West South, 200 South-Deep, Gallagher, and the old mining area of East Zone). The database audit was only partially completed, as only a portion of the QA/QC files were available at the time of the audit. Wire-frame modeling of the East Zone was also only partially completed due to time constraints.

Recommendations arising from the work related to identifying and filing documentation of historic drill logs and collar details; maintenance of QA/QC data such that data can be readily verified; reviewing collar location positions to ensure that the correct locations are assigned collars; review of East Zone drilling azimuths after magnetic declination is applied; consideration of modification of assay protocols such that mineralization in non-traditional ore lithologies is assayed; and database storage and review procedures between the acQuire® database package and the Datamine® modeling and estimation software.

AMEC performed a review of the 2009 Mineral Resources and Mineral Reserves for 5250 and 9A Zones, including reviews of supporting data, Mineral Resource estimates, mine designs and Mineral Reserve estimates.

AMEC found the error rate for the lithology, sampled intervals, assays and down-hole surveys to be acceptable and considers the database acceptable for use in resource estimation. Assay quality was controlled by a consistently-applied system of SRMs, pulp duplicate samples, coarse reject duplicate samples and check assays. AMEC did not find a fatal flaw in mine operations, planning scheduling and budgeting that would prevent Hecla from executing their plans to mine the 5250 and 9A Mineral Reserves.

Recommendations arising from the audit included notations relating to inclusion of Ba and “over-limit” samples for Zn in the database; investigation of potential assay biases at Acme and the mine laboratory; continued recommendations for real-time QA/QC monitoring; density assignments for white barite ore; and reconciliation.

AMEC, 2012

AMEC was requested to conduct a review of Hecla’s 2011 Mineral Resources and Mineral Reserves for the Deep 200 South, Southwest Bench, East Zone, and Gallagher Zones. As of the effective date of this Report, this audit is ongoing, but some of the significant conclusions and recommendations are included in this Report.

The definition of the domains appears to be done using applicable and reasonable parameters, care and execution. Grade capping and compositing was found to be reasonable, and variography is adequately executed. Estimation plans were found to be adequate, and AMEC agreed with the resource classification methods applied.

The mining review focused on the Southwest Bench area as mining is active in this zone. AMEC did not find any fatal flaws in mine operations, planning, scheduling, or budgeting that would prevent Hecla from executing its plans to mine the Southwest Bench Mineral Reserve. Reconciliation between actual mined and model depletion shows significant variation and requires addressing. Geotechnical reviews will be necessary as mining advances. The development plan and equipment are appropriate for the Southwest Bench zone.

Recommendations arising from the audit included compiling more formal documentation for mineral resource model reports for each mineralized zone; improving mineral resource model archiving procedures; investigating more comprehensive variography procedures including locally varying anisotropy; tracking each mining area by tons produced by mining method and capturing those volumes mined for the depletion model; generating a detailed ventilation model that shows areas by equipment used to improve the effectiveness of the total allotted airflows; create an equipment maintenance schedule that shows the equipment purchase, rebuild, breakdowns, and planned maintenance schedule by maintenance bay and the personnel allotted to each to enable a more proactive approach to maintenance; production histories should be kept for each mining block; and production forecasts should include appropriate dilution and recovery.

12.2 Internal Reviews

Until 2006, all geological data were stored in an Ingres database. This became corrupted, but extraction of most files was possible. A period of about two years followed where the database consisted of a number of Microsoft Access® databases. In 2007, acQuire® software was purchased, and over the following three years, all data were transferred to the database. All drill hole assay data was reloaded from the original electronic assay files. All data were checked during the transfer process.

A standard set of referential integrity checks are applied to the data as they are entered into the acQuire® database. These checks include checking for overlapping intervals or gaps, validation of lithologic codes against lookup tables, and enforcement of unique records for sample numbers and drill hole names.

As data are extracted from the acQuire® database and brought into Datamine® for modeling a second set of validation checks are performed. These checks include: flagging drill holes with missing survey data, checking for overlapping intervals or gaps, lithologic code validation, flagging drill holes with calculated angular deviation greater than 10° per 100 ft (30 m), flagging sampled intervals that are missing the assays required or have returned values greater than the detection limit.

Where errors are noted, the geologists fix the problem, prior to the database being used for resource estimation purposes.

12.3 Comments on Data Verification

The process of data verification for the Project has been performed by external consultant firms from 1997 to date, and by Hecla personnel. Hecla considers that a reasonable level of verification has been completed, and that no material issues would have been left unidentified from the programs undertaken.

The QPs, who rely upon this work, have reviewed the appropriate reports, and are of the opinion that the data verification programs undertaken on the data collected from the Project adequately support the geological interpretations, the analytical and database quality, and therefore support the use of the data in Mineral Resource and Mineral Reserve estimation, and in mine planning:

- No significant sample biases were identified from the QA/QC programs undertaken;
- Sample data collected adequately reflect deposit dimensions, true widths of mineralization, and the style of the deposit;
- External reviews of the database have been undertaken in support of acquisitions, support of feasibility-level studies, and in support of Mineral Resource and Mineral Reserve estimates, producing independent assessments of the database quality. No significant problems with the database, sampling protocols, flow sheets, check analysis program, or data storage were noted.Drill data are verified prior to Mineral Resource and Mineral Reserve estimation by running a software program check.

13.0 MINERAL PROCESSING AND METALLURGICAL TESTING

13.1 Metallurgical Testwork

Since mill construction and startup, numerous internal and external studies have been performed to investigate metallurgical issues and support mill modifications. Many of these are listed in Table 13-1.

Extensive initial testwork programs were conducted at Noranda's Matagami Lake and Mattabi laboratories in Ontario, Canada, and at Dawson Metallurgical Laboratory in Salt Lake City, Utah, as compiled and summarized by Banning (1983). Composites of various ore types were developed using drill core samples. Results of these programs allowed the development of the basic Greens Creek lead-zinc flotation flowsheet, with inclusion of a gravity gold circuit. Primary grinding requirements for the white ore types and massive sulfide types were developed and use of stage addition for flotation reagents was established, along with collector and modifier recommendations. These programs demonstrated the desirability of a preliminary carbon removal pre-flotation step and re-grinding of rougher concentrates prior to cleaner flotation.

Following mill start-up, investigations were pursued regarding alternatives to the originally installed plane table used for gravity recovery of relatively coarse free gold. The plane tables had proved to be labor intensive and did not perform up to expectations. Screening trials indicated that available centrifugal gravity concentrators would create water balance issues and that gravity spiral concentrators had better performance. They also indicated that re-grinding of spirals concentrate prior to final cleaning with a shaking table improved product grades significantly. Plant trials with spirals confirmed the screening results and a revised gravity circuit utilizing concentrating spirals, concentrate re-grinding and final tabling was implemented (Sawyer, 1997).

Mill expansion by way of construction of a new building primarily devoted to cleaner flotation circuits also allowed reallocation of existing equipment and floor space in the original mill building. Bench scale testwork followed by plant trials in 1999–2000 produced results used to develop modifications to the mill flowsheet, size and specify required equipment and analyze economic consequences of the expansion. Resulting concentrate assay improvements, improved recoveries and economically favorable redistribution of payable metals among the various concentrates indicated overall recovery improvements of 2% for lead, 8% for zinc, 1.5% for silver and 2% for gold.

Table 13-1: Greens Creek Metallurgical Studies

Title, year	Facility	Description
Metallurgical Evaluation of the Greens Creek Orebody. Approx. 1983 (Banning, 1983)	Matagami, Mattabi, Dawson Metallurgical	Mineralogical, physical evaluations. Grinding studies. Flotation studies, including flowsheet development and reagent requirements. Gravity processing studies. Product evaluations.
Recovery of Gold by Gravity Separation at the Greens Creek Mine Alaska. 1997. (Sawyer, 1997)	Greens Creek	Describes testwork, plant trials, evaluation and design of spirals gravity concentration circuit replacing original plane tables.
Three-Stage Lead and Zinc Cleaning for the Greens Creek Concentrator (Scheding, 2000)	Greens Creek	Summarizes bench scale and plant trial testwork used for design and economic analysis of mill expansion via new cleaner building.
Performance Assessment and Optimization of the Greens Creek Grinding Circuit. (Jankovic, 2003)	Greens Creek	Review of Greens Creek grinding circuit performance.
Green's Creek Mine: A Mineralogical Characterization of Selected Ores and Plant Products (Reynolds, 2007)	Rio Tinto Research, Bundoora, Australias	Extensive mineralogic investigation of ores and mill products.
Greens Creek Mine: Silver and Base Metal Mineralogy of a Suite of Products from the Lead Circuit (Blake, 2009)	Mineralogy Consultant, Clevedon, United Kingdom	Mineralogic investigation of selected ore feeds and mill products.
Cleaner Flotation on a New Sample of Baritic Ore: Our Project P-4167(Armstrong, 2011)	Dawson Metallurgical	Evaluation of metallurgical response of ore from new 5250 mining area.
Backfill Acid Consumption (Asarte, 2011)	Greens Creek	Investigation on effect of mine backfill on mill process pH and of effect of sulfuric acid on performance.
Report of Effects of Carbon Dioxide and Sulfuric Acid to Modify pH for Flotation of 90% Ore/10% Backfill Composite Feed (Peterson, 2012)	Dawson Metallurgical	Investigation of carbon dioxide use as process pH control reagent.
Initial Evaluation of Carbon Dioxide for pH Control at Greens Creek(Tahija, Initial Evaluation of Carbon Dioxide Use for pH Control at Greens Creek, 2012)	Greens Creek, Dawson Metallurgical	Discussion of testwork results and preliminary economic evaluation of carbon dioxide use.
Ruby silver testwork in progress.	Dawson Metallurgical	Investigation of ruby silver minerals recovery in current flotation circuit
Gravity gold investigation in progress.	Greens Creek	Statistical studies of correlations between gravity gold recovery and mill and feed parameters.

The performance of the grinding circuit was reviewed in 2003 as part of planning for a contemplated increase in throughput. Findings included Bond Work Index values ranging from 11.9 to 12.8 kWh/st, feed specific gravities ranging from 3.5 to 4.0 and Julius Kruttschnitt Mineral Research Centre (JKMRC) abrasion parameter (ta) values ranging from 0.51 to 0.88. Bond Index values referenced from a 1993 pilot plant ranged from 10.5 to 10.7 (Jankovic, 2003).

A number of formal and informal studies have been performed during the life of Greens Creek which investigated causes of poor mill recoveries. Two examples are an exhaustive 2007 study (Reynolds, 2007), which examined a variety of ore types and mill products, and a more focused 2009 study, which examined mill feeds producing particularly low recoveries, as well as examining more typical feeds for comparison (Blake, 2009). Both of these studies considered analytical and classic mineralogical results as well as SEM and other instrumental approaches. Both studies concluded that the principal cause of poor flotation recoveries was the presence of extremely fine-grained ore minerals and intergrowths that cannot be economically liberated by grinding.

The metallurgical response of mill feed to be produced from a new area of the mine, the 5250 Zone, was evaluated in a test program begun in 2010 (Armstrong, 2011). Results indicated that good recoveries of lead, zinc and silver could be expected using the standard Greens Creek flotation procedure, although final lead concentrate grades might be somewhat lower than for other ore types.

Metallurgical testing programs are conducted as indicated to evaluate possible changes in feed types from new mining areas, proposed changes in processing to improve recoveries and/or concentrate grades and to investigate factors causing lower than desired recoveries and concentrate grades. Some examples of such recent and current work include:

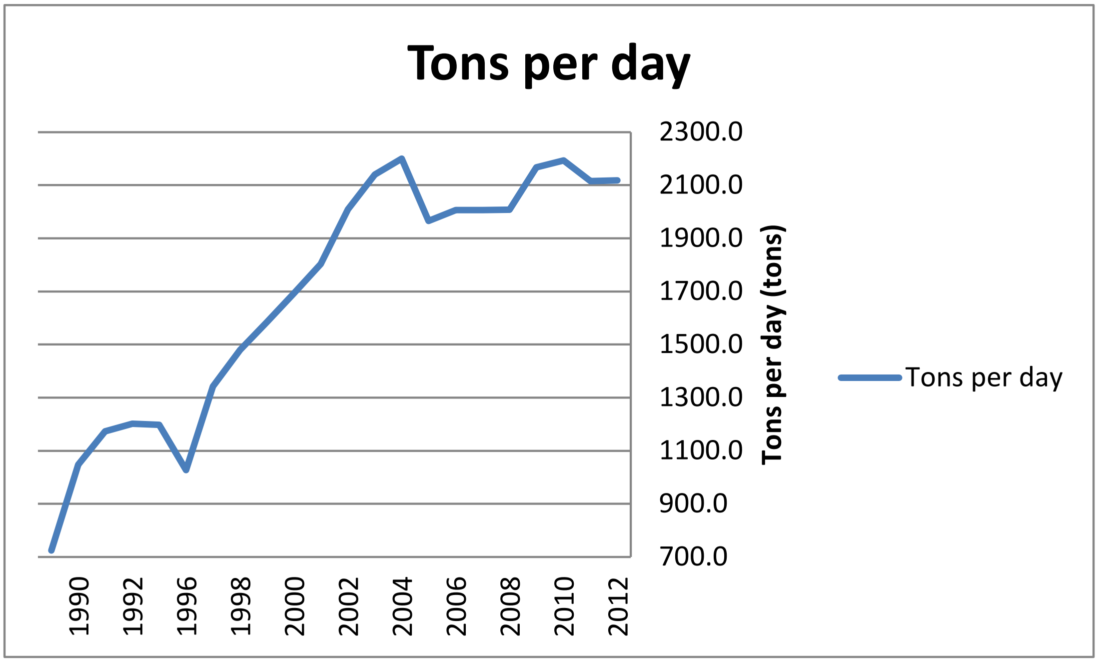
- Investigation of the effects of backfill reporting as dilution material in mined ore (Asarte, 2011);
- Evaluation of carbon dioxide for pH control in place of sulfuric acid (Tahija, 2012);
- Investigation of flotation recovery of ruby silver minerals;
- Statistical analysis of factors influencing mill recoveries into various mill products.

13.2 Recovery Estimates

13.2.1 History

Figure 13-1 shows the change in throughput rate from 1990 to 2012.

Figure 13-1: Incremental Throughput Improvements, 1990 to 2012



Production improvement efforts from commissioning through 2004 were centered mainly on increasing tonnage capabilities through the mill. This was a successful effort focused mainly in the grinding circuit and requiring minimal capital expenditures.

The cleaner expansion in 2000 was the first major capital project and was required to maintain the metallurgical performance at the increased throughput. Flotation capacity remained a significant issue and the cleaner circuits were again expanded in 2001 to help maintain metallurgical performance. In 2007, the lead rougher circuit capacity was expanded by 17% by adding two tank cells to the circuit to arrive at the current mill configuration.

13.2.2 Flotation Strategy Advancement

The mill was originally designed to skim off a small amount of high grade lead concentrate and then make a small amount of high-grade zinc concentrate. The remaining flotation concentrates were directed to a bulk sulfide concentrate. This strategy was effective because of the payment terms of the smelter contracts at that time.

Efforts were made to maximize NSR by adjusting distributions and recoveries of the payable metals. Increasing lead concentrate production was the major goal in these efforts due to the more favorable payment terms for metals in this concentrate. The grade of the lead concentrate was allowed to drop in conjunction with increased lead and silver recovery to this concentrate.

In 2004, the market for bulk concentrate was very tight due to the closure of several ISF plants. This forced a change in flotation strategy to prevent making large quantities of bulk concentrate with limited marketability. Several flow changes in the mill enabled these changes to be effective. The lead concentrate grade targets were considerably reduced which increased lead concentrate quantities. The zinc targets remained constant and the additional throughput resulted in more zinc concentrate production. The bulk production was significantly reduced to match market conditions. The change in strategy was necessary and recovery losses were minimized but evident.

Figure 13-2 to Figure 13-5 show the changes in concentrate production and throughput over time. The distributions of recovered silver and gold into the gravity products and concentrates are shown in Figures 13-6 and 13-7. Figure 13-8 shows the distribution of recovered zinc and lead into the respective lead, zinc and bulk concentrates.

13.2.3 Optimization and NSR Estimation

The initial flotation model was developed using detailed plant surveys and laboratory flotation testing with the help of JKTech. Model development also required measuring various flotation cell parameters throughout the mill and incorporating the data into the model. A base case model was developed from this survey and research data using JKSimFloat. The base model was adjusted to match the actual plant distributions and recoveries. This adjusted simulation became the primary flotation performance model used to predict the flotation response of any set of feed grade combinations.

Each set of flotation performance data produced by the primary flotation performance model must be entered into an optimization model. The optimization model is a custom metallurgical balance program developed at Greens Creek with the help of JKTech and now Mincom. This model allows constraints on concentrate specifications to be entered and adjusts distributions and recoveries to meet these constraints while using smelter contract data and metal prices to calculate the expected NSR from flotation concentrates.

Figure 13-2: Concentrate Production History, 1989 to 2011

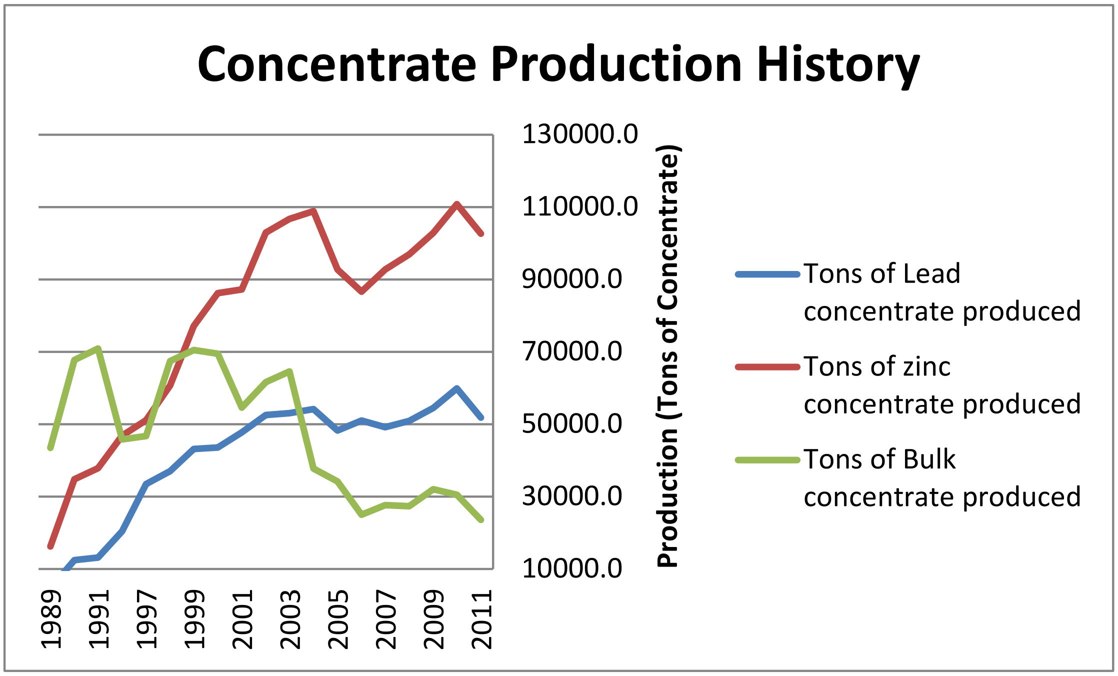


Figure 13-3: Changes in Metal Grades in Primary Concentrates, 1990 to 2012

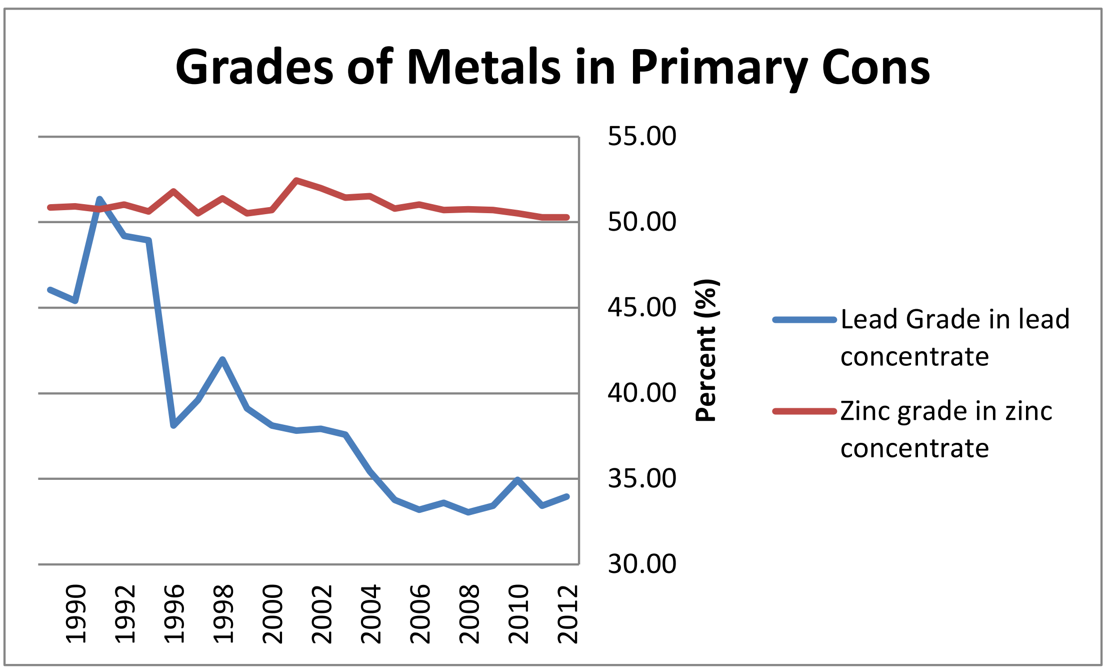


Figure 13-4: Changes in Lead Distribution in Primary Concentrates, 1990 to 2012

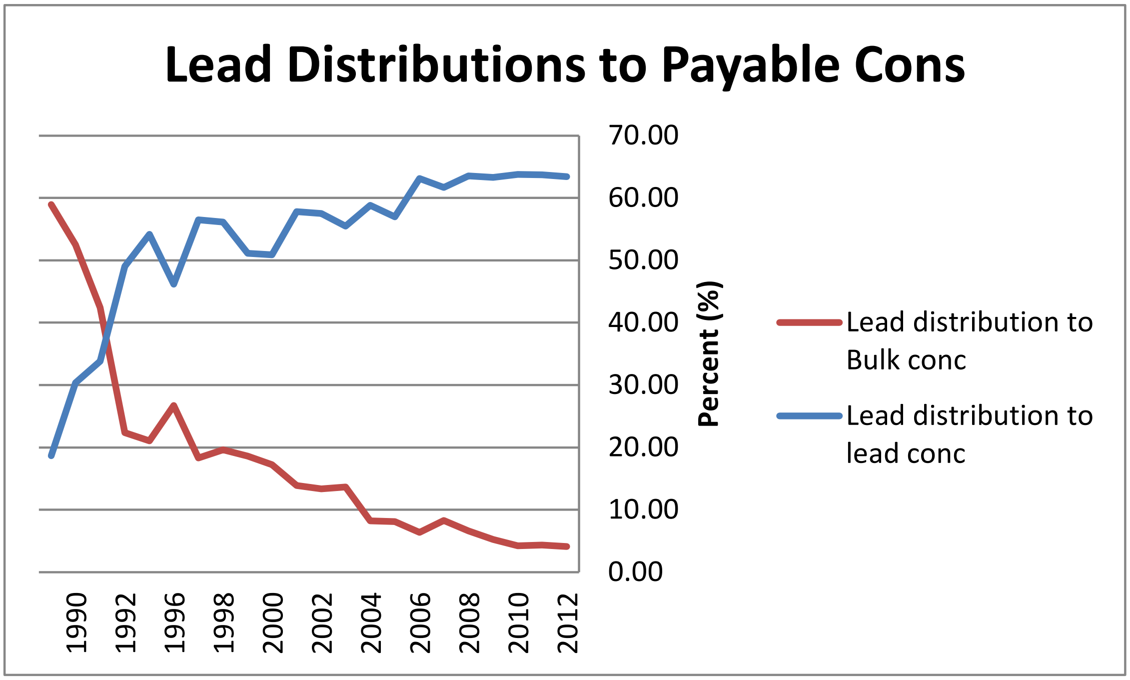


Figure 13-5: Changes in Lead Distribution in Primary Concentrates, 1990 to 2012

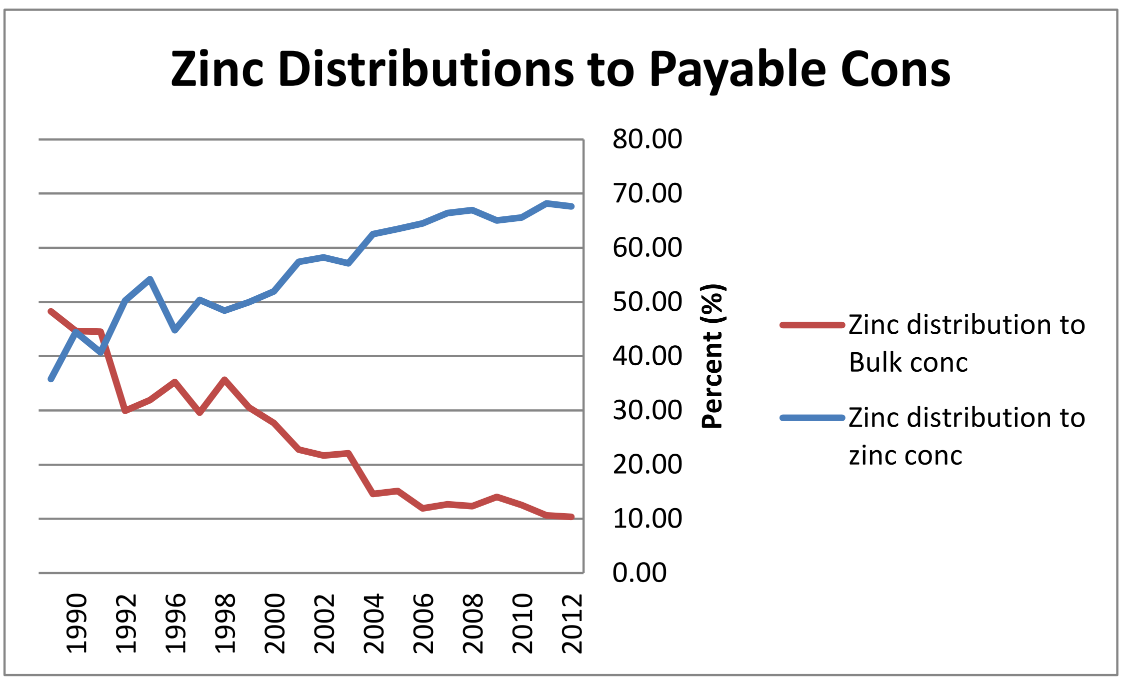


Figure 13-6: Distribution of Recovered Silver into Project Streams – 2012

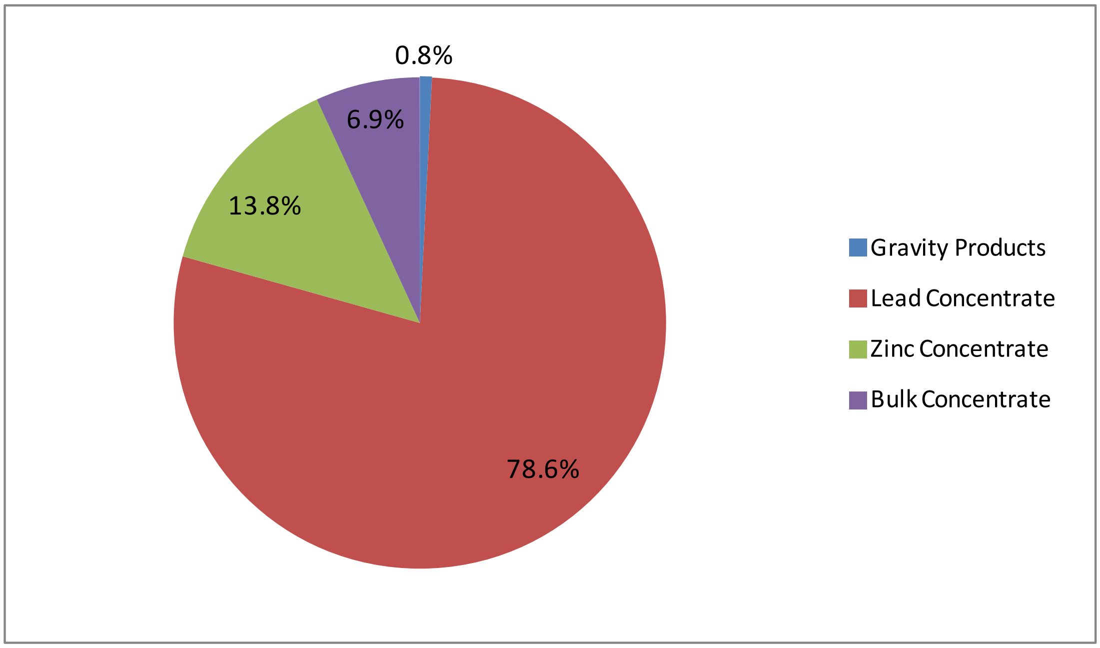


Figure 13-7: Distribution of Recovered Gold into Product Streams – 2012

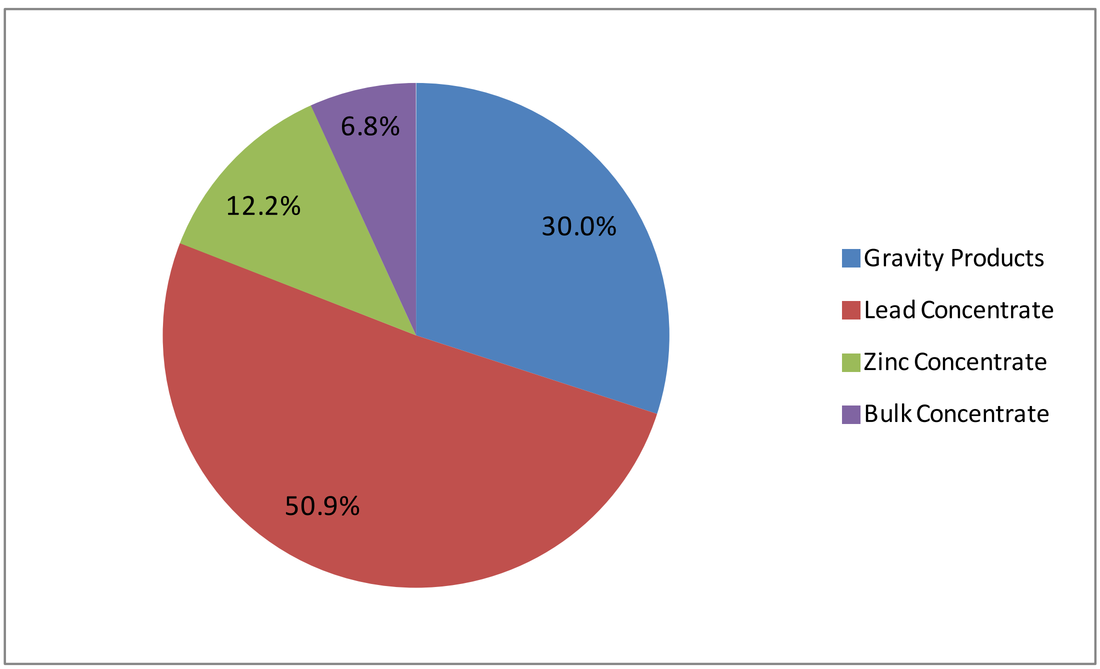
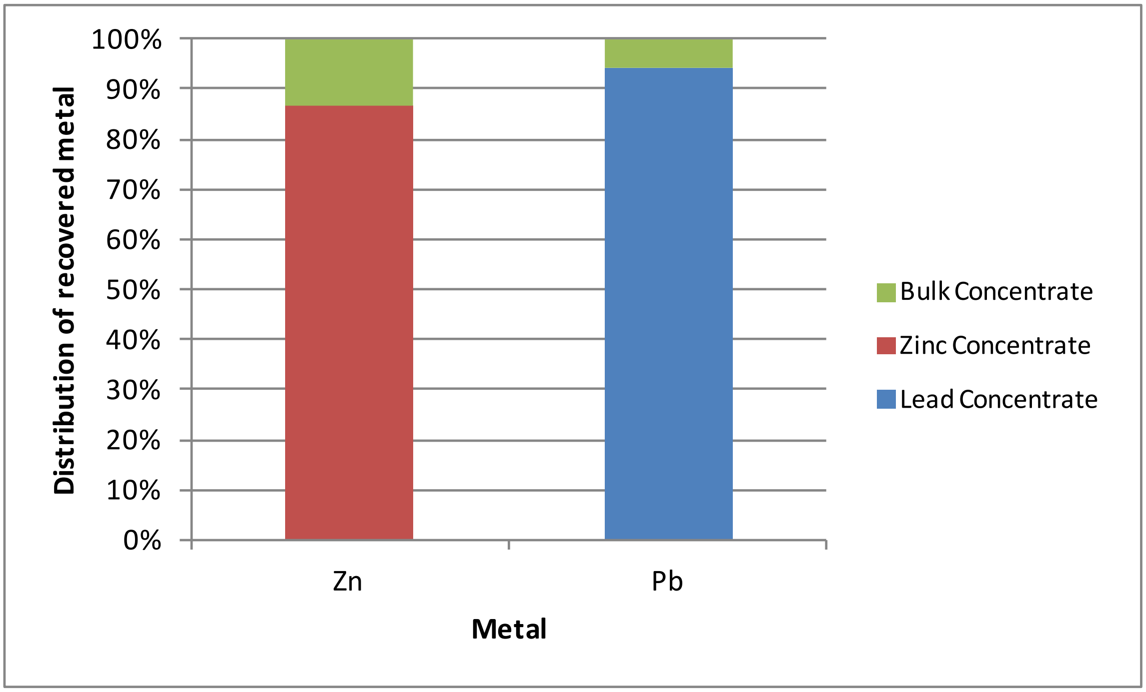


Figure 13-8: Distribution of Recovered Zinc and Lead into Product Streams – 2012



This process of modeling is too cumbersome to use directly in the Mineral Reserve estimation process due to the large number of ore blocks that require an NSR estimate, so a simplified equation was developed using multiple linear regression of data developed from the optimized NSR modeling as follows:

Flotation NSR = (0.385(Au oz/ton)*(Au $/oz))+(0.584*(Ag oz/ton)*(Ag $/oz))+(14.1*(%Pb)*(Pb $/lb))+(5.76*(%Zn)*(Zn $/lb))-(1.56*(%Fe))*

This equation only accounts for NSR from flotation. To get the NSR from gravity products, the amount of gold recovered in the gravity circuit was compared to the amount of gold in the feed over a 10-year period (January 2001 to December 2010) and a simple equation was built to calculate the amount of gold that will go to the gravity products from the grade of gold in the feed. The NSR for the gravity circuit is the product of the amount of gold in the gravity product, the price of gold, and the percentage of payout for gold in the gravity products as follows:

Gravity NSR = (0.2488(Au oz/ton)-0.0069)*(Au$/oz)*0.969;*

Total NSR = (Flotation NSR) + (Gravity NSR)

13.2.4 Projected Life-of-Mine Recoveries

Life-of-mine projected recovery figures are as summarized in Table 13-2.

Table 13-2: Projected Life-of-Mine Recovery Estimates

Product	Recovery (%)			
	Lead	Zinc	Silver	Gold
Lead Concentrate	61.20		55.14	29.35
Zinc Concentrate		67.60	10.65	8.35
Bulk Concentrate	4.08	10.72	5.85	4.15
Gravity Products			0.52	17.75

13.3 Metallurgical Variability

Samples selected for metallurgical testing during feasibility and development studies were representative of the various types and styles of mineralization within the different deposits. Samples were selected from a range of locations within the deposit zones. Sufficient samples were taken so that tests were performed on sufficient sample mass.

13.3.1 Mill Feed Variability

The Greens Creek mine produces several ore types differing in terms of mineralogy, mineral grain size and metals grades. Dilution rock types are also variable, with backfill from prior mining cycles typically being present in mill feed as well. No practical means of selective mining or ore stockpiling exists, as more than one mineralization type commonly is found even in a single working face and day-to-day production from multiple working places is necessary. Ore blending at the mill stockpile is utilized to maintain reasonably consistent mill feed over periods of a few days.

Mill control is largely on the basis of process stream assays, as determined by on-line analyzers of these streams. Mill metals feed grades have an influence on recoveries, while gold and silver feed grades influence the precious metals grades of concentrates. Recoveries in the future are expected to be similar to those observed currently and experienced in past years.

13.3.2 Backfill Materials in Mill Feed

Backfill materials can be incorporated in the mill feed as diluting material mined in those portions of active stopes that are in direct contact with previous mining areas. Once in the process plant, the backfill can raise flotation circuit pH levels, which can affect mill recoveries. Currently, Hecla manages fluctuating pH levels by sulfuric acid and flotation reagent adjustments. A number of studies have been completed (e.g. Asarte, 2011; Peterson, 2012; Tahija, 2012), and work remains ongoing to improve circuit performance on feed containing backfill.

13.3.3 Testwork Composite

Properties of average mill feed for 2012 to 2016 were estimated, in conjunction with geologic staff, on the basis of four major ore types and average grades for each ore type. During the summer and fall of 2011, mine geologists alerted the mill metallurgy staff when working faces with properties typical of one of the ore types were entering the mining cycle. Arrangements were made to collect large samples of actual blasted and loaded mine muck from rounds produced from these faces, thus insuring the sample would contain production-level amounts of dilution rock and backfill(Tahija, Large sample description, 2011).

Once adequate quantities of material representing each ore type were collected, the sample lots were shipped to a firm specializing in crushing, blending and splitting large mineral composites. A large composite weighing approximately 1,700 pounds was prepared using a blending recipe, as directed by Hecla metallurgical staff, and split into smaller lots for ease in use (Phillips, 2011). These small lots, as well as leftover lots of the individual ore types are held in refrigerated storage for use as needed in future metallurgical testing programs.

13.4 Deleterious Elements

The presence of the potentially deleterious elements arsenic, mercury and antimony was noted during initial testing (Banning, 1983).

Over the course of production and marketing since, deleterious element limits set by customers include:

- Arsenic, mercury and antimony in lead concentrates;
- Magnesium, arsenic and mercury in zinc concentrates;
- Magnesium, arsenic and mercury in bulk concentrates.

Penalties charges have been applied against some shipments from time to time, most commonly for arsenic and mercury content. Other potential deleterious elements have been identified in geological and concentrate analyses, including selenium, fluorine and thallium, but have not been present in high enough concentrations to cause marketing issues.

13.5 Comments on Mineral Processing and Metallurgical Testing

Industry-standard studies were performed as part of process development and initial Greens Creek mill design. Subsequent production experience and focused investigations, as well as marketing requirements, have guided mill expansions and process changes.

Testwork programs, both internal and external, continue to be performed to support current operations and potential improvements.

The QP reviewed the information compiled by Hecla as summarized in Section 13, and has performed a review of the reconciliation data available to verify the information used in the LOM plan.

Based on these checks, in the opinion of the QPs, the metallurgical test work and reconciliation and production data support the declaration of Mineral Resources and Mineral Reserves:

- The metallurgical test work completed on the Project has been appropriate for optimizing processing conditions and routes for proper process operation;
- Tests were performed on samples that are considered to be representative for the deposit and its mineralogies;
- Recovery factors estimated are based on appropriate metallurgical testwork and confirmed with production data;
- Recovery factors are appropriate to the mineralization types and the selected process route;
- The plant will produce variations in recovery due to the day-to-day changes in ore type or combinations of ore type being processed. These variations are expected to trend to the forecast recovery value for monthly or longer reporting periods.

14.0 MINERAL RESOURCE ESTIMATES

14.1 Key Assumptions/Basis of Estimate

Due to variations in mineralization, structural complexity, and spatial location, the Greens Creek ore bodies are segregated into ten unique model zones for both mineral resource modeling and mine planning purposes.

Table 14-1 provides an overview of the data base closeout date and other cut-off dates pertinent to model construction. Table 14-2 gives an overview of the modeling parameters, and interpolation methods for the separate zone models currently in use at Greens Creek.

Drill hole intercepts are uniquely coded to each zone; however, a single drill hole may pierce multiple zones. Block size is determined by selecting a block small enough to honor the geometry of the mineralized zone as well as being a multiple of the expected SMU which is 10 ft x 10 ft x 15 ft (3 m x 3 m x 4.6 m) in x, y and z axes respectively.

The coordinate system used for mineral resource modeling is the local geologic grid (geo-grid). The coordinate systems used at Greens Creek, and transform properties are discussed in Section 9.1.

Mineralized envelopes were constructed onscreen utilizing Datamine® Studio 3 commercial software. All drill hole processing, compositing, and modeling runs utilize Datamine® macros for control.

The 2012 Mineral Resource estimates were reviewed by Mr. Kerry Lear, who is employed as a contract resource geologist by Hecla. Estimates were prepared with reference to the Canadian Institute of Mining Metallurgy and Petroleum (CIM) Definition Standards (2005, 2010) and CIM Best Practice Guidelines (2003). The Qualified Person responsible for the estimates is Dr. Dean MacDonald, P.Geo, a Hecla employee.

14.2 Geological Models

Hecla Greens Creek geologists construct mineralized envelopes or "ore" perimeters which are critical in that they define the extents (and tons) of the zones. These perimeters are drawn on-screen in section (east–west geo-grid unless otherwise noted) and plan using a combination of ore lithologies, assay grades, and a review of structural continuity.

In all zones the phyllite/argillite contact (Mine Contact) forms the initial basis of the interpretation. Shapes are generally drawn around units that are logged as massive or white ore types and/or have significant base-metal mineralization (generally greater than 5% Zn).

Table 14-1: Model Construction Cut-off Dates

Zone	Drill Database Close-out Date	Mineral Resource Acceptance Date	Date of Supply of Metal Price/NSR Assumptions	Date of Final Review and Acceptance of Mineral Resource Statement	Modeler
East (Mineral Resource + Mineral Reserve)	2010	12/9/2010	12/15/2010	12/31/2010	Mr. Mike Satre
West	9/1/2010	12/15/2010	7/1/2012	12/31/2012	Mr. Lourens Smuts
9A Zone	3/1/2010	6/29/2011	7/1/2012	12/31/2012	Mr. Lourens Smuts
Northwest West -reserve	4/1/2012	7/30/2012	7/1/2012	12/31/2012	Mr. Kerry Lear
Northwest West resource	2008	12/29/2008	12/31/2008	12/31/2008	Mr. Lourens Smuts
Southwest Bench	2005	1/11/2006	7/1/2012	12/31/2012	Mr. Lourens Smuts
200S	3/30/2010	7/11/2012	7/1/2012	12/31/2012	Mr. Lourens Smuts
Deep 200S(resource)	11/30/2012	12/18/2012	7/1/2012	12/31/2012	Mr. Kerry Lear
5250	7/21/2011	7/26/2011	7/1/2012	12/31/2012	Mr. Lourens Smuts
Gallagher	10/31/2012	12/18/2012	7/1/2012	12/31/2012	Mr. Kerry Lear

Note: Messrs Satre, Smuts and Lear were either Hecla employees or full-time contractors with Hecla at the date of model completion.

Table 14-2: Summary of Zone Modeling Parameters

Parameter	East	West	9A	Northwest West	Northwest West-Upper	Southwest Bench	200 South	Deep 200 South	5250	Gallagher
Geological Interpretation	15 ft (3 m) vertical spaced plan perimeters	15 ft (3 m) vertical spaced plan perimeters	15 ft (3 m) vertical spaced plan perimeters	15 ft (3 m) vertical spaced plan perimeters	3D wireframe	15 ft (3 m) vertical spaced plan perimeters	15 ft (3 m) vertical spaced plan perimeters	3D wireframe	15 ft (3 m) vertical spaced plan perimeters	3D wireframe
Metal Zone Domains	No	Yes	No	Yes	No	No	No	No	No	No
Structural Zone Domains	No	Yes	Yes	Yes	No	Yes	No	Yes	Yes	Yes
Nominal Composite Length (ft)	12	12	12	12	5	5	12	5	12	5
Nominal Composite Length (m)	3.6	3.6	3.6	3.6	1.5	1.5	3.6	1.5	3.6	1.5
Avg. Composite Length (ft)	10.6	10.8	11.1	11.5	5.1	4.9	11.1	4.9	11.5	5.0
Avg. Composite Length (m)	3.2	3.3	3.4	3.5	1.5	1.5	3.4	1.5	3.5	1.5
n(count) composites	994	3516	2293	7194	258	1012	1202	681	1814	1211
Parent Block Size (x*y*z) (ft)	10 x 10 x 15	10 x 10 x 15	10 x10 x 15	10 x10 x15	5 x 5 x 5	10 x 10 x 15	10 x 10 x 15	5 x 5 x 15	10 x 10 x 15	5 x 5 x 15
Parent Block Size (x*y*z) (m))	3 x 3 x 4.6	3 x 3 x 4.6	3 x 3 x 4.6	3 x 3 x 4.6	1.5 x 1.5 x 1.5	3 x 3 x 4.6	3 x 3 x 4.6	1.5 x 1.5 x 4.6	3 x 3 x 4.6	1.5 x 1.5 x 4.6
Sub-blocking Allowed	Yes	Yes	Yes	Yes	No	No	Yes	No	Yes	No
Estimation Method	ID	OK	OK	OK	OK	ID	OK	OK/ID	OK	OK
Minimum Easting (ft)	5850	5100	5100	4350	3650	3500	3900	3300	4850	1900
Maximum Easting (ft)	7300	6200	6200	5250	5150	4500	4750	4300	5500	3000
Minimum Northing (ft)	1800	2670	2050	3950	4300	2350	650	-975	1250	-900
Maximum Northing (ft)	4650	4830	4200	5250	5550	3175	1800	1075	4550	400
Minimum Elevation (ft)	740	75	420	90	990	75	-610	-1500	400	-340
Maximum Elevation (ft)	1950	1065	1000	950	1330	495	-100	-400	1250	330
Last AMEC Review	2008	2002	2009	2008	2009	2005	2005	2012	2009	2012

Abbreviations: ID inverse distance, OK – ordinary kriging

Typically non-mineralized units such as phyllite and argillite were included if they were mineralized with visually recognizable sulfides and were near the contacts with the massive/white sulfide ore zones.

For models where structural sub-domains were used, individual perimeters were coded by domain. For models with metals zones, which are internal to the overall ore envelope, a series of coincident perimeters coded by metal zone were constructed. Except as noted below in the detailed zone descriptions, all boundaries between zones, structural domains, and metal zones were considered hard (samples are not shared between domains) with drill hole samples being uniquely coded.

Coding or "tagging" of drill hole samples with zone, structural domain, and or metal zone values was done in two steps. In the first step, drill holes were tagged using the plan perimeters projected ±7.5 ft (2.3 m) vertically, or, in the case of wireframes, if the mid-point of the sample intercepts lay inside the wireframe. In the second step, the dataset was printed out and reviewed manually by the resource geologist. Any mis-tags were corrected and a final reviewed tagging dataset was used to control composite generation. As a final check, the interpretation was reviewed against the final tagged drill hole dataset and any discrepancies in the interpretation were corrected.

To better model thinner zones that are smaller than the minimum stope design, the resource models are constructed using a two-pass estimation methodology. The first model estimates material inside the geologic perimeters or wireframe and the second or waste model is constructed around the ore model to estimate dilution that may be included during the stope designs. Perimeters for the waste model are created by expanding the standard plan perimeters 10 to 20 ft (3 to 6 m) in the horizontal plane. The expanded perimeters are checked for overlaps and edited as necessary. For zones modeled using wireframes a custom Datamine® macro is used to create a 20 ft (6 m) buffer model around the mineralized material. During the manual review of the drill hole dataset described above, 5 to 10 ft (1.5 to 3.0 m) of sampled drill core that is adjacent to "ore" tagged intervals is tagged for use in the waste model.

14.2.1 East Zone

The interpretation was done on 50 ft (15 m) spaced sections and then reconciled to 15 ft (4.6 m) spaced level plans which are the basis for the block model. The mined-out portion of the East zone below the 1,200 ft elevation is not included in the current block model.

14.2.2 West Zone

The interpretation was done on 50 ft (15 m) spaced, east–west sections and then reconciled to 15 ft (4.6 m) spaced level plans. A second pass of section to plan interpretations was done to code plan perimeters into the following domains based on overall ore geometry: Wall, Centroid, Z3 or lower limb, Z6A, and 700S. As of 2012, the Z6A and 700S zones are considered mined out and are not included in the current model.

For the Centroid zone, where primary sulfide zoning is well developed, a series of sections and plans have been created to define five metal zones: Cu–Fe, Zn, Pb–Zn, Ag–polymetallic, and Fe. The geologic and mineralogical basis for these zones is discussed in Section 7.5. A final set of 15 ft (4.6 m) spaced plans coded for domain and metal zone are the basis for the block model.

14.2.3 9A Zone

The 9A zone consists primarily of blocks and slices of mineralization that have been caught up within the Maki fault zone. These blocks are interpreted to be originally part of both the East and West zones. Geological interpretations of mineralization perimeters in the 9A zone are based on a geological model developed in 2002 by consulting geologist, Dr John Proffett. Dr Proffett developed his interpretation using cross sectional drill hole intercepts of massive sulfide units, augmented with geological mapping on the 600–650 ft elevation and 900 ft elevation mine levels.

There are four main subzones or areas of massive sulfide mineralization apparent within the 9A zone. These sub-zones are numbered 1–4, north to south, and represent spatially distinct sub-zones. In isolated areas, the sub-zones may lie adjacent to one another or may be adjacent to areas modeled in the Central West, 5250, or Northwest West zones. These contacts are delineated by individual faults with interpreted offsets of over 100 ft (30 m). The current model is based on 15 ft (4.6 m) spaced-plan perimeters that have been coded into the four distinct structural domains.

14.2.4 Northwest West Zone

The Northwest West zone is bounded to the east by the Maki fault system, and is considered to be an offset portion of the West Zone. Geologic interpretations of the ore perimeters in the Northwest West zone are based on a geological model developed in 1998 by consulting geologist, Dr John Proffett. Subsequent drill campaigns and mining experience have greatly expanded the understanding of the Northwest West zone.

The current model includes three structural domains: an upper limb, a centroid, and a lower limb. The centroid shows well developed metal zonation similar to the main portion of the Central West zone.

A slightly modified version of the Central West metal zonation system has been adopted for the Northwest West–Centroid. The three metal zones are: Cu–Fe, Zn–Pb, and Ag.

The current model is based on 15 ft (4.6 m) spaced level plans that with minor modification near current mining areas are reconciled back to vertical sections spaced on 25 ft (7.6 m) intervals that were interpreted in 2008.

14.2.5 Northwest West–Upper Plate Zone

The Northwest West–Upper Plate zone is a satellite zone that overlaps the northwest corner of the main Northwest West zone but lies above that model. The Northwest West–Upper zone is situated close to surface in a flat-lying isoclinal fold. This combination resulted in the zone being drill-pierced on a widely-spaced, regular grid. Mineralization is continuous with several faults displacing it. The displacement of which is not fully understood.

The Northwest West–Upper zone mineralization interpretation utilizes a 3D solid wireframe in place of plan perimeters. The wireframe was built using 50 ft (15 m) sections as well as a small number of 25 ft (7.6 m) sections. The ends of the zone were closed off by projecting the sectional interpretation 12.5 ft (3.8 m) beyond the interpreted section line. On sections where isolated mineralized lenses do not occur on surrounding sections, the zone was extruded 6.25 ft (1.9 m) in both directions giving the wireframe a width of 12.5 ft (3.8 m).

14.2.6 Southwest Bench Zone

The Southwest Bench zone is a sub-zone of the Southwest zone that includes the Lower, Upper, and Deep Southwest zones. The Southwest Bench zone is currently the only sub-zone in the Southwest zone with an active resource model; all of the other zones were mined out as of 2012.

Prior to 2005, drilling and geologic interpretation of the Southwest Bench zone was primarily conducted on north–south (geo-grid) -oriented ‘long-sections’, perpendicular to the ‘normal’ cross-section direction for most Greens Creek zones. In 2005, interpretation of additional drilling together with mining experience in the southeast part of the deposit led to the geologic interpretation being carried out on cross-sections that were oriented east–west in the geo-grid. The cross sections are spaced every 10 ft. (3 m) due to the complexity of the ore shapes. Sectional interpretations are rectified on 15 ft (4.6 m) level plans.

14.2.7 200 South Zone

The 200 South zone mineralization perimeters are interpreted on 50 ft (15 m) intervals in cross section and subsequently rectified to plan on 15 ft (4.6 m) intervals. Interpretation of the mineralization perimeters are based upon an iterative process of reviewing the down-hole lithology and major base metal grades and adjusting the boundaries to include mineralized lithologies as well as mineralized non-ore lithologies.

14.2.8 Deep 200 South Zone

The Deep 200 South zone is considered a sub-zone of the 200 South zone. There are two distinct trends in the Deep 200 South zone, an upper and a lower member. Both members were modeled utilizing a 3D solid wireframe in place of plan perimeters. The wireframe was built using 50 ft (15 m) sections and closed off at the ends on 25 ft (7.6 m) sections. The smaller pods of mineralization were closed off by extrusion, and in larger lenses, the closure surfaces were interpreted and modeled. The final surface was smoothed in the 3D environment by adjusting wireframe model triangle vertices.

14.2.9 5250 Zone

The interpretation was done on 50 ft (15 m) spaced sections and then reconciled to 15 ft (4.6 m) spaced level plans which are the basis for the block model. An additional set of waste plan-perimeters was created by expanding the ore envelopes by 20 ft (6.1 m) horizontally.

14.2.10 Gallagher Zone

Three-dimensional solid wireframe models were constructed from interpreted strings on 25 ft and 50 ft (7.5 and 15 m) sections (both east–west and north–-south); zone closures were interpreted rather than extruded. After the initial approximation solid model was created, a considerable, detailed effort to smooth and adjust the model triangles was undertaken to produce the final wireframe. This effort was required in order to accurately incorporate the large amount of off-section drilling that characterizes this zone.

14.3 Exploratory Data Analysis

Exploratory data analysis (EDA), in the form of summary statistics, correlation matrices, histograms, cumulative probability plots and XY plots are performed on both uncapped and capped sample and composites values for Au, Ag, Pb, Zn, Cu, Fe, As, Sb, Hg, Ba, measured SG, core recovery, and sample length to determine suitable geological constraints to mineralization.

14.4 Density Assignment

Greens Creek has developed a stoichiometric approach to calculating SG making use of chemical formulas for principal ore and gangue minerals. The coefficients have been adjusted using a least-squares polynomial fit to a dataset based on measured core specific gravity and corresponding assays where the number of values were 2,380. Subsequent to the original derivation of this formula in 1998, the coefficients have been regularly validated by increasing data numbers, such that the dataset is currently in excess of 9,000 measurements.

The resulting equation to determine the bulk density is:

Density (g/cm^3) *= 100/ (36.5 – 0.2695*Pb(%) – 0.1624*Zn(%) - 0.051*Cu(%) – 0.3319*Fe(%) – 0.2620*Ba(%))*

Depending upon the assay protocol in place at the time of sampling, not all core samples have the full suite of validated assays required by this formula. The following hierarchical approached is taken to assign a density to a sampled interval:

- Sample has a full suite of validated assays – use full regression;
- Sample has full suite except Ba; if logged as a non-baritic ore type (non-white baritic ore), assign a default value for Ba based on zone statistics for non-white baritic ore samples and apply the full regression. The default Ba value is only used for density assignment and not for interpolation;
- Sample does not meet the criteria for 1 or 2 above but has a measured SG; assign measured SG as final sample density;
- Sample does not meet criteria for 1–3 listed above; assign a default SG based on logged ore type. Default values are determined by zone/lithological type during EDA;
- Drill hole composites are length x density weighted.

After metal values have been estimated into the block model blocks, the block density is calculated using only the full density calculation formula.

14.5 Grade Capping/Outlier Restrictions

Grade capping is used to limit the spatial extrapolation of the occasional high grade but isolated precious metal grades. Capping analyses undertaken at Greens Creek include the use of probability plots, the Parrish decile method, and the AMEC simulation method. For all the zones modeled, two or more of these methods has been applied, the results compared and an appropriate value is determined for use as the grade cap. For low to moderate drill density areas, all methods tend to compare favorably. For high data density areas, the AMEC simulation tends to favor higher values than do the other two methods.

Capping levels are applied at the sample level only. Table 14-3 summarized the caps imposed by zone.

14.6 Composites

Composite lengths vary from 5 to 12 ft (1.5 to 3.7 m) in length depending upon zone (refer to summary in Table 14-2). Ore, waste, and where utilized, metal zone, tagging is honored by having a new composite start where the flags change values.

Grade composite values are length x density-weighted. Two methods have been utilized to handle intervals where the flagged length is not an integral multiple of the design composite length. If any un-assayed intervals are flagged the payable metal values are set to negligible default values (Au = 0.0005 oz/ton, Ag = 0.01 oz/ton, Pb = 0.01%, Zn = 0.01%). Non-payable elements were left as nulls (missing values).

Older models utilize an in-house custom Datamine ® macro that either:

- Adds the short-interval to the last whole composite if the length is less than one-half the design length; or
- Creates a separate composite whose length is between one-half and one whole nominal composite length.

The 2012 model utilizes an updated Datamine® function that will optimize the composite length by spreading the “short-length” material out equally along the flagged interval.

Table 14-3: Sample Capping Values by Zone

Parameter	East	West	9A	Northwest West and Northwest West–Upper	Southwest Bench #	200S	Deep 200S *	5250	Gallagher
Au (oz/ton)	0.981	0.9	0.774	1.4	1.1	0.79	1	0.54	0.49
Ag (oz/ton)	222	140	109.7	300	200	110	100	168.3	50
Pb (%)	NA	NA	NA	NA	NA	NA	14	NA	13
Zn (%)	NA	NA	NA	NA	NA	NA	32	NA	29
Cu (%)	NA	NA	NA	NA	NA	NA	1.25	NA	1.0

Notes:

Capping grades listed are for the Southwest Bench only; the other portions of the Southwest zone (Lower, Upper and Deep) are mined out and are not listed.

* The Deep 200S is considered a sub-zone of the 200 South zone, but has been modeled separately based on more recent drilling.

14.7 Variography

A variety of commercial and custom software packages, most recently Sage® or Snowden® SuperVisor, are used to analyze the geospatial relationships on capped composites.

Individual datasets are constructed by zone and if appropriate by structural or metal sub-zones. Typically, down-hole and directional variograms (correlogram function is used (modeled as 1-r(h)) are constructed for Au, Pb, Zn, Cu, Fe, As, Sb, Hg, and Ba. Data are modeled utilizing a two-structure spherical model with the nugget set using the down-hole variogram.

Given that most zones have experienced a complex, multiple-phase mineralization and structural deformation history it is not uncommon to have differing directional anisotropies for each of the major elements.

For zones with low drill data density directional variograms are calculated along the axes of the anisotropy as defined by the overall trend and geometry of the interpretations. Zones using this approach include the East, 9A, and Northwest West Upper, Southwest Bench, and Deep 200 South zones. For zones with moderate to high data densities, West, Northwest West and 5250, variograms are run on 3 orthogonal planes to determine the direction of maximum continuity.

Nugget values range between 0 to 50% of the sill, with Pb and Zn typically lower than Au and Ag. The structural ranges are short, with the first structure S1 typically less than 50 ft (15 m) and the sill at ranges of less than 200 ft (60 m).

14.8 Block Model Prototypes

Three different styles of interpretation are currently in use at Greens Creek, 15 ft (4.6 m) spaced plan perimeters or polylines, 3D solid wireframes, or 10 ft (3 m) spaced vertical sections. Each leads to a slightly different style of block model.

For all of the interpretational styles, the block size is determined by selecting a block small enough to honor the geometry of the mineralized zone as defined by the interpretations, as well as being a multiple of the expected SMU or minimum stope design of 10 ft x 10 ft x 15 ft (3 m x 3 m x 4.6 m) in x, y and z axes respectively. For the thin, vein-like zones or benches, the size of the mineralized material within the envelope is commonly less than the SMU size. Therefore, a 20 ft (6 m) block model buffer is created around the core mineralized blocks. Blocks in the buffer model are estimated separately. The buffer blocks are then used to estimate the grade of the material that may be included as dilution to meet the minimum stope design. This step typically occurs during the stope design process.

Block models based on 15 ft (4.6 m) spaced plan perimeters use parent block sizes of 10 ft x 10 ft x 15 ft (3 m x 3 m x 4.6 m) but allow sub-blocking in the x and y directions. The minimum sub-block x and y dimension is 3.3 ft x 3.3 ft (1 m x 1 m). The buffer models utilize the same approach. Models that utilize this approach are the East, 9A, Northwest West, 200 South, and 5250. The West model also utilizes this approach but in this case, the minimum sub-blocks are 2 ft x 10 ft x 15 ft (0.6 m x 3 m x 3.6 m).

Block models based on wireframes only use whole blocks (5 ft x 5 ft x 5 ft or 1.5 x 1.5 x 1.5 m) which are generated when block centroids lie inside the wireframe. After estimation but prior to resource tabulation or stope design, blocks (mineralized and buffer) are regularized back to 15 ft (4.6 m) high to meet the minimum mining height of the SMU. Models that utilize this approach are the Northwest West–Upper, Deep 200 South, and Gallagher zones.

The Southwest Bench model is unique in that it utilizes 10 ft (3 m) spaced vertical section to control block generation. The model uses a standard 10 x 10 x 15 ft (3 m x 3 m x 4.6 m) parent block, but sub-blocking is allowing in the z direction to a minimum of 5 ft (1.5 m) to accurately account for the thickness of the sub-horizontal mineralized horizon. The buffer model is used to account for the remainder of the material necessary to expand the block back to standard mining heights.

14.9 Estimation/Interpolation Methods

Grades are estimated in the block model using the composited drill hole data sets. Although not listed for each deposit area, the variograms provide input to search orientations and anisotropies. Search distances are typically set at 90% of the second structure of the variogram, although this can vary. In some cases, the local geologic structure guides the search orientations. Sample selection criteria vary between zones but are typically set as follows:

- Minimum number of composites: 5;
- Maximum number of composites: 20;
- Maximum number of composites from a single drill hole: depending on zone, can be two to three; for some zones an octant criterion is also used.

The first estimation pass starts with the original search distance, and then if enough composites are not located, the distances are doubled, and finally if enough composites still cannot be found, the distances are tripled. If reliable variograms can be constructed, models are estimated using OK. If the data are insufficient to construct reliable variograms, an inverse distance method is used.

Table 14-5 summarizes the specific methods used for estimation by zone.

Table 14-4: Summary of Estimation Methods by Zone

Zone	Au	Ag	Pb	Zn	Cu	Fe	Ba	As	Sb	Hg
East	ID2	ID2	ID2	ID2	Not estimated	ID2	Not estimated			
West	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
9A	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Northwest West	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Northwest West – Upper Plate	ID2	ID2	ID2	ID2	ID2	ID2	ID2	Not estimated		
Southwest Bench	ID1	ID1	ID2	ID2	ID2	ID2	ID2	ID2	ID2	ID2
5250	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
200 South	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Deep 200 South	ID2	ID2	ID2	ID2	ID2	ID2	ID2	ID2	ID2	ID2
Gallagher	OK	OK	OK	OK	OK	OK	OK	ID2	ID2	ID2

Notes

1. ID#: Inverse Distance weighting interpolation method; the number indicates the power used
2. OK: Ordinary Kriging

14.10 Block Model Validation

Estimation validation is done by performing one or more of the following checks on the model:

- Review and inspection of parameter files (Datamine macros) used in the resource estimation;
- Visual inspection of results by metal on plan and section;
- Comparison of ordinary-kriged or inverse-distance and NN distributions;
- Analysis of grade profiles by easting, northing and elevation using swath plots;
- External spot-checks of key calculations such as block kriging and compositing.

The checks showed the models were acceptable for use in Mineral Resource and Mineral Reserve estimation.

14.11 Classification of Mineral Resources

The systematics of the mineral resource classification system utilized at Greens Creek varies The systematics of the mineral resource classification methodology utilized at Greens Creek varies from zone to zone but generally utilizes the following approach.

Overall the classification is based on measures of confidence in the geological and grade continuity and relies heavily on the interpretative skills of the geologist. The geological continuity is judged qualitatively by inspection of sections and plans of the mineralized envelope. The interpreted continuity is based on the current understanding of the structural complications inherent to the Greens Creek deposit.

The general distinction between classification of blocks as Inferred and Indicated Mineral Resources is whether the level of drilling is sufficiently detailed to follow large scale (>50 ft or >15 m) fold structures and for major fault offsets (>50 ft or >15 m) to be traceable from drill section to drill section. A similar inspection of sections and plans of block grades as compared to nearby composites is used to judge grade continuity. Large areas (>100 ft^2 or 9.3 m^2) of near-constant grade without supporting, tightly-spaced (<50 ft or <15 m) drill holes are more likely to be smoothed and as a result, classified as Inferred Mineral Resources. An inspection for any smearing of high-grade precious metals is also undertaken. In areas that are sparsely drilled, which show localized zones of high-grade precious metals surrounded by lower-grade material, the high-grade areas may be specifically classified as Inferred Mineral Resources to restrict the area of influence, even though the surrounding area meets all other criteria for an Indicated Mineral Resources classification.

Currently all underground mineralization at Greens Creek is classified as Indicated or Inferred Mineral Resources. The Measured category has only been applied to the surface stockpile as its volume and grade have been determined by metallurgical balance based on milling results.

14.12 Reasonable Prospects of Economic Extraction

Over 20 years of production experience demonstrates that the orebodies at Greens Creek are amenable to underground overhand cut-and-fill and long-hole stoping methods. Based on this production history, the following assumptions have been applied to determine the extent of the classified material that might have a reasonable expectation of economic extraction.

Depending on the Mineral Resource estimation date (see Table 14-1), different metal prices and NSR cut-off assumptions are used (Table 14-5). Hecla prepares mineral resource models as new drill data are available or mining progresses in a zone. Hecla is currently mining from all of the models listed in Table 14-5 except for the Gallagher, Northwest West–Upper Plate and the East zones. The Gallagher model was updated at the end of 2012. There has been no mining or drilling activity on the Northwest West–Upper Plate and the East zones since 2008.

Mineral Resource estimates assume that the mining method will primarily be overhand cut-and-fill. The minimum mining height and width is assumed to be 15 ft (4.6 m).

For estimation purposes:

- Blocks are deemed recoverable if they fall inside of a conceptual stope design which is created using the Datamine® Mine 24-D software package.
- An additional 4% overbreak dilution is applied to blocks selected as being recoverable. This applies to all Mineral Resources listed except the East zone. The 4% dilution factor was not applied to the East zone due to on-going studies which are evaluating options of different mining techniques. These methods include narrow-vein cut-and-fill, narrow-vein long-hole, and a base case of current methods. Upon completion of the studies later in 2013, it is expected that the East zone will be re-evaluated with an appropriate SMU and dilution factor applied for the selected method or methods.

Table 14-5: Reasonable Prospects Key Assumptions

Zone	Category	NSR Cut-off	Metal Prices			
			Au (USD/ oz.)	**Ag (USD/ oz.)**	**Pb (USD/lb)**	**Pb (USD/lb)**
East	Mineral Resource	$150	$950	$16.00	$0.80	$0.80
	Mineral Reserve	$150	$1,400	$26.50	$0.85	$0.85
West	Mineral Resource and Mineral Reserve	$190	$1,400	$26.50	$0.85	$0.85
9A	Mineral Resource and Mineral Reserve	$190	$1,400	$26.50	$0.85	$0.85
Northwest West	Mineral Resource	$102	$650	$12.25	$0.80	$0.80
	Mineral Reserve	$190	$1,400	$26.50	$0.85	$0.85
Southwest	Mineral Resource and Mineral Reserve	$190	$1,400	$26.50	$0.85	$0.85
200S	Mineral Resource	$190	$1,400	$26.50	$0.85	$0.85
	Mineral Reserve	$190	$1,400	$26.50	$0.85	$0.85
5250	Mineral Resource and Mineral Reserve	$190	$1,400	$26.50	$0.85	$0.85
Gallagher	Mineral Resource	$190	$1,400	$26.50	$0.85	$0.85
Stockpile	Mineral Reserve	$190	$1,400	$26.50	$0.85	$0.85

Notes: Tons: dry short tons (dst); Au (troy ounces/dst); Ag (troy ounces/dst); Pb and Zn percent (%).

14.13 Mineral Resource Statement

Mineral Resources take into account geologic, mining, processing and economic constraints, and have been defined within a conceptual stope design, and therefore are classified in accordance with the 2005 and 2010 CIM Definition Standards for Mineral Resources and Mineral Reserves and the 2003 CIM Best Practice Guidelines.

The qualified person for the Mineral Resource estimate is Dr Dean McDonald, P.Geo., a Hecla employee. Mineral Resources are reported exclusive of Mineral Reserves, and are reported using variable NSR cut-offs by zone. Mineral Resources have different effective dates and are reported using different NSR cut-offs.

Hecla cautions that Mineral Resources that are not Mineral Reserves do not have demonstrated economic viability. Measured and Indicated Mineral Resources are reported in Table 14-6. Inferred Mineral Resources are summarized in Table 14-7.

14.14 Factors That May Affect the Mineral Resource Estimate

Factors which may affect the Mineral Resource estimates include:

- Metal price assumptions;
- Changes to design parameter assumptions that pertain to stope design;
- Changes to geotechnical, mining and metallurgical recovery assumptions;
- Changes to the assumptions used to generate the NSR cut-off;
- Changes in interpretations of mineralization geometry and continuity of mineralization zones;
- Changes to the assumptions related to mineral tenure rights and royalty assumptions associated with the Land Exchange properties.

Table 14-6: Measured and Indicated Mineral Resource Statement 2012

Mineral Resource Classification	Zone	Tons	Gold (Oz/ton)	Silver (Oz/ton)	Lead (%)	Zinc (%)	Gold (Ounces)	Silver (Ounces)	Lead (Tons)	Zinc (Tons)
Measured		—	—	—	—	—	—	—	—	—
Indicated	Gallagher	449,000	0.119	5.9	3.2	7.0	53,400	2,649,000	14,400	31,400
Total Measured and Indicated Mineral Resource		**449,000**	**0.119**	**5.9**	**3.2**	**7.0**	**53,400**	**2,649,000**	**14,400**	**31,400**

Table 14-7: Inferred Mineral Resource Statement

Mineral Resource Classification	Zone	Tons	Gold (Oz/ton)	Silver (Oz/ton)	Lead (%)	Zinc (%)	Gold (Ounces)	Silver (Ounces)	Lead (Tons)	Zinc (Tons)
Inferred	East	1,207,000	0.093	12.6	2.5	7.1	112,300	15,208,000	30,200	85,700
	Northwest West	427,000	0.014	7.1	1.5	3.6	6,000	3,032,000	6,400	15,400
	200S	2,030,000	0.122	11.8	2.5	6.1	247,700	23,954,000	50,800	123,800
	Gallagher	120,000	0.113	5.4	2.9	6.8	13,600	648,000	3,500	8,200
Total Inferred Mineral Resource		**3,784,000**	**0.100**	**11.3**	**2.4**	**6.2**	**379,600**	**42,842,000**	**90,900**	**233,100**

<u>Note to Accompany Mineral Resource Tables</u>

1. Mineral Resource models were prepared by Mr Mike Satre, Mr Lourens Smuts and Mr Kerry Lear who were either employees of Hecla or contracted to Hecla, between 2008 and 2012.
2. The Qualified Person for the Mineral Resource estimates is Dr Dean McDonald, P.Geo., a Hecla employee.
3. Mineral Resources are exclusive of Mineral Reserves and do not have demonstrated economic viability.
4. Mineral Resource block models have a number of database cut-off dates from 2008 to 2012. Metal pricing and NSR cut-off assumption supply dates also vary from 2008 to 2010
5. Mineral resources have been factored for dilution associated with recovery by a conceptual stope design.
6. Mineral Resources are based on the following metal prices and cut-off assumptions: East Zone: $950/oz Au, $16/oz Ag, $0.80/lb Pb, $0.80/lb Zn, NSR cut-off of $150/t; Northwest West Zone: $650/oz Au, $12.50/oz Ag, $0.80/lb Pb, $0.80/lb Zn, NSR cut-off of $102/t; 200S Zone: $1,400/oz Au, $26.50/oz Ag, $0.85/lb Pb, $0.85/lb Zn, NSR cut-off of $190/t; and Gallagher Zone: $1400/oz Au, $26.50/oz Ag, $0.85/lb Pb, $0.85/lb Zn, NSR cut-off of $190/t.
7. Mineral Resources have the following effective dates: Northwest West, 31 December 2008; East, 31 December 2010; Gallagher and 200S, 31 December, 2012.
8. Reporting units are all US customary, Tons:dry short tons(dst); Au (troy ounces/dst); Ag (troy ounces/dst); Pb and Zn percent (%).

14.15 Comments on Mineral Resource Estimates

Hecla is listed on the New York Stock Exchange and is subject to SEC requirements when reporting on the Greens Creek mine. In forms filed with the SEC, Hecla uses terminology in SEC Industry Guide 7 for reporting Ore Reserves. On its website, Hecla uses the Industry Guide 7 terms for Ore Reserves, and the 2007 Society for Mining, Metallurgy and Exploration Guide (2007 SME Guide) terms for the categories of mineral resources.

NI 43-101 allows mining companies incorporated outside of Canada to report mineral resources and mineral reserves under accepted foreign codes. SEC Industry Guide 7 is an acceptable foreign code under National Instrument 43-101 *Standards of Disclosure for Mineral Projects* (NI 43-101), but only for the reporting of mineral reserves. Canadian securities regulators do not accept the SEC usage of “mineralized material” as a category of mineral resources and will not accept tons and grade of mineralized material reported in technical reports unless it has been reclassified into the mineral resource categories accepted under NI 43-101.

Hecla is therefore reporting the Proven and Probable Mineral Reserves, and Measured, Indicated, and Inferred Mineral Resources in Sections 14 and 15 using the definitions and categories set out in the Canadian Institute of Mining, Metallurgy, and Petroleum 2010 Definition Standards for Mineral Resources and Mineral Reserves (2010 CIM Definition Standards) as follows:

- The term “Proven Ore Reserve” under SEC Industry Guide 7 is equivalent to “Proven Mineral Reserve” under CIM Definition Standards;
- The term “Probable Ore Reserve” under Industry Guide 7 is equivalent to “Probable Mineral Reserve” under CIM Definition Standards;
- The term “Indicated Resource” or “Mineralized Material” that Hecla is using for the Greens Creek mine in website disclosures is equivalent to “Indicated Mineral Resource” under CIM Definition Standards;
- The term “Inferred Resources” or “Other Resources” that Hecla is using for the Greens Creek mine in website disclosures is equivalent to “Inferred Mineral Resources” under CIM Definition Standards.

The QPs are of the opinion that the Mineral Resources for the Project, which have been estimated using core drill data, have been performed to industry best practices, and conform to the requirements of CIM (2010).

15.0 MINERAL RESERVE ESTIMATES

15.1 Key Assumptions/Basis of Estimate

Mineral Reserves have been estimated from the geological resources block model, which is developed by the geology department annually. All zones in the geological model are considered for conversion from Mineral Resource to Mineral Reserve as the models are updated.

The current zones estimated as Mineral Reserves are East, West, 9A, Northwest West, Southwest Bench, 200 South, Deep 200 South and 5250 zones. No Mineral Reserves are declared for Northwest West-Upper, or the Gallagher zone.

Hecla used the following criteria to convert Mineral Resources to Mineral Reserves:

- Only Measured and Indicated Mineral Resources are considered;
- Dilution is included in the Mineral Reserve estimate;
- Mineral Reserves are supported by an economic mine plan.

The mine design is completed in Mine24D® software, which is used to interrogate the mining blocks, and then subsequently used to estimate grade and tonnage for each iteration of the mine design. The designed stopes and mine sequencing are then exported to Enhanced Production Scheduler (EPS), where an optimized schedule is generated.

15.2 Stope Considerations

All areas have been historically designed for long-hole or overhand cut-and-fill mining methods. Long-hole stoping is considered when the mineral resource model shows an orebody with vertical parting of at least 35 ft (10.7 m) and strike lengths over 100 ft (30 m). If it is determined that mining by long-hole methods is not practicable, either because of orebody geometry, or geotechnical constraints, overhand cut-and-fill is the mining method used. The cut-and-fill is designed with minimum mining dimensions of 15 ft high by 15 ft wide (4.6 x 4.6 m), which are the smallest dimensions that can effectively accommodate Greens Creek’s current mining fleet.

15.3 Dilution and Mining Losses

Hecla uses 100% mine recovery for scheduling the life-of-mine Mineral Reserves. Reconciliation data indicate that such recovery levels can be met due to a combination of the high-grade nature of the orebodies and the existence of mineralized material on the stope periphery that is not included in the Mineral Reserves, but which may be extracted during the mining process and therefore contribute to production.

A universal dilution factor of 4% is assumed from backfill for both mining methods in all zones. This dilution factor is a global average based on experience. Other waste rock dilution is accounted for in the mine design, which includes both mineralized material from the mineral resource model and dilution from the waste or buffer model.

15.4 Conversion Factors from Mineral Resources to Mineral Reserves

LOM plans and tabulation of Mineral Resources and Mineral Reserves are completed using Mine 2-4D® planning software. This software allows for comprehensive three-dimensional design and interface between all development, production and backfilling activities in each zone of the mine.

A standard mine design procedure is followed, whereby the mine design is developed from the orebody outward, to create a mine plan, as follows:

- Evaluate the block model to determine an appropriate mining method in each area;
- Determine stoping criteria, such as stope dimensions, and level spacing, based on the mining method selected, geological and geotechnical criteria and shape of the orebody;
- Design supporting infrastructure such as footwall development, cross cuts, level accesses, internal ramps, and ventilation infrastructure;
- Design appropriate orebody access from surface or pre-existing infrastructure;
- Develop schedule based on development, construction and stoping sequencing.

Due to the complex combinations of ore types, metal ratios, and metallurgical performances at the Greens Creek mine, the mining cut-off is expressed in terms of NSR; this is the net revenue required to breakeven per mining unit. The target NSR value is calculated from the property-wide direct costs distributed on a per-ton basis. NSR is determined by a formula that includes metal prices, process recoveries, treatment charges and losses, and outlined in Section 13.2. Currently Greens Creek employs a global NSR cut-off of $190 for reporting Mineral Reserves.

15.5 Mineral Reserves Statement

Mineral Reserves by definition have taken into account environmental, permitting, legal, title, taxation, socio-economic, marketing and political factors and constraints. The Mineral Reserves are acceptable to support mine planning.

Underground Probable Mineral Reserves included only mineralization classified as Indicated Mineral Resources. The surface stockpile is classified as Proven Mineral Reserves as its volume and grade have been determined by metallurgical balance based on milling results.

Mr. Bryan Morgen, P.E., a Hecla employee, is the QP for the estimate. Mineral Reserves have an effective date of 31 December, 2012 and are reported using an NSR cut-off of $190/ton for all zones except the East zone, where the NSR cut-off applied was $150/ton. Mineral Reserves are summarized in Table 15-1.

15.6 Factors That May Affect the Mineral Reserve Estimates

Factors that may affect the Mineral Reserve estimates include:

- Metal price assumptions:
- Assumptions relating to geotechnical parameters used in mine design;
- Assumptions that go into defining the NSR cut-off used to constrain Mineral Reserves;
- Appropriate dilution control being able to be maintained;
- Mining and metallurgical recovery assumptions;
- Variations to the expected revenue from short-term marketing and sales contracts;
- Variations to the permitting, operating or social license regime assumptions.

15.7 Comments on Mineral Reserve Estimates

In the opinion of the QPs, Mineral Reserves for the Project, which have been estimated using core drill data, appropriately consider modifying factors, have been estimated using industry best practices, and conform to the requirements of CIM (2010).

Table 15-1: Mineral Reserve Statement

Classification	Zone	Tons	Gold (Oz/ton)	Silver (Oz/ton)	Lead (%)	Zinc (%)	Gold (Ounces)	Silver (Ounces)	Lead (Tons)	Zinc (Tons)
Proven	East	—	—	—	—	—	—	—	—	—
	West	—	—	—	—	—	—	—	—	—
	9A	—	—	—	—	—	—	—	—	—
	NWW	—	—	—	—	—	—	—	—	—
	SW	—	—	—	—	—	—	—	—	—
	200S	—	—	—	—	—	—	—	—	—
	5250	—	—	—	—	—	—	—	—	—
	Gallagher	—	—	—	—	—	—	—	—	—
	Stockpile	12,000	0.095	9.3	2.7	7.8	1,100	111,600	320	940
Total Proven		**12,000**	**0.095**	**9.3**	**2.7**	**7.8**	**1,100**	**111,600**	**320**	**940**
Probable	East	683,000	0.081	13.0	3.2	7.9	55,300	8,879,000	21,900	54,000
	West	893,000	0.123	10.5	4.2	12.1	109,800	9,377,000	37,500	108,100
	9A	1,549,000	0.089	9.8	3.9	9.8	137,900	15,180,000	60,400	151,800
	NWW	1,753,000	0.114	11.3	3.6	10.4	199,800	19,809,000	63,100	182,300
	SW	131,000	0.105	17.6	2.8	7.9	13,800	2,306,000	3,700	10,300
	200S	684,000	0.137	14.7	2.9	6.7	93,700	10,055,000	19,800	45,800
	5250	2,152,000	0.051	13.4	2.8	7.0	109,800	28,837,000	60,300	150,600
	Gallagher	—	—	—	—	—	—	—	—	—
	Stockpile	—	—	—	—	—	—	—	—	—
Total Probable		**7,845,000**	**0.092**	**12.0**	**3.4**	**9.0**	**720,100**	**94,443,000**	**266,700**	**702,900**
Total Proven and Probable	East	683,000	0.081	13.0	3.2	7.9	55,300	8,879,000	21,900	54,000
	West	893,000	0.123	10.5	4.2	12.1	109,800	9,377,000	37,500	108,100

Classification	Zone	Tons	Gold (Oz/ton)	Silver (Oz/ton)	Lead (%)	Zinc (%)	Gold (Ounces)	Silver (Ounces)	Lead (Tons)	Zinc (Tons)
	9A	1,549,000	0.089	9.8	3.9	9.8	137,900	15,180,000	60,400	151,800
	NWW	1,753,000	0.114	11.3	3.6	10.4	199,800	19,809,000	63,100	182,300
	SW	131,000	0.105	17.6	2.8	7.9	13,800	2,306,000	3,700	10,300
	200S	684,000	0.137	14.7	2.9	6.7	93,700	10,055,000	19,800	45,800
	5250	2,152,000	0.051	13.4	2.8	7.0	109,800	28,837,000	60,300	150,600
	Gallagher	—	—	—	—	—	—	—	—	—
	Stockpile	12,000	0.095	9.3	2.7	7.8	1,100	111,600	320	940
Grand Total Proven & Probable		**7,857,000**	**0.092**	**12.0**	**3.4**	**9.0**	**721,200**	**94,554,600**	**267,020**	**703,840**

Note to Accompany Mineral Reserve Table

1. The Qualified Person for the Mineral Reserve estimate is Mr. Bryan Morgen, P.E., a Hecla employee.
2. Probable Mineral Reserves are contained within Indicated stope designs, and supported by a mine plan. Proven Mineral Reserves are mill stockpiles.
3. Mineral Reserves are based on the following metal prices and cut-off assumptions: East Zone: $950/oz Au, $16/oz Ag, $0.80/lb Pb, $0.80/lb Zn, NSR cut-off of $150/t; all other zones: $1400/oz Au, $26.50/oz Ag, $0.85/lb Pb, $0.85/lb Zn, NSR cut-off of $190/t;
4. Mining methods assumed are long-hole open stoping and cut-and-fill. A universal dilution factor of 4% is assumed from backfill for both mining methods in all zones except the East zone.
5. Mineral Reserves have an effective date of 31 December, 2012.
6. Reporting units are all US customary, Tons: dry short tons (dst); Au: (troy ounces/dst); Ag: (troy ounces/dst); Pb and Zn: percent (%)

16.0 MINING METHODS

16.1 Underground Mining

The underground mine is accessed by a portal (920 Main) on the 920 ft elevation, which is located in the same general area as the mill, ore pad and administration building. The 920 Main is the primary equipment and personnel travel way. A secondary escapeway (the 59 Secondary Escapeway) offers a secondary egress as necessary. There are several ramp systems used to access the current mine workings, which are all fed by primary (through-flow) ventilation. There are currently 12 refuge chambers strategically located throughout the mine; these refuge chambers are equipped with compressed breathable air, mine air/water, and mine phones.

A general mine layout schematic plan for the underground operations is included as Figure 16-1.

16.2 Mine Development

Development and face production activities are performed by a fleet of twin/single boom drilling jumbos. Blasting is carried out with mobile explosives vehicles utilizing bulk emulsion. Ground support activities are performed with dedicated bolting equipment and shotcrete is applied as required. Primary ground support consists of split set and Swellex friction rock bolts and wire mesh. Shotcrete and fully-grouted cable bolts are applied to specific areas, as dictated by Hecla's rock mechanics specialist, when required. Standard mine development is driven at 15 ft x15 ft (4.6 x 4.6 m).

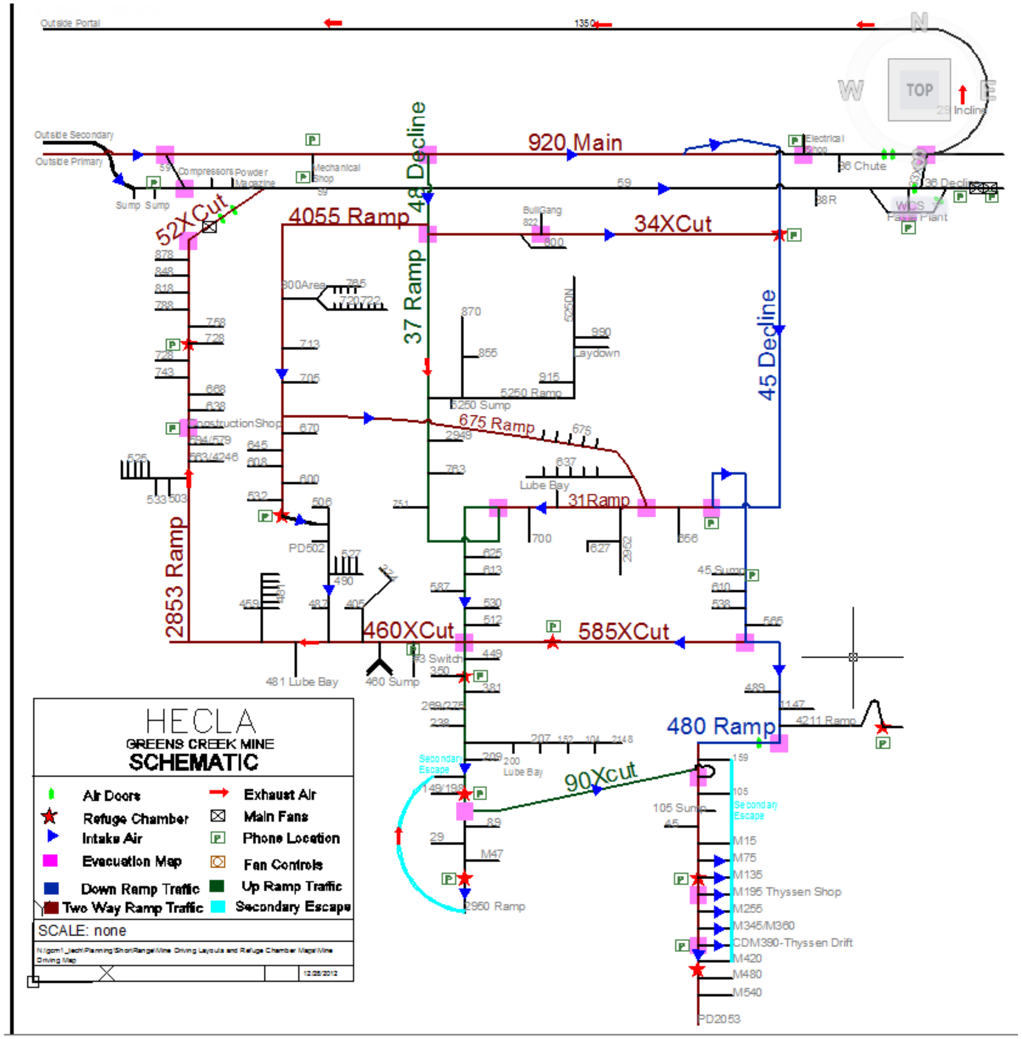
Vertical development is typically completed by drop raising, wherever possible. When drop raising is not possible, such as with longer raises, a raise-boring crew will normally be mobilized. Approximately 95% of vertical development is attributed to ventilation raises and secondary escapeway raises and 5% attributed to muck passes.

16.3 Production Mining

Hecla utilizes two primary mining methods at Greens Creek:

- Overhand cut-and-fill;
- Long-hole stoping.

Figure 16-1: General Underground Mine Layout Schematic



Where overhand cut-and-fill is used, production levels are mined at a minimum dimension of 15 ft wide x 15 ft high (4.6 x 4.6 m). Upon exhaustion of Mineral Reserves on each individual level, the established access is breasted down, providing re-access to the next extraction level.

Long-hole stoping, which accounts for 20% of planned annual production, is used when practicable. Overcut and undercut drives are established at nominal dimensions of 15 ft high x 25 ft wide (4.6 x 7.6 m), and separated by thicknesses ranging from 35 to 120 ft (10.7–36.6 m) vertically. Typical zone level widths range from 200–1,000 ft (60–305 m); with overcut and undercut drive penetration of 100–200 ft (30–60 m) into the ore. Ore zones are drilled and blasted from the overcut or undercut, while extraction occurs via remote mucking on the undercut level. All level layouts are designed as primaries and secondaries, with primary and secondary stopes being similar in size.

A typical section view of the mine production areas is shown in Figure 16-2.

16.4 Mine Backfill

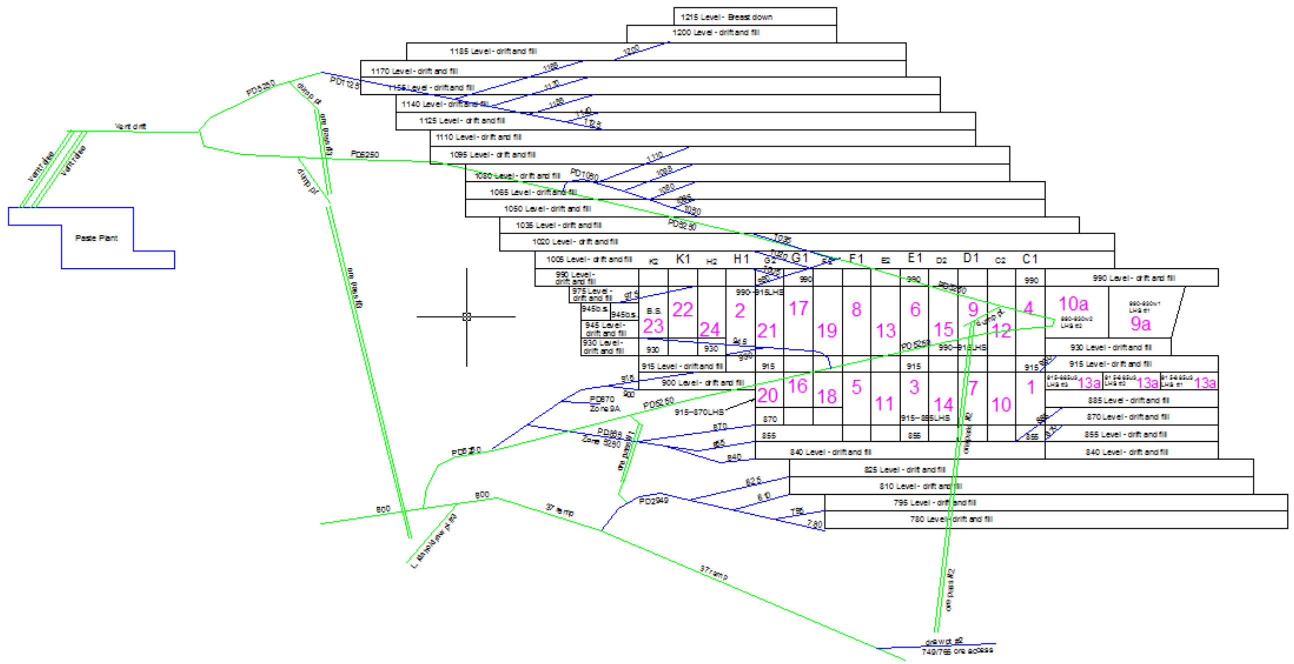
In the cut-and-fill excavations, extracted panels are “tight-filled” with a combination of cement and waste, allowing further panel extraction alongside and between backfill. The waste fill mixture is composed of 5–8% cement and run-of-mine tailings and is delivered to the stopes by underground haul trucks, or is pumped to the stopes from the underground paste plant. The tailings are batched with cement on surface and hauled either directly to the stope or to the paste plant where it is then pumped directly to the stope.

The long-hole stopes are filled with paste backfill, containing a cement content of 5-8%. This allows the safe extraction of secondary blocks between backfill, while minimizing dilution. Secondary blocks are filled with waste rock from mine development wherever possible.

16.5 Ore Handling

Ore handling is performed with a fleet of underground haulage vehicles and LHDs. Some LHDs are equipped with remote capability and provide mucking and loading activities for materials under unsupported ground. All ore is trucked out of the mine to the surface mill stockpile, located approximately 450 ft (137 m) from the 920 Portal utilizing the 40 ton (36 tonne) underground haulage fleet. Haulage distances vary per zone and the distance from the main access way and local ramp system. A round trip distance from the 920 portal to the 90 cross-cut is 21,200 ft (6,462 m).

Figure 16-2: Typical Long-hole Cut and Fill Section View



16.6 Waste Handling

Waste is either trucked out of the mine to the Site 23 waste disposal area located approximately 0.5 miles (0.8 km) from the 920 portal, or is placed in previously mined-out stopes. The waste used to backfill secondary long-hole stopes is dumped near the top cut and pushed into the empty stope using a LHD or jammer.

The waste used to backfill cut and fill stopes is placed on the floor and cemented tailings are subsequently placed on top.

16.7 Stope Design

Greens Creek stope designs are based on an array of criteria learned from historical experience, which may include:

- Known safety constraints;
- Limitations of the equipment fleet;
- Geotechnical constraints;
- Orebody geometry.

Stope design factors include orebody shape, accessibility, mining method and dilution. A universal dilution factor of 4% is assumed from backfill for both mining methods in all zones. This dilution factor is a global average based on experience (Table16-1). Other waste rock dilution is accounted for in the mine design which includes both mineralized material from the resource model and dilution from the waste or buffer model.

16.8 Consideration of Marginal NSR Cut-Off

Due to the complex combinations of ore types, metal ratios, and metallurgical performances at Greens Creek, the cut-off is expressed in terms of NSR, rather than by metal grade. The NSR refers to the amount of revenue that is expected from ore based on the Au, Ag, Pb, Zn, and Fe grades. The methodology for estimating NSR combines results from a metallurgical model that estimates metal recovery and distributions as a function of ore feed grades and concentrate product constraints. These results are combined with average marketing terms and metal prices to calculate an NSR for each block in the model. The calculated NSR then forms the basis for selection based on cut-off criteria. The calculations for the NSR are described in Section 13.2.

Table 16-1: Backfill Dilution Grades

Backfill Dilution Grades	
Ag (opt)	4.8
Au (opt)	0.066
Pb%	1.04
Zn%	1.78
Fe%	14.61

In the case of the Greens Creek mine, the NSR cut-off is essential to achieve production goals and limit marginally economic material. The target NSR covers property-wide direct costs distributed on a per-ton basis of production ore. The design cut-off is $190/ton NSR.

16.9 Production/Throughput Rates

The mine plan from 2013 forward is designed and scheduled for 2,200 tons per day (1,996 tonnes) or 803,000 tons (728,469 tonnes) per annum.

16.10 Mine Plan

The Greens Creek mine planning department uses Mine 2-4D® and EPS to generate life of mine plans, and tabulation of Mineral Resources and Mineral Reserves. The design process begins with the primary development and ore access ramp design. Each planned drift is created to maximize the planned ore extraction of the block model. These designs are finalized by extruding them into 3D solids. 3D solids are also created in the areas where long-hole mining occurs and the height and width of these solids reflect the design.

Once the designs are completed, attributes are assigned to each design. Once the attributes have been assigned and properly linked, the LOM plan is exported into the EPS scheduling software.

Dilution factors representing over-break and sloughed material from neighboring stopes and rock masses are added to create diluted tons and grades. The final schedule is then determined and the actual timing of each zone's activities is planned.

The product from EPS is a day-by-day schedule of activities for the entire LOM. This plan is presented on a month by month basis for 2013 and 2014, and then reported on an annual basis for 2015 through the end of mine life. The LOM plan is shown in Table 16-2.

Table 16-2: Greens Creek LOM Plan by Ore Zone

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
West Zone										
C West Tons	34,803	39,625	53,139	54,254	8,984	—	—	—	—	—
C West Zinc	10.91	9.95	10.15	10.15	10.15	—	—	—	—	—
C West Lead	3.59	3.45	3.40	3.40	3.40	—	—	—	—	—
C West Silver	8.16	9.08	7.91	7.91	7.91	—	—	—	—	—
C West Gold	0.15	0.14	0.14	0.136	0.136	—	—	—	—	—
C West Copper	0.44	0.29	0.36	0.36	0.36	—	—	—	—	—
C West Iron	19.54	17.75	15.98	15.98	15.98	—	—	—	—	—
C West Mercury	24.66	22.92	21.00	21.00	21.00	—	—	—	—	—
C West Arsenic	0.16	0.15	0.14	0.14	0.14	—	—	—	—	—
C West Antimony	0.03	0.04	0.03	0.03	0.03	—	—	—	—	—
C West NSR	305.61	317.01	282.00	282.00	282.00	—	—	—	—	—
200 S										
200S Tons	64,661	88,254	46,960	43,623	43,589	43,609	43,609	43,645	43,567	17,160
200S Zinc	6.96	6.14	7.14	7.14	7.14	7.14	7.14	7.14	7.14	7.14
200S Lead	3.17	2.87	3.32	3.32	3.32	3.32	3.32	3.32	3.32	3.32
200S Silver	17.02	13.67	15.83	15.83	15.83	15.83	15.83	15.83	15.83	15.83
200S Gold	0.157	0.120	0.156	0.156	0.156	0.156	0.156	0.156	0.156	0.156
200S Copper	0.21	0.20	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22
200S Iron	11.70	10.40	10.92	10.92	10.92	10.92	10.92	10.92	10.92	10.92
200S Mercury	21.93	22.77	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00
200S Arsenic	0.15	0.13	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
200S Antimony	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
200S NSR	400.27	327.30	395.00	395.00	395.00	395.00	395.00	395.00	395.00	395.00
Northwest West										
NWW Tons	216,728	201,992	171,966	170,232	192,576	197,113	197,113	197,276	171,022	61,929
NWW Zinc	10.69	10.76	10.45	10.42	10.42	10.42	10.42	10.42	10.42	10.42
NWW Lead	4.00	4.19	3.58	3.52	3.52	3.52	3.52	3.52	3.52	3.52

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NWW Silver	12.39	12.70	11.36	11.24	11.24	11.24	11.24	11.24	11.24	11.24
NWW Gold	0.115	0.119	0.114	0.113	0.113	0.113	0.113	0.113	0.113	0.113
NWW Copper	0.45	0.41	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43
NWW Iron	14.35	14.76	15.36	15.41	15.41	15.41	15.41	15.41	15.41	15.41
NWW Mercury	23.62	24.67	27.71	28.00	28.00	28.00	28.00	28.00	28.00	28.00
NWW Aresenic	0.13	0.15	0.14	0.13	0.13	0.13	0.13	0.13	0.13	0.13
NWW Antimony	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
NWW NSR	323.55	330.74	303.56	301.00	301.00	301.00	301.00	301.00	301.00	301.00
Southwest										
SW Tons	19,851	4,206	316	—	—	—	—	—	—	—
SW Zinc	8.64	6.17	5.61	—	—	—	—	—	—	—
SW Lead	4.39	3.12	2.76	—	—	—	—	—	—	—
SW Silver	28.73	20.17	18.21	—	—	—	—	—	—	—
SW Gold	0.244	0.204	0.171	—	—	—	—	—	—	—
SW Copper	0.23	0.17	0.16	—	—	—	—	—	—	—
SW Iron	12.05	9.47	8.29	—	—	—	—	—	—	—
SW Mercury	43.90	23.57	20.92	—	—	—	—	—	—	—
SW Arsenic	0.46	0.60	0.49	—	—	—	—	—	—	—
SW Antimony	0.15	0.10	0.09	—	—	—	—	—	—	—
SW NSR	812.66	594.31	520.58	—	—	—	—	—	—	—
West Wall and Other West										
WW & OW Tons	64,876	100,280	76,646	74,753	74,694	74,728	74,728	74,790	74,657	29,406
WW & OW Zinc	12.59	11.53	12.76	12.92	12.92	12.92	12.92	12.92	12.92	12.92
WW & OW Lead	4.66	3.87	4.39	4.45	4.45	4.45	4.45	4.45	4.45	4.45
WW & OW Silver	9.87	9.75	11.26	11.39	11.39	11.39	11.39	11.39	11.39	11.39
WW & OW Gold	0.113	0.103	0.121	0.123	0.123	0.123	0.123	0.123	0.123	0.123
WW & OW Copper	0.44	0.35	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
WW & OW Iron	13.90	14.46	15.60	15.73	15.73	15.73	15.73	15.73	15.73	15.73
WW & OW Mercury	30.46	27.00	29.64	30.00	30.00	30.00	30.00	30.00	30.00	30.00

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
WW & OW Arsenic	0.10	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
WW & OW Antimony	0.05	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
WW & OW NSR	306.76	295.78	322.55	325.00	325.00	325.00	325.00	325.00	325.00	325.00
Southwest Bench										
SWB Tons	20,618	26,146	28,337	28,523	4,723	—	—	—	—	—
SWB Zinc	5.05	4.58	9.92	10.25	10.25	—	—	—	—	—
SWB Lead	1.70	1.63	2.99	3.07	3.07	—	—	—	—	—
SWB Silver	16.23	13.33	16.56	16.60	16.60	—	—	—	—	—
SWB Gold	0.075	0.059	0.082	0.083	0.083	—	—	—	—	—
SWB Copper	0.31	0.28	0.39	0.40	0.40	—	—	—	—	—
SWB Iron	7.75	6.36	10.14	10.33	10.33	—	—	—	—	—
SWB Mercury	24.38	22.98	27.04	27.00	27.00	—	—	—	—	—
SWB Aresenic	0.08	0.08	0.09	0.09	0.09	—	—	—	—	—
SWB Antimony	0.08	0.07	0.06	0.06	0.06	—	—	—	—	—
SWB NSR	296.85	277.09	301.31	299.00	299.00	—	—	—	—	—
5250										
5250 Tons	228,189	186,513	170,804	170,230	192,575	197,112	197,112	198,812	309,775	145,216
5250 Zinc	7.19	7.15	6.99	6.99	6.99	6.99	6.99	6.99	6.99	6.99
5250 Lead	3.50	3.08	2.73	2.70	2.70	2.70	2.70	2.70	2.70	2.70
5250 Silver	11.77	11.88	13.61	13.76	13.76	13.76	13.76	13.76	13.76	13.76
5250 Gold	0.060	0.054	0.049	0.049	0.049	0.049	0.049	0.049	0.049	0.049
5250 Copper	0.21	0.21	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26
5250 Iron	7.76	8.59	9.88	10.00	10.00	10.00	10.00	10.00	10.00	10.00
5250 Mercury	34.47	38.01	40.69	41.00	41.00	41.00	41.00	41.00	41.00	41.00
5250 Aresenic	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
5250 Antimony	0.06	0.05	0.06	0.07	0.07	0.07	0.07	0.07	0.07	0.07
5250 NSR	262.22	238.48	267.32	270.00	270.00	270.00	270.00	270.00	270.00	270.00
9A										
9A Tons	153,275	155,985	168,512	170,230	192,575	197,112	197,112	197,275	110,742	25,546

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
9A Zinc	10.71	9.49	9.73	9.73	9.73	9.73	9.73	9.73	9.73	9.73
9A Lead	4.30	3.81	3.87	3.87	3.87	3.87	3.87	3.87	3.87	3.87
9A Silver	10.54	11.93	9.41	9.41	9.41	9.41	9.41	9.41	9.41	9.41
9A Gold	0.099	0.086	0.088	0.088	0.088	0.088	0.088	0.088	0.088	0.088
9A Copper	0.34	0.36	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35
9A Iron	14.32	13.78	15.39	15.39	15.39	15.39	15.39	15.39	15.39	15.39
9A Mercury	29.86	35.27	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00
9A Arsenic	0.09	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
9A Antimony	0.06	0.08	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
9A NSR	276.07	301.66	241.00	241.00	241.00	241.00	241.00	241.00	241.00	241.00
East	—	—								
East Ore Tons	—	—	86,319	93,356	93,283	93,325	93,325	93,402	93,236	36,723
East Zinc	—	—	7.89	7.89	7.89	7.89	7.89	7.89	7.89	7.89
East Lead	—	—	3.23	3.23	3.23	3.23	3.23	3.23	3.23	3.23
East Silver	—	—	13.01	13.01	13.01	13.01	13.01	13.01	13.01	13.01
East Gold	—	—	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080
East Copper	—	—	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
East Iron	—	—	11.30	11.30	11.30	11.30	11.30	11.30	11.30	11.30
East Mercury	—	—	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00
East Arsenic	—	—	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
East Antimony	—	—	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
East NSR	—	—	—	—	—	—	—	—	—	—
LOM Totals										
Summary Tons	803,000	803,000	803,000	805,200	803,000	803,000	803,000	805,200	803,000	315,980
Summary Zinc	9.37	9.00	9.28	9.29	9.19	9.17	9.17	9.16	8.76	8.55
Summary Lead	3.83	3.55	3.45	3.44	3.45	3.45	3.45	3.45	3.29	3.21
Summary Silver	12.35	11.98	11.82	11.82	11.87	11.88	11.88	11.88	12.43	12.72
Summary Gold	0.103	0.095	0.095	0.094	0.091	0.091	0.091	0.091	0.084	0.081
Summary Copper	0.33	0.31	0.35	0.35	0.35	0.35	0.35	0.35	0.34	0.33

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Summary Iron	12.22	12.47	13.38	13.43	13.39	13.39	13.39	13.38	12.63	12.23
Summary Mercury	28.88	29.76	29.35	29.49	30.25	30.40	30.40	30.42	32.33	33.35
Summary Arsenic	0.11	0.11	0.10	0.10	0.10	0.09	0.09	0.09	0.09	0.09
Summary Antimony	0.06	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.06
Summary NSR	312.51	297.88	255.83	252.83	251.32	251.02	251.02	251.05	253.15	254.26

Notes on Abbreviations: C = Central West; WW and OW = West Wall and Other West; NWW = Northwest West; SW = Southwest; SWB = Southwest Bench

As part of day-to-day operations, Hecla will continue to perform reviews of the mine plan and consideration of alternatives to and variations within the plan. Alternative scenarios and reviews can be based on ongoing or future mining considerations, evaluation of different potential input factors and assumptions, and corporate directives. As a result, the reviews may alter the actual mine plan from that presented in Table 16-2.

16.11 Ventilation

The Greens Creek mine is ventilated using an exhausting system with a design capacity of 463,000 cfm. There are nine main fans with an operating horsepower totaling 1550 hp. Underground fans, typically 100 hp x 44" in diameter, pull air from the main ramps to provide ventilation to the working faces. The underground air flow is controlled by four sets of ventilation doors. Three sets of the air doors separate intake from exhaust and one set redistributes air to the lower 2950 Ramp.

Fresh air is drawn down the 920 Main portal and 59 Escapeway. The air is split between the 45 Ramp and 48 Decline. The air that feeds the 48 Decline feeds the 37 Ramp and 2950 Ramp and exits the mine on through the 2853 Ramp. The air feeding the 45 Ramp continues down the 480 Decline and exits the mine through the 1350 Level.

A schematic of the ventilation is shown in Figure 16-3. The booster layout is illustrated in Figure 16-4.

16.12 Blasting and Explosives

Blasting is carried out with the use of mobile explosives vehicles utilizing bulk emulsion. Bulk emulsion is transported by ISO containers to permanent underground storage tanks located in the underground powder magazine on the 59 drift. Non-electric (non-el) blasting caps are used in mine development and electronic icon detonators are used in long-hole stoping.

Blasting typically takes place at the end of shift with only the blasters remaining in the mine; however, localized blasting on demand can be permitted in designated "safe" zones when applicable.

16.13 Geotechnical

The GCMP summarizes how the mine deals with the ground conditions created due to mining. The rock mass at Greens Creek has undergone several folding sequences that have resulted in a contorted rock mass yielding a complex structural system. Standard ground support designs are used based on design conditions, primarily related to back span.

Figure 16-3: Greens Creek Mine Ventilation System

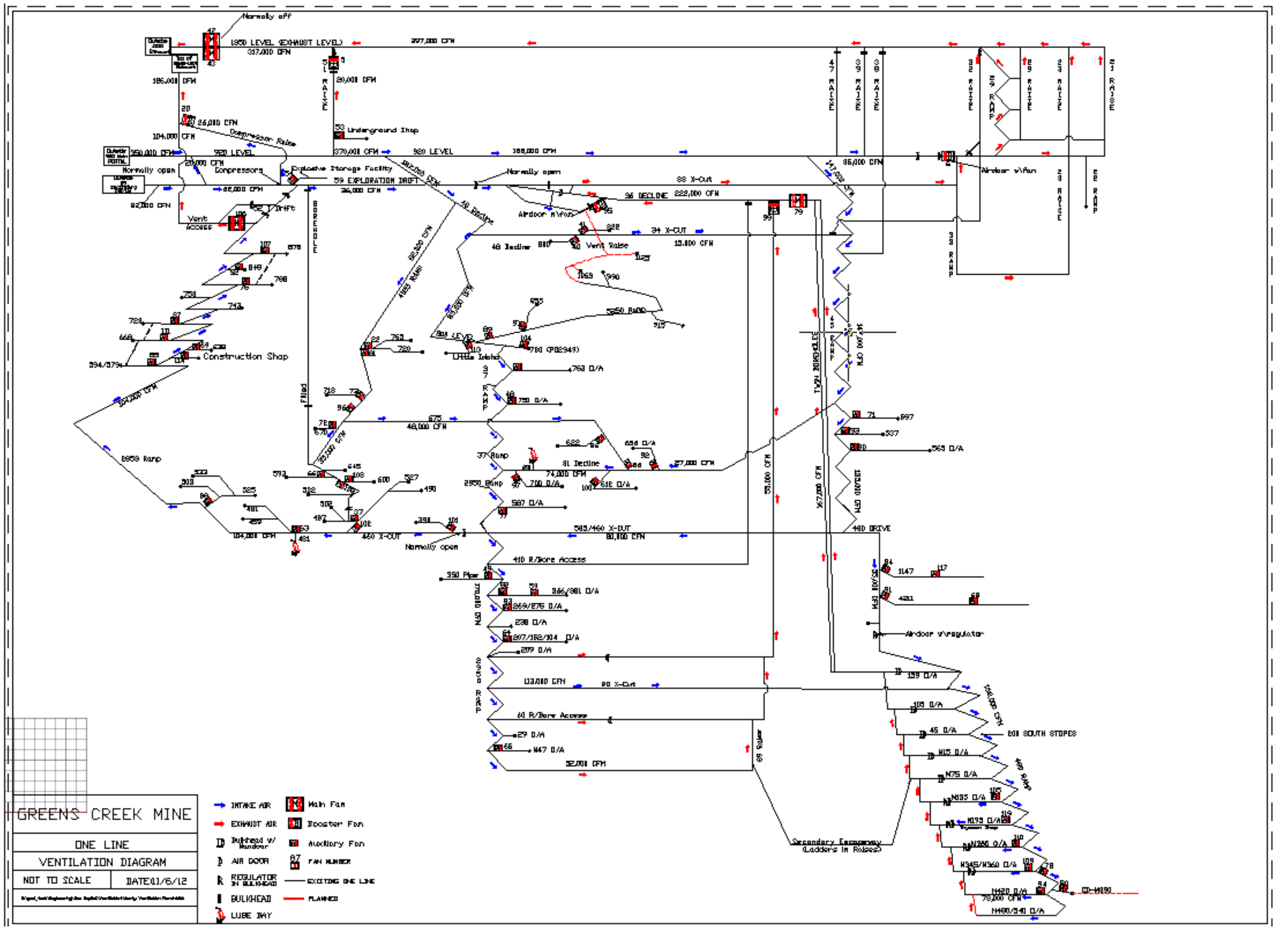
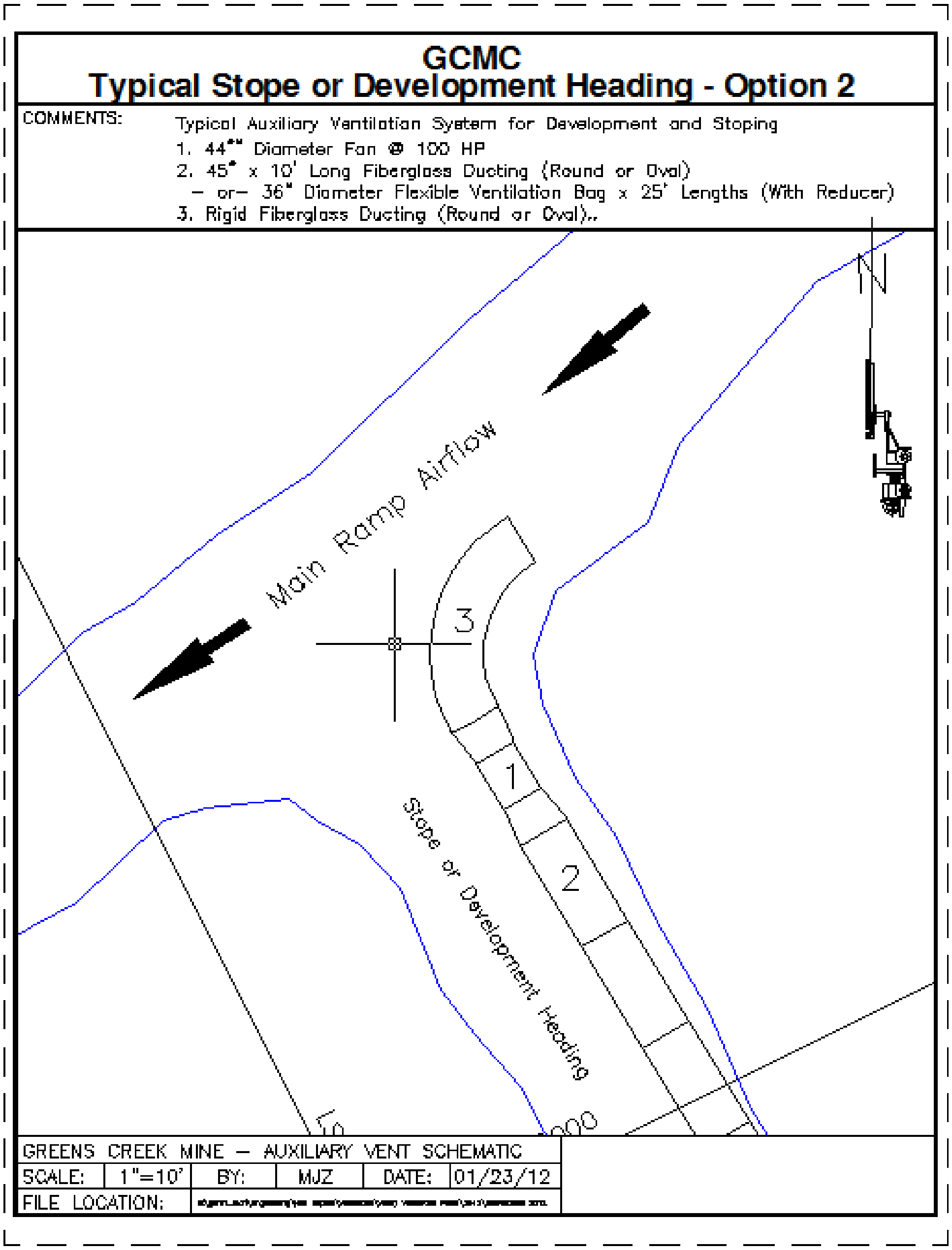


Figure 16-4: Typical Booster Fan Layout



In terms of ground integrity, the ore is the strongest and most competent material. Ore lithologies have a rock strength that ranges up to 30,000 psi. The structural footwall unit, composed primarily of phyllite, has a rock strength up to 15,000 psi. The structural hanging wall unit, composed primarily of argillite, has a rock strength up to 7,000 psi.

The ground control management plan follows Hecla policies and procedures and Federal statutes as outlined in Code of Federal Regulations CFR 30 - Part 57 Metal and Non Metal Underground Mines specifically 57.3200 - 3203 and 57.3360.

Ground support fixtures employed at the mine conform to the American Standards for Testing and Materials standard ASTM F432-95 and the subsequently established F432-10.

The ground support strategy developed at the mine uses the concept of rock reinforcement and surface control to construct a stable support arch for the specified excavation geometry. Rock reinforcement or rock bolts clamp the arch together and assures its integrity and strength. Surface support ensures an intact and regular excavation profile that allows the bolts to perform at maximum efficiency. The combination of these two criteria establish ground control measures employed in the mine headings, and on current knowledge, providing a safe and stable work area.

Typically, Hecla uses the following general specifications for ground support at Greens Creek:

- Galvanized bolts are used in development headings and plain steel in production unless otherwise specified;
- Coated Standard Swellex bolts are used in development headings and plain steel in production unless otherwise specified;
- Galvanized wire mesh is used in development headings and plain steel in production unless otherwise specified;
- All Standard Swellex bolts are added on a 5 ft by 6 ft (1.5 m x 1.8 m) pattern in the back unless specified otherwise.

Ground conditions with a rock mass quality (Q) < 0.1 or rock mass rating (RMR) < 25% are excavated only under specific geotechnical designs that are approved by Hecla's Operations and Technical Services Management.

Ground support standard designations "A", "B", "C", and "D" have been instituted to ensure stability for underground excavations at Greens Creek. Each designation of ground support corresponds to a description of rock mass conditions as well as the objective parameters of Q and RMR.

16.14 Hydrogeology

Greens Creek is considered to be a dry mine. The mine is overlain by topography that offers little opportunity to develop a perched water table of significant volume. The average annual precipitation at the 920 ft elevation ranges from 67 to 80 inches (1,702–2,032 mm). Despite this surface precipitation, the net water pumped out of the mine due to groundwater sources ranges from approximately 25 to 50 gpm.

The mine depth is planned to extend below 540 feet beneath sea level and the coastline is about 5.5 miles (8.8 km) from the mine site.

Results from a Strategic Risk Review completed by then operator, Kennecott, in 1999 concluded that *"hydrogeologic issues do not present a critical risk."*

The Maki fault is a major geological feature encountered at the mine. This fault, and sympathetic Maki-like faults, intersect the Greens Creek drainage and provide the most probable conduit for water ingress into the mine. The Maki fault has been intersected on multiple occasions in the mine workings at various orientations and elevations. It has, on at least one occasion; exhibited fairly high pressure intersects with water. The water pressure bled off reasonably quickly and there has not been a recurrence of the event. While there has been increased water flow into the mine on these occasions, the water inflow has typically been characterized by seeps as opposed to flows. Groundwater that has been encountered has been slightly saline, with pH values around 7.5 to 8.5.

Groundwater determination prior to stope development is covered by a set of fanned diamond drill core holes (pre-production holes) that are driven into the undeveloped orebodies. These holes are monitored for artesian pressure and if any exists, they are allowed to drain off under controlled conditions by using packers and valves. If the flow is minor, the holes are allowed to free drain.

Longer range development initiatives which are outside the developed boundaries of the mine are covered by drilling water cover holes from 500 to 1,000 ft (152–305 m) in advance of development. These holes are also monitored for artesian pressure and are dealt with similarly to the stope development holes. The water cover holes are also logged to get an advance indication of expected lithology, ground conditions, and acid rock drainage potential.

16.15 Underground Mobile Equipment

Conventional underground mining equipment is used to support the underground mining activities. This equipment is standard to the industry and has been proven on site. The underground equipment fleet is in good working condition and a large percentage has recently been replaced or overhauled as part of the natural equipment rebuild/replacement schedule.

The equipment listed in Table 16-3 is currently used and required for remainder of the currently planned mine life to sustain a 2,200 tpd (1,996 tonnes/day) operation.

16.16 Maintenance

Comprehensive maintenance tracking and reporting systems, in addition to preventive maintenance (PM) programs are well established.

Site maintenance facilities are considered adequate to support the current and forecast LOM fleet and exist in centralized facilities both underground and on surface.

PMs are routinely performed as per the manufacturer's recommendations, which is generally at 250 hour intervals.

Frame-up rebuilds are performed based on engine hours, as recommended by the equipment supplier, and/or based on component wear factors. Major overhauls and rebuilds are often done offsite at a contracted facility. The LOM equipment replacement/rebuild schedule is appropriate to the mine plan.

16.17 Comments on Mining Methods

In the opinion of the QPs:

- The mining methods used are appropriate to the deposit style and employ conventional mining tools and mechanization;
- The LOM underground mine plan has been appropriately developed to maximize mining efficiencies, based on the current knowledge of geotechnical, hydrological, mining and processing information on the Project;
- The equipment and infrastructure requirements required for life-of-mine operations are well understood. Conventional underground mining equipment is used to support the underground mining activities. This equipment is standard to the industry and has been proven on site. The underground equipment fleet is in good working condition and a large percentage has recently been replaced or overhauled as part of the natural equipment rebuild/replacement schedule Appropriate allocation has been made for overhaul and rebuild of underground equipment, as required. The LOM fleet requirements are appropriate to the planned production rate and methods;
- The predicted mine life to 2022 is achievable based on the projected annual production rate and the Mineral Reserves estimated.

Table 16-3: LOM Equipment List

Equipment Type	Equipment Supplier	Quantity
Mucker,	Sandvik LH514 LHD	2
Mucker	Toro T1250D	2
Mucker	Toro T1400D LHD	1
Mucker	Cat R1700	2
Mucker	Wagner ST3.5	2
Mucker	Atlas Copco ST7	1
Haul truck	Toro T40D	3
Haul truck	Cat AD45B	3
Haul truck	Sandvik TH540	3
Haul truck	Atlas Copco MT2010	6
Haul truck	Wagner MT436B	3
Jumbo drill ,	Tamrock H205D	2
Jumbo drill	Tamrock H105D	2
Jumbo drill	Sandvik DD420	1
Jumbo drill	Sandvik DD311	1
Rock bolter	Robolt 320-30 SSW	1
Rock bolter	Tamrock Robolt 07-330S	1
Rock bolter	Tamrock Robolt 7 737SSW	1
Rock bolter	Secoma Robolt 05	1
Rock bolter	Sandvik DS410-C	1
Rock bolter	Sandvik DS311D-EC	3
Production drill	Cubex Orion	1
Production drill	Atlas Copco Simba H157	1
Explosives truck	Getman A64	2
Dozer	Cat D4G XL	2
Jammer	Wagner ST3.5	1
Jammer	Atlas Copco ST7	1
Grader	Cat 120G and M120H	2
Scissor truck	Getman A64	2
Boom truck	Truck Boom, Getman A64	2
Water truck	Wagner MT420	2

17.0 RECOVERY METHODS

17.1 Process Flow Sheet

The Greens Creek mill produces three saleable flotation concentrates and two gravity concentrates. A carbon concentrate is produced as part of the process but is discarded as part of tailings.

A gravity circuit utilizing spiral concentrators and a cleaner table treats a bleed stream from the grinding circuit cyclones. It produces a final gravity concentrate and middlings gravity concentrate. Lead concentrate is produced in a rougher-cleaner circuit with re-grinding of the cleaner feed. The lead concentrate is relatively low grade, at approximately 35% lead, but carries a large proportion of the silver in mill feed.

Zinc concentrate is produced in a rougher-cleaner circuit, also with re-grinding, using lead rougher tailings as feed. The zinc concentrate typically contains 50% zinc, which is a normal grade, and considerably less silver than the lead concentrate.

Bulk concentrate is produced in a complex circuit which has as feed cleaner tailings from both the lead and zinc circuits. It is a relatively low-grade zinc concentrate, at 35% zinc, with a smaller amount of lead and some silver. Bulk concentrate has a relatively limited market so lead and zinc concentrates production is preferred over that of bulk.

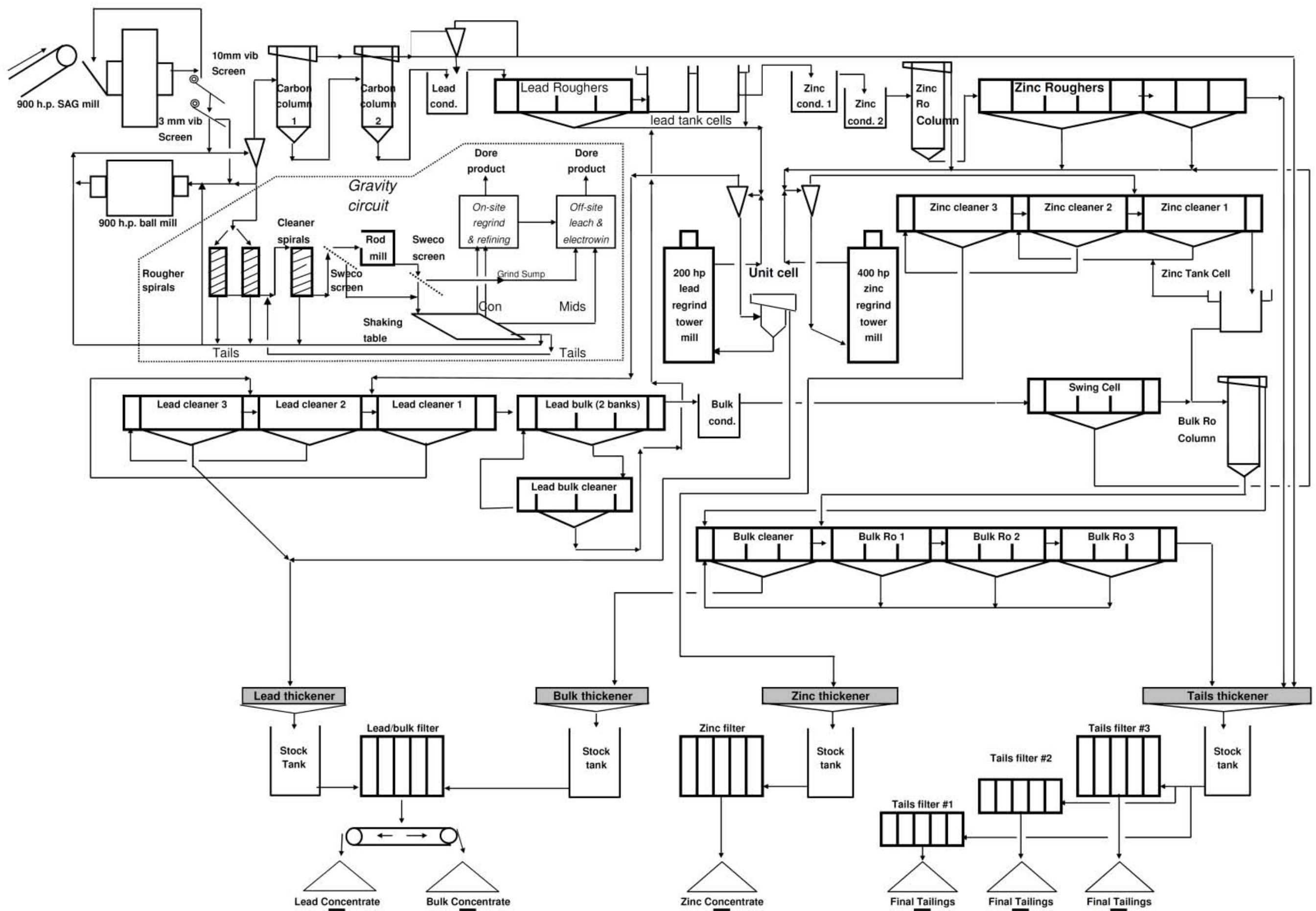
A mill flowsheet is shown as Figure 17-1.

17.2 Plant Description

Mined ore is delivered to the mill stockpile near the portal by underground haulage trucks. It is dumped into a “build” stockpile, which is regularly blended by the pad operator using either a loader or bulldozer. The pad operator at the same time uses the loader to feed the mill feed bin with material from the immediately adjacent “mill feed” stockpile, which consists of ore that has been previously delivered and blended. The mill feed stockpile is used until it is exhausted, at which point the build stockpile is designated the “mill feed” pile and is used to feed the mill.

The old mill feed area then becomes the build stockpile area and mine haulage is henceforth dumped there for blending. The two stockpile areas are thus alternated between the build and mill feed roles. A fresh mill feed stockpile can vary in size between as little as 1,000 tons (907 tonnes) to as much as 15,000 tons (13,608 tonnes) and so have a feed life ranging from less than a day to several days, depending on relative mine production rates and mill feed rates.

Figure 17-1: Greens Creek Mill Flowsheet



A Caterpillar 980 loader is used to transfer blended ore to a fixed grizzly with 15 in (38 cm) square apertures located above a dump pocket with a 60 ton, 35 minute capacity. A hydraulic rock-breaker is used to break the small volume of oversize and a 48 in (122 cm) apron feeder is used to regulate the flow of grizzly undersize ore onto a 48 in (122 cm) belt feeding the semi-autogenous grind (SAG) mill. The apron feeder speed is controlled to maintain target SAG mill feed rate of 85–110 wet tons/h (77–100 tonnes) based on the feed belt weightometer output. A 16 ft x 5 ft (4.9 x 4.5 m) Marcy SAG mill is operated in closed circuit with a primary vibrating screen with 10 mm apertures.

17.2.1 Secondary Grinding

Primary screen undersize gravitates to the ball mill cyclone feed box where it combines with the discharge from the 900 hp 11 ft x 13 ft (3.3 x 4 m) Marcy overflow ball mill, before being pumped to a cluster of five 10 in (25 cm) diameter Warman Cavex cyclones. Two-inch diameter forged steel balls are added to maintain a target mill power draw of 600 kW. Four cyclones are usually in operation at 2,200 tons per day (1,996 tonnes/day); with the underflow from two cyclones being diverted through the gravity circuit for free gold recovery prior to return to the cyclone feed pumpbox. Cyclone overflow at 48–54% solids has a particle size range of 80% passing 70–85 µm and 95% passing 140 to 160 µm. Liberation of flotation feed is sufficient for recovery to low grade rougher concentrates, but not for production of final concentrates, which requires re-grinding prior to the cleaner circuits.

17.2.2 Gravity Circuit

A gravity circuit is operated to improve overall gold recovery. Two banks of eight single-start spirals are installed for roughing, with a single bank of two double-start spirals for open circuit cleaning. Cleaner spiral concentrates report to a Gemini shaking table, which produces a final and a middlings concentrate.

The final gravity concentrate is refined on-site and poured into doré bars for shipment to a precious metals refiner. The lower-grade middlings gravity concentrate is collected and stored in barrels to be shipped to an off-site toll facility where it is treated using intensive cyanidation to produce precious metals. Together, the two gravity concentrates typically recover 15% to 20% of the gold in mill feed and less than 1% of the silver.

17.3 Flotation Circuits

All flotation is carried out in conventional Outokumpu mechanical flotation cells, unless otherwise noted.

Cyclone overflow is diluted from 48% to 45% solids before gravitating to carbon flotation circuit that consists of one 8 ft (2.4 m) diameter column in series with one 7 ft (2.1 m) diameter column. These columns remove naturally-floatable material (graphite, carbonaceous pyrite and layer silicates) from the ore and direct it to final tailings.

Lead roughing takes place at a target pH of 9.2 in two banks of three 300 ft^3 (8.5 m^3) conventional flotation cells each followed by two 20 m^3 tank cells. Sulfuric acid is added to the ball mill cyclone feedbox to stabilize the pH of the lead rougher. A low-grade 20% Pb–18% Zn lead rougher concentrate is reground to 80% passing 20 µm with a tower mill, and then cleaned at pH 8.0 in ten 100 ft^3 (2.8 m^3) cells.

The lead cleaning circuit comprises three stages in closed circuit. Several options have been installed on the lead cleaning circuit. There are options to run the circuit as a three stage cleaner or as a two-stage cleaner plus scavenger. Lead cleaner tailings are sent to the lead–bulk rougher cells at pH 8.5. The lead–bulk rougher concentrate is cleaned in closed circuit to form one component of the final bulk concentrate. Lead–bulk rougher tailings form part of the feed to the zinc–bulk rougher circuit by way of the swing cell.

Zinc depression in the lead circuit is accomplished by use of zinc sulfate in lead roughers. Zinc sulfate and cyanide are used in the lead cleaners for both zinc and iron depression. Lead rougher tailings are conditioned with lime and then copper sulfate ahead of zinc roughing.

Zinc roughing is carried out at a pH of 10.0–10.5 in a 7 ft diameter x 30 ft high (2.1 x 9 m) zinc rougher column, followed by five 300 ft^3 (8.5 m^3) cells in series with three 100 ft^3 (2.8 m^3) cells. Zinc rougher tailings form the majority of the final tailings flow.

Rougher concentrate is reground to 80% passing 20 µm with a tower mill before being fed to three-stage zinc cleaning at pH 10.5–11.0. Zinc cleaner tailings join the swing cell tailings to feed the 7 ft diameter x 30 ft high (2.1 x 9 m) bulk rougher column, the tails from which feed nine 100 ft^3 (2.8 m^3) bulk rougher cells. Bulk rougher tailings are directed to final tailings, while bulk rougher concentrate is cleaned once in three 100 ft^3 (2.8 m^3) cells in closed circuit with the rougher to produce final bulk concentrate. Zinc cleaner cell capacity can be redistributed from three stages to two stages of cleaning during periods of high-zinc head grades.

17.3.1 Reagents

Reagents are distributed throughout the grinding and flotation circuits by means of head tanks and computerized solenoids for xanthate, copper sulfate, zinc sulfate, 3418A and MIBC reagents. Sodium cyanide, sulfuric acid, hydrogen peroxide and non-ionic and anionic flocculants are added by positive displacement pumps (Pulsafeeder, Liquid Metronics, Micro or Moyno).

17.3.2 Dewatering

Lead, bulk and zinc concentrates and final tailings are pumped to their separate thickeners, which are respectively 20 ft, 30 ft, 30 ft, and 60 ft in diameter (6 m, 10 m, 10 m, and 20 m). All thickeners have been retrofitted with high-capacity auto dilution feedwells.

Thickener underflows are pumped by Warman variable speed horizontal spindle pumps or Denver diaphragm pumps at 65–70% solids to individual stock tanks and into Sala filter presses using high pressure Warman pumps. Thickener underflows are fully instrumented for flow, density and pressure to allow thickener inventory control and to eliminate sanding problems.

There are three tails filters, a zinc filter and a shared lead/bulk filter. Filter cake produced from these filters falls into the appropriate bin below the filter. These filter cakes are the final concentrate products and tailings from the milling operation.

17.4 Product/Materials Handling

All three flotation concentrates, as well as the final tailings, are thickened and filtered to approximately 10% moisture. Storage capacity at the mill is limited and all products are hauled to longer-term storage on a daily basis, using highway-type trucks.

Concentrates are separately hauled and stored to a storage–loadout facility at Hawk Inlet, approximately eight miles (10 km) from the mine. At the Hawk Inlet facility they are stored indoors in piles until being loaded periodically into ocean-going ships for transport to a variety of smelters.

Tailings are sent to the surface batch plant as required by the needs of the mine for underground backfill. Remaining tailings are hauled daily to the tailings repository approximately seven miles from the mill for final storage. Tailings sent to the batch plant are fed to a pug mill, into which cement is also added, for thorough blending before being discharged to a hopper. Underground mine trucks haul the tailings backfill either directly to a heading for use as conventional backfill or to the underground paste plant. At the underground paste plant, tailings backfill is blended with water and the resulting slurry pumped to headings for use as paste backfill.

Overflow from the three concentrate thickeners and the tailings thickeners is sent to one of two water treatment plants. One plant is rated to treat 400 gpm and the other 800 gpm, but otherwise the plants are similar. Ferric chloride and flocculants are added to treatment plant feed water to coagulate and flocculate fine solids particles. Solution pH is adjusted, as needed, by lime or sulfuric acid. Hydrogen peroxide is used, as needed, to destroy remnant cyanide. The flocculated solids are allowed to settle out in settling tanks and are then sent to tailings. The overflow is used for mill process purposes or sent to the site water treatment plant via pipeline.

17.5 Energy, Water, and Process Materials Requirements

Table 17-1 summaries the process consumables used in the concentrator.

The Greens Creek mine is allowed by permit to withdraw 700 gallons per minute of fresh water from Greens Creek. This provides the fresh water to the entire site, including the mine and potable water system, with approximately 520 gpm of fresh water being available for mill use. However, the mill requires approximately 1,600 gpm of total water to operate. The difference between the fresh water and total water required for the mill is made up using recycled water. Some process recycle water is taken directly from the tailings thickener overflow, with the balance supplied by treated mill discharge water.

The mill requires approximately 4.8 MW of power to operate at full capacity.

17.6 Production and Recovery Forecasts

The Greens Creek LOM production plan for the mill assumes similar throughputs, recoveries, and concentrate grades to those achieved in recent years, based on projected mill feed grades provided by geology and mine staff for the LOM.

Table 17-2 shows the forecast mill feed tonnages and grades, contained metal in product streams and total metal recoveries in US customary units; Table 17-3 presents the same data in metric units. Mill throughput is based on an average of 2,200 ton/day (1,996 tonnes/day) of ore.

The forecast concentrate production by concentrate type is shown in Table 17-4 in US customary units and in Table 17-5 in metric units. Table 17-6 and Table 17-7 show the concentrate grade forecasts by year in US customary and metric units respectively.

Table 17-1: Reagent and Consumable Summary Table

Item	Usage
Mill Consumables	
4.5” SAG mill balls	Primary grinding
2" ball mill balls	Secondary grinding
1/2" regrind balls (12% Cr)	Lead and zinc re-grinding
Plant Reagents	
Sulfuric acid (93%)	pH modifier, (Lead roughing/cleaning)
Zinc sulfate monohydrate	Zinc depressant, (Lead roughing/cleaning)
Sodium cyanide	Zinc –iron depressant, Lead cleaning
Sodium isopropyl xanthate	Collector, all circuits
Aerophine 3418A promoter	Collector/promoter, Lead roughing and cleaning
Copper sulfate pentahydrate	Activator, zinc and bulk circuits
MIBC	Frother (all circuits)
Lime (unslaked)	pH modifier (zinc circuit, treatment plants)
Flocculants and Coagulants	
Z Flocc 2525	Non-ionic flocculant (thickeners)
Hydrogen peroxide (50%)	Cyanide destruction (treatment plant)
Ferric chloride (42%)	Coagulant - water treatment plants
Goldenwest 774	Anionic flocculant - treatment plants

Table 17-2: Production Forecast by Feed Grade (US customary units)

Year	Units	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Total
Ore Milled												
	Tons/year	803,000	803,000	803,000	805,200	803,000	803,000	803,000	805,200	803,000	315,980	7,547,380
Mill Feed Grades												
Zinc	%	9.37	9.00	9.28	9.29	9.19	9.17	9.17	9.16	8.76	8.55	9.13
Lead	%	3.83	3.55	3.45	3.44	3.45	3.45	3.45	3.45	3.29	3.21	3.47
Silver	oz/ton	12.3	12.0	11.8	11.8	11.9	11.9	11.9	11.9	12.4	12.7	12.0
Gold	oz/ton	0.103	0.095	0.095	0.094	0.091	0.091	0.091	0.091	0.084	0.081	0.092

Table 17-3: Production Forecast by Feed Grade (metric units)

Year	Units	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Total
Ore Milled												
	Tonnes/year	728,470	728,470	728,470	730,465	728,470	728,470	728,470	730,465	728,470	286,652	6,846,870
Mill Feed Grades												
Zinc	%	9.37	9.00	9.28	9.29	9.19	9.17	9.17	9.16	8.76	8.55	9.13
Lead	%	3.83	3.55	3.45	3.44	3.45	3.45	3.45	3.45	3.29	3.21	3.47
Silver	g/tonne	423	411	405	405	407	407	407	407	426	436	412
Gold	g/tonne	3.54	3.26	3.24	3.23	3.13	3.11	3.11	3.10	2.89	2.78	3.16

Table 17-4: Production Forecast by Concentrate Type (US customary units)

Year	Units	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Total
Gravity Products Contained Metals												
Silver	oz	51,702	50,159	49,471	49,621	49,691	49,733	49,733	49,884	52,035	20,955	472,984
Gold	oz	14,724	13,560	13,476	13,450	12,994	12,911	12,911	12,935	12,015	4,543	123,520
Lead Concentrate Contained Metals												
Lead	M lb	38.8	34.8	33.8	33.7	33.7	33.7	33.7	33.8	32.2	12.4	321
Silver	oz	5,626,969	5,291,619	5,212,305	5,228,032	5,235,489	5,239,829	5,239,829	5,255,773	5,482,427	2,207,817	50,020,090
Gold	oz	25,094	22,400	22,185	22,141	21,392	21,255	21,255	21,294	19,779	7,479	204,273
Zinc Concentrate Contained Metals												
Zinc	M lb	102	98	101	101	100	100	100	100	95	37	931
Silver	oz	1,018,842	1,013,384	1,016,584	1,019,651	1,021,105	1,021,952	1,021,952	1,025,061	1,069,267	430,602	9,658,399
Gold	oz	7,051	6,507	6,300	6,287	6,074	6,035	6,035	6,047	5,616	2,124	58,076
Bulk Concentrate Contained Metals												
Zinc	M lb	16.3	15.5	15.9	16.0	15.8	15.8	15.8	15.8	15.1	5.8	147.7
Lead	M lb	2.6	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.2	0.8	21.4
Silver	oz	520,586	524,321	568,077	569,791	570,604	571,077	571,077	572,814	597,517	240,625	5,306,487
Gold	oz	3,401	3,077	3,167	3,161	3,054	3,034	3,034	3,040	2,824	1,068	28,859
Total Contained Metals in Products												
Zinc	M lb	118	113	117	117	116	115	115	116	110	42	1,079
Lead	M lb	41.4	37.1	36.0	36.0	36.0	36.0	36.0	36.1	34.4	13.2	342.1
Silver	oz	7,218,098	6,879,483	6,846,437	6,867,094	6,876,889	6,882,591	6,882,591	6,903,533	7,201,246	2,899,999	65,457,960
Gold	oz	50,270	45,544	45,128	45,038	43,514	43,236	43,236	43,316	40,233	15,213	414,728
Total Recovery												
Zinc	%	78.6	78.3	78.3	78.3	78.3	78.3	78.3	78.3	78.3	78.3	78.3
Lead	%	67.2	65.1	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.3

Year	Units	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Total
Silver	%	72.8	71.5	72.2	72.2	72.2	72.2	72.2	72.2	72.2	72.2	72.2
Gold	%	60.6	59.6	59.4	59.4	59.4	59.4	59.4	59.4	59.4	59.4	59.6

Table 17-5: Production Forecast by Concentrate Type (metric units)

Year	Units	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Total
Gravity Products Contained Metals												
Silver	oz	51,702	50,159	49,471	49,621	49,691	49,733	49,733	49,884	52,035	20,955	472,984
Gold	oz	14,724	13,560	13,476	13,450	12,994	12,911	12,911	12,935	12,015	4,543	123,520
Lead Concentrate Contained Metals												
Lead	tonnes	17,611	15,791	15,319	15,305	15,293	15,299	15,299	15,335	14,621	5,613	145,487
Silver	oz	5,626,969	5,291,619	5,212,305	5,228,032	5,235,489	5,239,829	5,239,829	5,255,773	5,482,427	2,207,817	50,020,090
Gold	oz	25,094	22,400	22,185	22,141	21,392	21,255	21,255	21,294	19,779	7,479	204,273
Zinc Concentrate Contained Metals												
Zinc	tonnes	46,204	44,244	45,673	45,851	45,247	45,152	45,152	45,255	43,148	16,564	422,490
Silver	oz	1,018,842	1,013,384	1,016,584	1,019,651	1,021,105	1,021,952	1,021,952	1,025,061	1,069,267	430,602	9,658,399
Gold	oz	7,051	6,507	6,300	6,287	6,074	6,035	6,035	6,047	5,616	2,124	58,076
Bulk Concentrate Contained Metals												
Zinc	tonnes	7,406	7,046	7,229	7,257	7,161	7,146	7,146	7,163	6,829	2,622	67,006
Lead	tonnes	1,175	1,034	1,023	1,022	1,022	1,022	1,022	1,024	977	375	9,697
Silver	oz	520,586	524,321	568,077	569,791	570,604	571,077	571,077	572,814	597,517	240,625	5,306,487
Gold	oz	3,401	3,077	3,167	3,161	3,054	3,034	3,034	3,040	2,824	1,068	28,859
Total Contained Metals in Products												
Zinc	tonnes	53,610	51,290	52,902	53,108	52,408	52,298	52,298	52,417	49,978	19,186	489,496
Lead	tonnes	18,786	16,825	16,343	16,328	16,315	16,321	16,321	16,359	15,598	5,988	155,185
Silver	oz	7,218,098	6,879,483	6,846,437	6,867,094	6,876,889	6,882,591	6,882,591	6,903,533	7,201,246	2,899,999	65,457,960

Year	Units	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Total
Gold	oz	50,270	45,544	45,128	45,038	43,514	43,236	43,236	43,316	40,233	15,213	414,728
Total Recovery												
Zinc	%	78.6	78.3	78.3	78.3	78.3	78.3	78.3	78.3	78.3	78.3	78.3
Lead	%	67.2	65.1	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.3
Silver	%	72.8	71.5	72.2	72.2	72.2	72.2	72.2	72.2	72.2	72.2	72.2
Gold	%	60.6	59.6	59.4	59.4	59.4	59.4	59.4	59.4	59.4	59.4	59.6

Table 17-6: Concentrate Grade Forecasts (US customary units)

Year	Units	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Total
Lead Concentrate												
	% Pb	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0
	oz/ton Ag	101	106	108	108	109	109	109	109	119	125	109
	oz/ton Au	0.45	0.45	0.46	0.46	0.44	0.44	0.44	0.44	0.43	0.42	0.45
Zinc Concentrate												
	% Zn	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
	oz/ton Ag	10.0	10.4	10.1	10.1	10.2	10.3	10.3	10.3	11.2	11.8	10.4
	oz/ton Au	0.069	0.067	0.063	0.062	0.061	0.061	0.061	0.061	0.059	0.058	0.062
Bulk Concentrate												
	% Zn	34.5	34.5	34.5	34.5	34.5	34.5	34.5	34.5	34.5	34.5	34.5
	% Pb	5.5	5.1	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	5.0
	oz/ton Ag	22.0	23.3	24.6	24.6	24.9	25.0	25.0	25.0	27.4	28.7	24.8
	oz/ton Au	0.14	0.14	0.14	0.14	0.13	0.13	0.13	0.13	0.13	0.13	0.13

Table 17-7: Concentrate Grade Forecasts (metric units)

Year	Units	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Total
Lead Concentrate												
	tonnes	50,316	45,121	43,768	43,728	43,694	43,711	43,711	43,813	41,774	16,037	415,673
	% Pb	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0
	g/t Ag	3,478	3,648	3,704	3,719	3,727	3,728	3,728	3,731	4,082	4,282	3,743
	g/t Au	15.5	15.4	15.8	15.7	15.2	15.1	15.1	15.1	14.7	14.5	15.3
Zinc Concentrate												
	tonnes	92,408	88,486	91,344	91,700	90,491	90,301	90,301	90,507	86,294	33,127	844,959
	% Zn	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
	g/t Ag	343	356	346	346	351	352	352	352	385	404	356
	g/t Au	2.37	2.29	2.15	2.13	2.09	2.08	2.08	2.08	2.02	1.99	2.14
Bulk Concentrate												
	tonnes	21,467	20,425	20,955	21,037	20,759	20,716	20,716	20,763	19,797	7,600	194,234
	% Zn	34.5	34.5	34.5	34.5	34.5	34.5	34.5	34.5	34.5	34.5	34.5
	% Pb	5.5	5.1	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	5.0
	g/t Ag	754	798	843	842	855	857	857	858	939	985	850
	g/t Au	4.93	4.69	4.70	4.67	4.58	4.56	4.56	4.55	4.44	4.37	4.62

Note: Conversion factors used in tables include:

Short ton to metric tonne	1 short ton = 0.90718474 metric tonnes	0.907185
Troy ounce to gram	1 troy ounces = 31.1034768 grams	31.1035
Pounds per tonne		2204.6

17.7 Comments on Recovery Method

Hecla staff developed the LOM production plan. The process plant is operational, and there is 24 years of production history that allows for a reasonable assessment of plant performance in a production setting.

The QP has reviewed the information in this section provided by Hecla, and considers that there are no data or assumptions in the LOM plan that are significantly different from previous plant operating experience, previous production throughputs and recoveries, or the Project background history.

In the opinion of the QP, the current process facilities are appropriate to the mineralization types provided from the mine. The flowsheet, equipment and infrastructure are expected to support the current life-of-mine plan. A new tailings storage facility will be required toward the end of mine life, and is discussed in Section 18.

18.0 PROJECT INFRASTRUCTURE

18.1 Road and Logistics

The mine roads link the Young Bay site, the Hawk Inlet site, and the mine/mill site (refer to Figure 2-2). A five-mile long (8 km), 18 ft wide (5.5 m) road allows transport of personnel from the Young Bay dock to Hawk Inlet. An 8.5 mile long (13.7 km), 20 ft wide (6 m) road allows transport of personnel, supplies, and concentrate between Hawk Inlet and the mine/mill site, as well as transport of dry tailings from the mine/mill site to the tailings area.

Hecla's policy for travel on these single-lane roads with turnouts requires that all drivers maintain radio contact during transit. Operators call over the in-vehicle radios on an assigned channel to note their position, direction of travel, and vehicle type at least once per mile (1.8 km) travelled.

18.2 Mine Layout

The major infrastructure areas (Figure 18-1) supporting operations at Greens Creek include the 920/860 Area, Site 23, Hawk Inlet, Tailings Area, the Young Bay dock, 13 miles (21 km) of connecting roadways, a power-intertie connecting to the Juneau area power grid, and various pipelines and outfalls for wastewater and storm water conveyance.

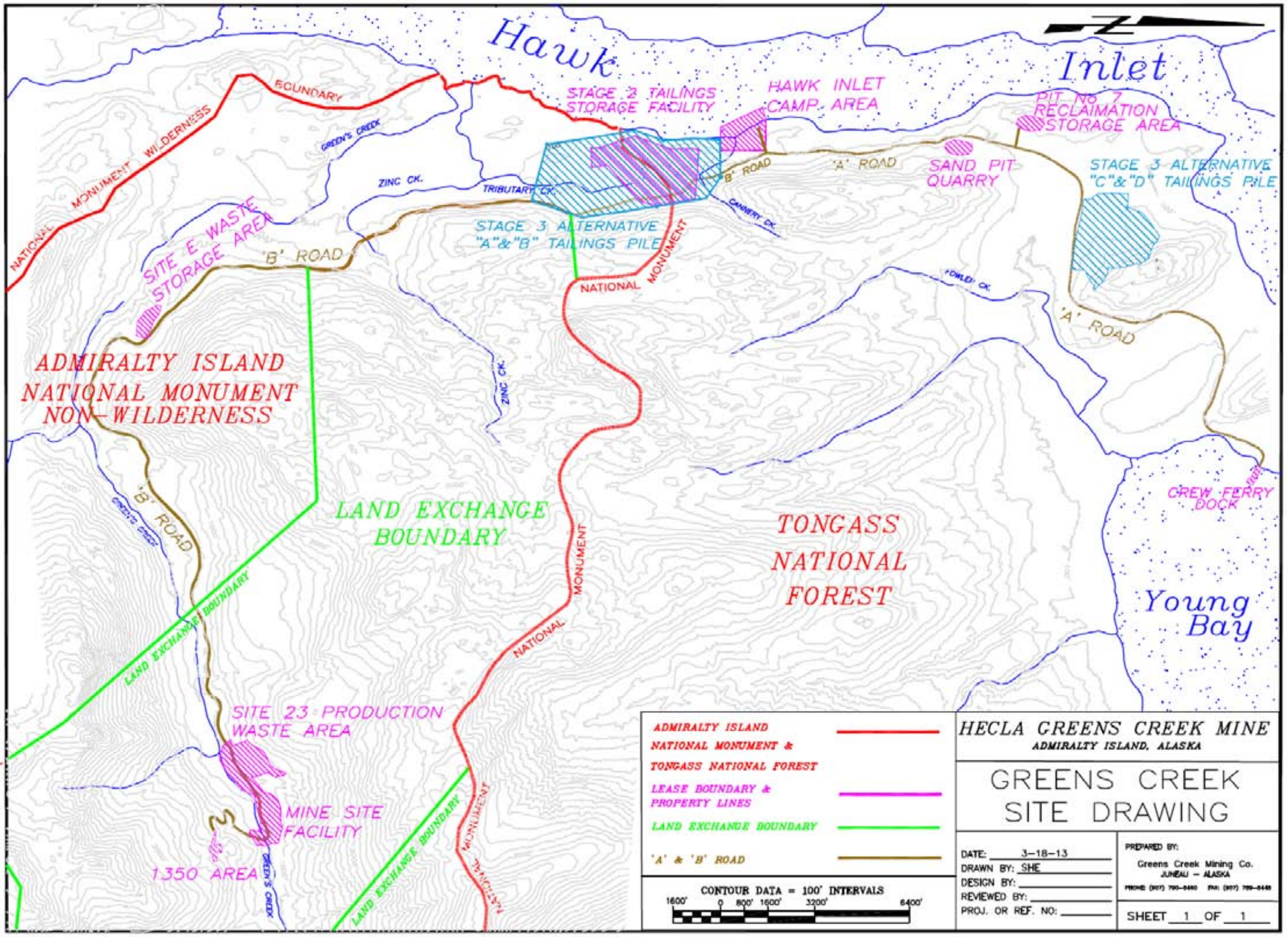
The 920 Area is located adjacent to the main portal at the 920 ft elevation or approximately eight road miles (13 km) from the tidewater facilities located at Hawk Inlet. Located at the 920 Area are the mill, power-house, water-treatment plant, surface-maintenance shop, main warehouse, administrative offices, and fuel storage tanks. The 860 Area, which is immediately adjacent to the 920 Area, has additional office buildings, assay laboratory, and core-logging facilities. Site 23, which is adjacent to the 860 Area or approximately 0.2 miles (0.3 km) from the 920 Area, is the current active waste rock storage facility.

The TSF includes all the tailings produced to date that have not been backfilled underground. There is additional permitted capacity for several years of production needs, storm water ponds, water-treatment plant and fully permitted APDES discharge facilities.

Support facilities at Hawk Inlet include core storage, concentrate storage and shipping, barge port facilities, warehouse, waste and potable water treatment, fuel storage, and camp housing.

The Young Bay facilities consist solely of a boat dock for the regular crew transport boat that runs twice daily from Juneau and a small generator to power lights.

Figure 18-1: Infrastructure Layout Plan



18.3 Waste Disposal Facilities

The current production rock storage area is production rock site 23 (Site 23), which is situated 1,100 ft (335 m) west of the process facility.

Historic production rock storage areas are found at two locations; Site D, immediately down slope of Site 23 and at Site E, located at mile marker 4.6 on the B Road, approximately half the road distance between Hawk Inlet and the mine portal. Site E is currently undergoing a multi-year removal and reclamation effort.

18.4 Tailings Storage Facilities

Approximately one-half of the mine tailings, dewatered at the mill site, are used in the mine backfill cycle. Tailings not used for backfill are placed on the surface at the TSF, the location of which is included in Figure 18-1. The most recent multiple-stage, incremental expansion of the TSF capacity began in 2004. This expansion will continue to accommodate projected mine tailings storage requirements through 2019.

The monitoring system associated with the TSF includes surface and ground water monitoring, water level monitoring, geochemical and geotechnical monitoring, and aquatic biological monitoring in a small, adjacent creek.

A request for an expansion of the TSF was made to the USFS in 2010, with the intent to have the permitting process completed a few years prior to reaching capacity at the existing facility. A Record of Decision is expected from the USFS in 2013, which will state whether the proposed expansion is approved, or whether a new TSF at a different location will be approved.

Reclamation material storage stockpiles are located at various points along the haul road connecting the 920 Area and Hawk Inlet facilities and within old rock quarry areas. None of these reclamation material storage stockpiles have stability issues

18.5 Stockpiles

In addition to Site E, discussed in Section 18.2, reclamation material storage stockpiles are located at various points along the haul road connecting the 920 Area and Hawk Inlet. None of these reclamation material storage stockpiles have associated stability or geochemical issues.

The mill and build stockpiles are discussed in Section 17.2.

18.6 Water Management

Greens Creek is located in a maritime environment and receives considerable precipitation (refer to Section 5.2).

18.6.1 Surface Water Management

Contact Water 920

The main objective of the 920 Area storm water systems is to protect the environment by controlling contact water at the site for treatment. The storm water system at the 920 Area mill site is in place to route, contain, treat, store, recycle and export storm water from the mine and mill site. In addition, surface mine drainage and underground mine discharge is also handled by this system.

The system components are integral to each other with site collection ditches routed to primary sediment removal basins. The water then reports to the pond containment area for recycling, or to the transport systems that remove the water from the 920 Area. In general, all storm water that is considered “contact” water is contained at the 920 Area and eventually treated. The 920 Area site is designed to handle a 10 year/24 hour event as per regulatory permits.

Storm water from the northeast end of the site flows to a de-gritting basin (DB-01), where the heaviest grit (fine to coarse sand and gravel in size) is removed and flow is routed to Pond A. Underground mine water (excess mine process water) can report to Pond A, DB-01 or to the mill process water treatment plant standpipe TK-83.

Storm water from the remaining drainage area is ditched and piped to a second de-gritting basin (DB-02). DB-02 also accepts treated effluent flow from the 920 Area domestic sewage treatment plant (STP-01), process water from the backfill plant, reclaim water from reclaim water tank (TK-85) and process water from the process water tank (TK-67) overflow. Process water overflow only occurs when there is excess water in the mill’s process system (i.e., more water than the recycle and treated water export systems are using). De-gritted flow from DB-02 is routed over weirs and flows via ditch to Pond A.

Pond A also receives pumped water collected and discharged from the B Pond wet well. Pond A has a synthetic liner installed to eliminate release of collected storm water. The Pond A pump system discharges to the pipeline leaving the 920 Area site. Storm water can also be recycled to the mill from Pond A for use in the process, which saves freshwater usage. This flow use is limited during nominal periods as Pond A is maintained at low levels to provide maximum storage availability.

18.6.2 Hawk Inlet Water Management

The main objective of the Hawk Inlet storm water system is to protect the environment by controlling contact and drainage water. The system routes, contains, stores, collects and exports water to tailings area for additional treatment and ultimate discharge.

Water is received from the following sources:

- Upper Hawk Inlet site drainage;
- Lower Hawk Inlet site drainage;
- Hawk Inlet wheel wash facility;
- Potable filter backwash water;
- Storm water and wash-down from concentrate storage and ship loader;
- Treated and disinfected domestic sewage treatment effluent.

These waters report to de-gritting basin number DB-04, where the heaviest material settles out. Flows are then routed by gravity to the storm water wet well (integral to the wheel wash building), where it is exported to tailings by two pumps for additional treatment at the Pond 7 water treatment plant and ultimate discharge to seawater through the outfall line (NPDES discharge point 002) located in Hawk Inlet.

18.6.3 Water Treatment

920 Area

The purpose of the wastewater treatment system at the 920 Area mill site is to collect, treat, and discharge and/or recycle wastewater generated from mining, milling and associated concentration processes.

Two chemical precipitation plants (CPPs) are used to process wastewater at the 920 Area mine site. The systems are configured and designed to provide maximum flexibility in treatment and distribution of water back to the mill, Pond 7 and the Pond 7 water treatment plant, or directly to the outfall line. Control of the system is partially automated, but still requires operator monitoring to maintain prescribed operational parameters and National Pollutant Discharge Elimination System (NPDES) discharge limits.

Site 23

The main objective of the Site D/Site 23 system is to protect the environment by controlling contact and drainage water at the waste rock storage sites for treatment. The system is in place to route, contain, store, recycle and export water from the site.

Pond D Level Control and Operation

Pond D receives water from run-off and the Site D curtain drain system. This water is collected at the under drain sump located inside the pond. From this point, it is discharged by two pumps to Pond 23. These pumps operate automatically to maintain level in the sump and therefore Pond D. Each pump has its own separate discharge line and drain back valve to prevent freezing in cold weather.

Pond 23 Level Control and Operation

Pond 23 receives water from site run-off, site 23 curtain drains, storm water from two pumps located at Pond A, Pond D discharge, Pond C discharge, and a portion of the 10 in (25 cm) mill reclaim tank discharge. Collected water is primarily discharged to the tailings area for additional treatment by two pumps. These pumps operate automatically to maintain low levels in the pond thereby providing maximum storage availability. There is a secondary standpipe at Pond 23 that houses a variable speed pump used to discharge a portion of the stored water back to the mill for recycle and reuse. An 18 in (46 cm) Godwin diesel pump is also available to maintain pond levels if required. This pump is operated manually and reports to the tailings area Pond 7 by a 18 in (46 cm) discharge line.

Hawk Inlet

The purpose of the water system at the Pond 7 site is to collect, treat, store, and discharge process water generated from the 920 Area CPPs, wastewater from the tailings disposal site, Site D/23, the Hawk Inlet site, and other process or mine ore/tailings contact water.

Process and wastewater to be treated is routed to Pond 7, which has a capacity of 31.46 acre-feet (38,805 m^3). This pond is used as a central accumulation and blending point for eventual water redistribution. From Pond 7, water is routed via pipelines to the tails area CPP. The Pond 7 water treatment plant is rated at 2,500 gpm (157.7 L/s), treated, and then discharged to the outfall line via Tank-07. Additionally, process water from the 920 Area CPPs meeting discharge standards can be routed directly to Tank-07 without the need for further treatment.

Non-Contact Water

Non-contact water is diverted from the site by upland ditches and drains and discharge to the numerous fresh water courses found throughout the site.

18.7 Water Supply

18.7.1 920 Water System

A subsurface (submerged) intake screen system infiltrates water from the creek for mine usage. Fresh water intake from the creek must cease if stream flow is below

2.5 cfs (70.8 L/s) as a precaution to in-stream habitat loss; the intake is carefully monitored.

Filtered, non-disinfected water is routed to the 1160 storage tank (base at elevation 1160 ft), directly to the mill fresh water tank, or to filter backwash. Water is distributed from the storage tank to process use points in the mill or kept in storage for fire suppression. Process and fire suppression water is piped to storage without disinfection.

The storage tank has two outlets. The lower outlet supplies the fire suppression system, and filters and chlorination system for domestic water supply. The upper tank outlet is above the fire storage level and provides water to the mill and mine. Thus, fire suppression storage reserve is automatically maintained in the tank.

18.7.2 Hawk Inlet Water System

Water infiltrates from Cannery Creek into the systems' caisson-type wet well and provides a common accumulation point for redistribution to both the tails truck wash supply tank via a pump inside the caisson or pumped/gravity fed through a 4 in (10 cm) line to the Hawk Inlet fire tanks. The withdrawal is limited and regulated by the ADNR, to a maximum limit of 104,000 gpd (394,000 L/d). Control of each system is based on demand and corresponding storage tank levels.

Water from the wet well is pumped to three 20,000 gallon (75,708 L) tanks located outside the Hawk Inlet water utilities building. Of this initial 60,000 gallons (227,000 L), 45,000 gallons (170,000 L) are reserved for the fire suppression systems. Water demand by the camp facilities, wash down and domestic uses is drawn from these storage tanks. These tanks also supply the PCI Membrane potable water filtration system where fresh water is treated and disinfected.

Water can also be drawn from Cannery Creek by a pump located at the Hawk Inlet camp facilities; this was the original withdrawal point, however, it is now used only as a back-up system for supplying the Hawk Inlet fire tanks.

18.8 Power and Electrical

The mine's electrical power needs are met by utilizing a combination of two major sources.

The primary source is onsite diesel-powered generation. This system includes two separate power-houses that contain nine generating units capable of producing 11.25 MW. The on-site generators include a mixture of reciprocating and turbine generators.

The secondary source is from purchased power generated by the local Juneau power utility. This power is generated by hydro and only available to Greens Creek when lake levels are above predetermined limits. The Juneau power grid is connected to the Greens Creek grid by an undersea cable and a 13 mile (21 km) long 69 kV aerial power line.

18.9 Fuel

Fuel arrives at the Hawk Inlet Port Facility by ocean barges that serve southeast Alaska. It is pumped directly into a 200,000 gallon (757,000 L) storage tank that is equipped with full spillage containment. The fuel is then delivered by 9,500 gallon (36,000 L) tank trailers to the 920 Area fuel storage area, which consists of three fully contained tanks yielding a storage capacity of approximately 140,000 gallons (530,000 L).

Fuel is delivery on a bimonthly basis and is necessary if the mine is required to operate the diesel generators to supply power to the site. If power is being supplied from the local utility, fuel usage drops dramatically and is delivered as necessary to fuel the mobile equipment.

18.10 Communications

Corporate communications on the Greens Creek mine site are handled over fiber-optic cables, leased from GCI Communication Corp, utilizing voice-over-internet-protocol technology.

Process control management is accomplished over an internal Ethernet system utilizing both fiber optic and Cat5 communications. The internal fiber optic system extends into the mine and is utilized to monitor/control fan systems. A supervisory control and data acquisition (SCADA) program is used, allowing remote monitoring and control from multiple sites. A single, site-wide standard is accomplished utilizing "Ignition SCADA" software.

Vehicle safety and emergency reporting are accomplished through the use of an island- and mine-wide radio system with dedicated channels for mill operations, mine operations, and road operations. The radio system extends throughout the mine by use of a leaky feeder system. Vehicle safety on the surface is enhanced with a mine safe collision avoidance system.

A hard-wired mine phone system is also installed throughout the mine with direct communication to supervisory offices and the medical office.

In the event of a fiber optic failure, a satellite system is in place to ensure site safety.

18.11 Comments on Infrastructure

In the opinion of the QP, the existing infrastructure is appropriate to support the current life-of-mine plan to 2019.

In 2019, the capacity of the existing TSF will be reached. Hecla commenced a new tailings facility permitting process with Federal and State agencies in 2010, with the intent to have a new facility permitted and built prior to completion of the existing facility. A Record of Decision is expected from the USFS in 2013, which will state whether the proposed expansion is approved, or whether a new TSF at a different location will be approved. The two-year construction of a new facility is planned to begin in advance of completion of the existing facility.

19.0 MARKET STUDIES AND CONTRACTS

19.1 Market Studies

The mine has now been operational for a 24-year period, and continuously operational for the last 17 years, and has current contracts in place for concentrate sales, doré refining, concentrate transportation, metals hedging and other goods and services required to operate an underground mine.

19.2 Commodity Price Projections

Metal price assumptions are provided by Hecla management and are based on three-year trailing average prices applicable at the time the Mineral Reserves are estimated. Prices used for the 2012 Mineral Reserve estimates:

- Gold: $1400.00/oz
- Silver $26.50/oz
- Lead $0.85/lb
- Zinc $0.85/lb
- Copper $3.40/lb.

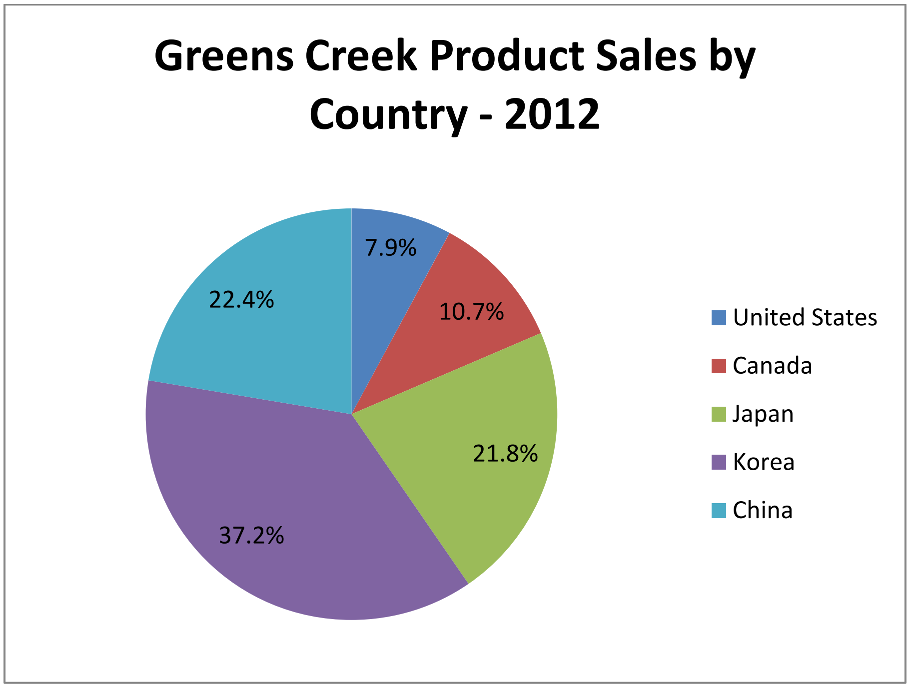
The metal price assumptions provided by Hecla management for life-of-mine plans and budget purposes are:

- Gold $1500.00/oz
- Silver $27.00/oz
- Lead $0.80/lb
- Zinc $0.80/lb
- Copper $3.00/lb.

19.3 Contracts

Hecla has agreements at typical lead and zinc concentrates industry benchmark terms for metal payables, treatment charges and refining charges for concentrates produced from the Greens Creek mine. These custom smelters are located in Canada, Japan, Korea and China. Figure 19-1 shows the product sales by country for Greens Creek products.

Figure 19-1 Concentrate Destinations



The major customers in 2012 included, Korea Zinc (37.2%), Trafigura AG (22.4%), MS Zinc (12.3%), and Teck Metals Limited (10.7%).

Hecla has had concentrate sales frame contracts in place since the beginning of operations in 1989 and these contracts are typical sales contracts in the industry. New frame contracts are negotiated at the end of their terms. For all of Hecla's sales contracts, the title and risk of ownership of the concentrates transfers either at the load port or discharge port.

Treatment costs and refining costs vary depending on the concentrate type and the destination smelter. Table 19-1 summarizes the average metal payability factors.

Table 19-1: Payability and Treatment Charges Summary

Description	Lead	Zinc	Bulk
Payability %:			
Pb	90–95	None	90–95
Zn	None	83–85	83–85
Ag	90–95	50–60	70–80
Au	90–94	25–45	55–65
Treatment Charge (US$)			
Base $/dmt	270–300	190–215	Zinc + 10–15

Greens Creek concentrates are higher in precious metals content, but lower in lead and zinc content than typical lead, zinc and bulk concentrates.

With regard to Greens Creek's bulk concentrate, this product requires treatment at ISFs which are declining in number due to more efficient technologies coming on-line. All bulk concentrate tonnage anticipated to be produced at Greens Creek through the end of 2015 is committed to the current frame contract. Hecla has also previously delivered bulk concentrate to China and Korea and has those relationships in place should it be necessary to place additional bulk concentrate tonnage at any time during life-of-mine operations.

Hecla is in the process of reviewing production scenarios at the Greens Creek mill which will enable the company to produce two different qualities of lead concentrate. A by-product of these production scenarios is that adoption of the scenarios would also allow Hecla to greatly manipulate the quantity of bulk concentrate produced, from 0–30,000 dmt per year, depending on the scenario adopted.

In addition, gold and silver bearing doré is shipped from two different processes to a North American refiner (Metalor USA) for further processing under a toll refining agreement.

The first process involves on-site grinding, melting and pouring of the gravity table concentrate into doré on a monthly basis. Once poured, these doré bars are shipped directly to Metalor for further refining. The second process involves shipping the gravity middlings and fines to a processor in Kimberly, ID (Metals Research) for treatment through their oxygenated-cyanide leach process. Once treated through this process, Metals Research then produces doré bars and forwards them to Metalor on Hecla's behalf for further refining.

In both cases, upon receipt of doré bars from Greens Creek, Metalor further refines the material and Hecla's account is credited with ounces of gold and silver bullion from this process. This gold and silver bullion is sold monthly to large banks at prevailing spot prices.

Lastly, the tails resulting from the oxygenated-cyanide leach process at Metals Research are sent via truck to Teck's smelter in Trail, B.C. twice a year for further processing and eventual disposal.

A Contract of Affreightment is in place with an international shipping company covering the shipments of the lead, zinc and bulk concentrates from the Greens Creek port facilities at Hawk Inlet, Alaska, USA to overseas discharge ports serving the smelter customers. The current Contract of Affreightment has a term of five years and expires at the end of March 2013. Negotiations are currently underway for a new Contract of Affreightment with the same shipping company.

In the second quarter of 2010, Hecla began utilizing two financially-settled forward contract programs to manage the exposure to changes in prices of zinc and lead contained in concentrate shipments between the time of sale and final settlement and the forecasted future concentrate shipments. The contracts under these programs do not qualify for hedge accounting, and are marked-to-market through earnings each period.

Several other contracts have been utilized for other goods and services required to operate an underground mine. Large contracts include lease of office facilities in Juneau, lease of a boat dock at Auke Bay, Alaska for employee parking and boat dock facilities, employee marine transportation services for the Greens Creek workforce to commute from Auke Bay to Admiralty Island, contract drilling services for surface exploration and underground core drilling, camp catering and housekeeping for an employee camp facility, barge transportation of supplies and equipment from Seattle to Admiralty Island and small float plane and helicopter support.

A contract is in place with the local Juneau electric utility for any excess hydroelectric power not required for the City and Borough of Juneau.

On occasions, mining contractors are sometimes employed for specific mine development projects.

Many supplies contracts are in place with suppliers for purchase of various goods the largest contracts including purchase of fuel, reagents, ground support and leases of mining equipment.

19.4 Comments on Market Studies and Contracts

In the opinion of the QPs:

- Hecla is able to market the gravity products, lead, zinc, and bulk concentrates produced from the Project

- The terms contained within the gravity products and concentrate sales contracts are typical and consistent with standard industry practice, and are similar to contracts for the supply of doré and concentrates elsewhere in the world
- Although ISFs are being phased out, which can affect long-term marketing of bulk concentrates, Hecla has existing frame contracts in place and relationships with other buyers for such concentrates, and it is a reasonable expectation that the bulk concentrates will be able to continue to be marketed
- Current studies evaluating production of different-quality lead concentrate will add to marketing flexibility
- Metal prices are set by Hecla management and are appropriate to the commodity and mine life projections.

20.0 ENVIRONMENTAL STUDIES, PERMITTING, AND SOCIAL OR COMMUNITY IMPACT

20.1 Overview

The emphasis at the Greens Creek mine is to achieve a goal of zero environmental incidents. Hecla has implemented work place processes and training programs designed to minimize waste and prevent pollution, comply with all applicable laws, regulations and corporate requirements, including all requirements relating to environmental aspects.

The Greens Creek mine is currently regulated by approximately 60 separate permits and approvals issued by various Federal, State and Municipal agencies covering activities at and around the Greens Creek operation. The operation of the mine and associated facilities are authorized in part under a series of leases and other land use authorizations from the USFS and are carried out in accordance with the General Plan of Operations (GPO) approved by the USFS. Certain areas of the mine's operation are also subject to other Federal and State permits and approvals issued by other Federal and State agencies.

The USFS has issued special use permits and leases for various aspects of the operations. In addition, Hecla holds approximately 7,301 acres (2,955 ha) classified as a Land Exchange Area for which the USFS has granted Hecla exclusive rights to explore and mine, with specified restrictions, for 99 years. This area is inclusive of the patented mining claims and some previously leased and permitted sites from the USFS within the area. All lands owned by or leased to Hecla by the USFS will be conveyed to the United States at the end of mine life, or in 2095 at the latest.

ADEC regulates mill tailings and production rock disposal facilities at the mine, as well as other aspects of the operation primarily through Title 18 of the Alaska Administrative Code (AAC), Chapters 50, 60, 70, 72 and 80. Several permits are issued by ADEC, including, but not limited to the Air Quality Operating Permit No. 302TVP02, the APDES permit AK-004320-6 and the Waste Management Permit 0211-BA001 (WMP), which authorizes tailings and production rock disposal and prescribes monitoring, reporting, closure, post-closure and financial responsibility requirements.

ADNR issues certain land and water use authorizations and dam safety certificates covering site wide operations, including some of the tailings management infrastructure. In addition, ADNR works with the USFS and ADEC to oversee the reclamation and closure plan and bonding for the mine.

Oversight by the EPA includes storm water management and hazardous waste disposal regulated by the Resource Conservation and Recovery Act, and the management of fuel and oil under the oil pollution prevention requirements of 40 CFR

112. Other federal agencies involved in the operation of the mine include the U.S. Coast Guard, Nuclear Regulatory Commission (nuclear sources), Bureau of Alcohol, Tobacco and Firearms (explosives), Federal Communication Commission (radio station authorization) and Federal Aviation Administration (float-plane landing facility).

20.2 Baseline Studies

The technical and environmental library containing baseline reports and ongoing studies at the Greens Creek mine contains over 1,000 documents from 1980–2011.

Annual reports that are required under various permits that are submitted to the regulatory agencies, and which are available to the public are as summarized in Table 20-1.

20.3 Monitoring Activities

20.3.1 Integrated Waste Management Monitoring Plan

Compliance monitoring is undertaken to verify that the project operates within permit limitations thereby minimizing impact to the environment during operations and post closure. The objective of the Integrated Waste Management Monitoring Plan (IWMMP) is to provide mine operations and state and federal regulators with a clear and concise plan that lists monitoring and sampling criteria for surface and ground water quality, geochemical characterization of materials, geotechnical stability of structures, and aquatic biological resources present at the site. The relevant historical and procedural information important to the development and implementation of this monitoring plan for sample collection/analysis, data analysis, and reporting are contained in the IWMMP.

Monitoring activities outlined in this plan include surface, ground, process, and drinking water monitoring, geochemical characterization of tailings, waste rock, and construction rock, geotechnical monitoring of Site 23 and the TSF Pond 7, and biological monitoring of activities during operations and closure.

In general, monitoring will be similar during operations and closure, with monitoring decreasing as reclamation activities are completed and performance goals are met. Long-term water treatment may be required for some components of the contact water through active water treatment facilities. The waste water treatment plant (WWTP) has the capacity to treat 2,500 gpm and has adequate capacity to efficiently treat identified sources from the mine drainage, and seepage from the TSF at closure. The facility will have capacity to treat water until Alaska Water Quality Standards (AWQS) are met.

Table 20-1: Annual Reporting Requirements

Report Title	Permit	Subjects Covered
Fresh Water Monitoring Program (FWMP) Annual Report	State Waste Management Permit (WMP) 0211-BA001	Upgradient and downgrandient water quality sites are sampled monthly and reported herein. A comparison to AWQS is required. Trend analysis is carried out by two different methods. The first method is a visual trend analysis for each analyte. For each site sampled a series of time-concentration graphs are constructed for the previous five years of data collected. The second method is a non-parametric statistical method, Kendall seasonal trend analysis.
Tailings and Site 23 Annual Report	WMP 0211-BA001	Monitoring results for the past year are presented with historical data with trend discussions for the tailings disposal facility and waste rock disposal facility (Site 23). Monitoring of water quality, stability, compaction, acid base accounting (ABA), material volumes, inspections and summaries of pertinent studies are included.
Inactive Rock Sites and Quarries Annual Report	WMP 0211-BA001	Monitoring results for the past year are presented with historical data with trend discussions for five inactive production rock sites and five quarries. Monitoring of water quality, ABA, material volumes, reclamation projects, inspections and summaries of pertinent studies are included.
Greens Creek Biomonitoring Report	WMP 0211-BA001	Documents stream health in Greens Creek and Tributary Creek, two streams near mine development and operations. The aquatic biomonitoring includes sampling of three levels of aquatic productivity, reporting of results, and analysis for trends so that stream health can be determined.
Hawk Inlet Monitoring Program Annual Report	APDES	The Hawk Inlet monitoring program documents the water quality, sediment and biological conditions in receiving waters and marine environments that may be impacted by the mine's operations.
Best Management Practices (BMP)and Stormwater Monitoring Report	APDES	Summarizes the scope and dates of the comprehensive site compliance inspections/evaluations, major observations related to implementation of the Best Management Practicies (BMP) Plan, corrective actions taken as a result of the inspections/evaluations, identification of potential incidents of noncompliance as they pertain to the BMP Plan, description of the quantity and quality of the storm water discharged, and BMP Plan modifications made during the year
Hawk Inlet Owner Requested Limit (ORL) Annual Report	ADEC AQ0853ORL02	Reporting on emissions for Hawk Inlet area generators and camp incinerator
Greens Creek Flow and Withdrawal Report	ADNR LAS 11807	Daily Greens Creek flow and the mine's withdrawal
Semi-Annual Air Quality Control Facility Operating Report	ADEC AQ302TVP02 Revision 1	Emission report and description of permit condition requirements satisfied
Fiscal Year	ADEC	Estimated air emission for subsequent fiscal year for billing

Report Title	Permit	Subjects Covered
Emissions Estimates	AQ302TVP02 Revision 1	purposes
Toxic Release Inventory (TRI)		As per EPA requirements

20.4 Environmental Issues

Greens Creek mines an ore body that is made up of massive sulfides in a temperate rainforest environment. Proper management of the waste materials from the mining process is of primary importance due to ARD and metals leaching considerations. Regulatory oversight is rigorous, and the relationship between the agencies and the mine is transparent. Waste materials are regulated under the State's Waste Management Permit, which involves provisions for building contained waste storage facilities, diverting water from the facilities, and capturing and treating all water that contacts the waste.

20.5 Closure Plan

Hecla has prepared a reclamation and closure plan to address interim, concurrent, final reclamation and post-mining land use of the Greens Creek mine. The reclamation and closure plan and closure cost estimates are submitted to the USFS as required under 36 CFR 228.1 et. seq. and 36 CFR 228A (Training Guide for Reclamation Bond Estimation and Administration 2004). Concurrently, the reclamation and closure plan and cost estimate are submitted to ADNR and ADEC in accordance with AS 27.19.010 et. seq., 11 AAC 97.100 et. seq., AS 46.03.010 et. seq., and 18 AAC 60.25 et seq.

The reclamation and closure plan sets performance goals applicable to interim, concurrent, and final reclamation, and addresses post-closure monitoring requirements. It also sets scheduling and other standards for reclamation and for final closure planning requirements, and it explains how detailed, regularly-updated reclamation task planning will be used for purposes of calculating a reclamation bond.

Hecla will reclaim exploration, development, mining and process-related disturbances at the Greens Creek mine in a manner compatible with the final land use selected and applicable regulations. Reclamation practices will utilize best practicable established and accepted technologies and methodologies suitable for the southeast Alaska environment.

Reclamation philosophies, technologies, and methodologies are, and will continue to be, subject to change. Reclamation practices are under constant scrutiny by government, industry, and the public. Therefore, reclamation plans must be, within the context of existing regulations, dynamic and capable of changing with the input of new information, ideas, and techniques (11 AAC 97.330 Amendment of Reclamation Plan).

Final reclamation will be initiated immediately, and completed within two years of cessation of mining and milling operations where affected land cannot practicably be reclaimed concurrently. Notification, in writing, of final closure will be given to the USFS, ADEC, and ADNR within 90 days after cessation of mining and milling operations.

Final reclamation of the mine facilities will take into account anticipated post-mining land uses. Since such uses likely will be limited primarily to Admiralty Island National Monument-related activities, returning the surface to a near-natural condition should satisfy post-mining land use needs. Private lands will retain their status after mining and were developed for non-Monument uses prior to creation of the Admiralty Island National Monument. After closure, Hecla will consult with the ultimate landowners, as well as any agencies having regulatory authority over reclamation of such lands, to determine the final disposition of structures and facilities.

Two years prior to final commencement of operations, Hecla will submit a final reclamation plan that will be used as the basis for remaining reclamation activities at the site. This final reclamation plan will follow the same format as prior updates. The final reclamation plan will also include a monitoring and contingency plan that describes in detail what actions Hecla will follow if the site fails to meet performance goals during the post-closure monitoring period, including long-term contact water treatment. The actions described in the contingency plan may be used to determine potential costs that may be associated with the post-closure care and maintenance period. These costs can be used to calculate the bonding amount that needs to be retained after incremental bond release.

General procedures for physical stabilization and re-vegetation of mined land disturbances are well documented and proven. Post-closure water treatment facilities and associated ancillary facilities will remain until all water associated with the process component of the mine meets applicable discharge standards.

During operation of the Greens Creek mine, water collected from the underground workings, seepage collected beneath waste rock facility (Site 23) and the TSF, and storm water run-off from the waste rock facility (Site 23/D), the mill area and the TSF are collected and treated. The contact water is collected and treated prior to discharge under an APDES permit.

Hecla plans to phase out collection and conventional treatment of surface storm water (contact water) from some of these sources as areas are reclaimed, the engineered cover is constructed on the TSF, vegetation established, and water monitoring demonstrates the applicable AWQS are met.

In order to ensure that water quality will be protected after Hecla ceases to collect and treat contact water from these sources, the following requirements will be satisfied:

- Before Hecla will be allowed to cease collection and conventional treatment of contact water, a report will be developed for submission to the appropriate agencies. The report will utilize results of analysis from collected samples and a water quality predictive model of the TSF to determine whether AWQS are or will be met at down-gradient stations, and will include identification of effective treatment methods. Achievement of applicable AWQS at the compliance point can be by any of the following processes alone or in combination: batch treatment using conventional WWTP (high density sludge process), reduction in ARD or metals loads due to reclamation practices, deployment of demonstrated biological or other non-conventional treatment techniques, or reliance on natural attenuation mechanisms;
- A monitoring plan will be submitted with the report that identifies “early warning” stations that will detect increases in metal loading that represent a precursor to violation of AWQS at the facility compliance points. The monitoring plan will describe the indicator parameters to be monitored, the monitoring frequency, and duration. Additionally, “trigger levels” will be proposed at each early warning station that represents levels of constituents that may cause subsequent violation of AWQS at the compliance points. The findings of the report and the monitoring plan are subject to review and approval by the appropriate agencies;
- Early warning stations and the down-gradient points of compliance will be monitored for a minimum of three years after cessation of collection and treatment of contact water. If a violation of the AWQS occurs at the compliance points, or if trigger levels are exceeded at the early warning stations, then Hecla will notify the agencies as required by the IWMMP. Additionally, a report will be prepared which describes the potential or observed water quality violation, and will identify probable causes. This report will be submitted by Hecla to the appropriate agencies within 30 days of problem identification. A corrective action plan will be submitted by Hecla to the appropriate agencies for review and approval within 75 days of the date of problem identification. Following approval of the plan, Hecla will implement the plan in a timely manner. The corrective actions to be taken may include, but need not be limited to, changes in the passive treatment system, modification of the water management system, re-establishment of conventional treatment, or improvements to the facility reclamation;
- Long-term water treatment may be required for some components of the contact water through active water treatment facilities. The WWTP has the capacity to treat 2,500 gpm and has adequate capacity to efficiently treat identified sources

from the mine drainage, and seepage from the TDF at closure. The facility will have additional capacity to treat surface water runoff until AWQS are met.

The ultimate goal of final reclamation of the site is to blend into the natural landscape features of Admiralty Island, minimize or eliminate long-term management requirements, and meet applicable AWQS for surface and groundwater.

The currently approved closure cost is $29 million, which is funded via sureties.

20.6 Permitting

The land comprising the Greens Creek mine, inclusive of all Admiralty Island facilities, consists of both publicly and privately owned uplands and tidelands. Greens Creek leases parcels from the United States on both the Monument and non-monument lands. Hecla uses other public lands pursuant to special use permits issued by the USFS and leases issued by the State of Alaska. It owns land on Admiralty Island both as a result of patenting mining and millsite claims and through transfer of private lands in the historic cannery area from its predecessor. Additionally, Greens Creek holds subsurface and restricted surface use rights to approximately 7,301 acres (2,955 ha) of public lands as a result of the Land Exchange made pursuant to the Greens Creek Land Exchange Act of 1995 (Pub. L. 104-123 April 1, 1996).

Under the Land Exchange agreement, certain private lands (e.g. patented claims) owned by Hecla ultimately will be transferred to the United States, and the 7,301 acres (2,955 ha) of subsurface and restricted-use surface lands patented to Greens Creek in 1999 will revert to the United States. The Land Exchange agreement does not impose special reclamation requirements on these lands. It requires that they must be reclaimed in accordance with applicable laws and the approved reclamation plan.

A list of the current permits in place is included in Table 20-2.

Table 20-2: Current Project Permits

Agency	Description	Number	Issue Date	Expiration Date	Category
ADEC/EPA	APDES/NPDES Name Change Renewal Request	AK-004320-6	05/20/05; Effective 07/01/05	07/01/10; five year renewal 2005 permit in effect until new permit issued per EPA letter (renewal request)	Water
ADEC	401 certification for NPDES permit	For AK-004320-6	03/31/05	To be updated with APDES permit	Water
ADEC	Health Permit Cannery Camp - (Food Service)	113010178	01/13	12/31/13; Annual Renewal	Facilities
ADEC	Waste Management Permit Permit Modification (temporary pad at 23) Permit Extension	0211-BA001 Rescinds Solid Waste Permit 0111-BA001	11/07/03; Modified 06/12/08; extension 10/6/08	11/7/08; five year renewal; extension received 10/06/08 until renewal work complete	Waste
ADEC	Waste Permit 070720 Waiver (waiver of slope limitation)	0211-BA001	07/20/07		Waste
ADEC	Minor Air Permit	AQ0302MSS01; rescinds AQ0302CP03	01/26/11	6/30/13; five year renewal	Air
ADEC	Title V Air Quality Operating Permit	AQ302TVP02 Revision 1	07/01/08; Revised 03/3/11	6/30/13; five year renewal	Air
ADEC	Owner Requested Limit (ORL) Air Quality Operating Permit	0853ORL02	03/11/10	Until modified or revoked	Air
ADEC	Cooperative Service Agreement	Letter of Agreement	04/27/09	04/27/14; (to be placed under ADNR-OPMP annual agreement)	Other
ADEC SPARR	Underground Secondary Containment Agreement	Letter of Agreement	12/30/08	Until rescinded	Spill
ADEC	Corrosion Control Addition Approval	Plan Rev #4874; PWSID #113560	11/19/09	Indefinite	Water
ADEC	Drinking Water System Classification Letter	PWSID #113560	08/10/05	Until modified or revoked	Water
ADEC	Drinking Water System Classification Letter	PWSID #119205	08/10/05	Until modified or revoked	Water
ADEC	Waiver Asbestos Monitoring Affidavit	PWSID #113560	2002		Water
ADEC	Waiver Asbestos Monitoring Affidavit	PWSID #119205	2002		Water
ADEC	Waiver SOC & OOC Monitoring	PWSID# 113560	01/01/11	12/31/13; re-apply every 3 years	Water

Agency	Description	Number	Issue Date	Expiration Date	Category
ADEC	Waiver SOC & OOC Monitoring	PWSID# 119205	01/01/11	12/31/13; re-apply every 3 years	Water
ADNR	Log Brand Certificate of Registration	08-04-13	03/15/08	03/15/13	Other
ADNR	Certificate of Approval to Operate a Dam – Pond 7	AK00307	08/30/07	08/30/12; every three years; renewal in process	Facilities
Agency	Description	Number	Issue Date	Expiration Date	Category
ADNR	Jurisdictional Review Dam – A Pond (Pond A 'not a dam' determination)	N/A	08/01/06	Indefinite	Facilities
ADNR	Right of Way Permit (Marine Outfall to Hawk Inlet)	ADL 105124 Amendment 2	07/01/91; Amended 05/01/08 for name change	6/30/16	Land
ADNR	Tideland Lease (Young Bay Dock)	ADL 106488; Amendment 1	01/25/00; Amended 05/01/08 for name change	01/24/2055	Land
ADNR	Tideland Permit (Mooring Buoy in Hawk Inlet)	LAS 19928	10/6/10	10/05/15; renewal every five years	Land
ADNR	Water Right # 656 (Cannery Creek - 17,000 Gal/Day - Public Supply) Name Change	ADL 43347	10/06/86	Until water use is abandoned for 5 years	Water
ADNR	Temporary Water Use Permit (Cannery Creek 103,400 gal/day)	TWUP J2000-10	10/6/00	10/5/05; renewal every three years	Water
ADNR	Water Use Permit (700 gal/min-Greens Creek-for milling purposes) Name Change	LAS 11807	10/05/88	03/10/98; letter on 02/25/99 from ADNR states water rights have been maintained and waiting on ADNR to proceed	Water
ADNR	Water Use Permit (5 dewatering wells within mill site complex, 10 gpm limit) Name Change	LAS 11808	10/05/88	03/10/98; letter on 02/25/99 from ADNR states water rights have been maintained and waiting on ADNR to proceed	Water
ADNR	Temporary Water Use Permit (Fowler Creek drainage streams (5 sites)	TWUP J2010-03	05/18/10	12/31/15; renewal every five years	Water

Agency	Description	Number	Issue Date	Expiration Date	Category
ADNR	Temporary Water Use Permit 04, 06, 07 (Greens Creek drainage streams (15 sites); renewal in 2010 broke 15 sites into 3 different permits as only 5 sources are allowed per permit)	TWUP J2010-04, 06 and 07	05/18/10	12/31/15; renewal every five years	Water
ADNR F&G	Fish Habitat Permit (100,000 gal/day) {accompanies TWUP}	FH05-III-0072, Amendment No. 2	03/02/10	12/31/15; every three years	Wildlife
ADNR F&G	Fish Habitat Permit	FH-08-III-0210	07/15/08	Upon abandonment	Wildlife
ADOR (AK Dept. Of Revenue)	Mining License	APMA Ref # J55571; License No 99475	06/22/07	Annual Renewal	Land
CBJ	Large Mine Permit	M-02-95	01/01/94		Land
EPA / USCG	Facility Response Plan	EPA #FRPAKA0096 USCG GPO Append 9	03/02/10	EPA 04/03/14; USCG 03/02/15 (submitted to USCG for review, made changes and resubmitted in July 09)	Spill
Agency	Description	Number	Issue Date	Expiration Date	Category
EPA	Underground Injection Well Class V (Tailings Materials to Active Stope Areas)		Notification sent 09/03/98		Waste
EPA	Underground Injection Well Class V (#33 Decline in Mine/Mill used for temporary storage of approximately one million gallons of water)		Notification sent 11/16/94		Waste
EPA	Underground Injection Well Class V (Stope 21AS in Section 21, Zone 8 of the mine used to permanently store sludge and sediment)		Notification sent 11/16/94		Waste
EPA	Underground Injection Well Class V (380 cy of settleable solids and water stored temporarily in stope off the 33 Cross Cut)		Notification sent 11/21/94		Waste
FAA	Landing Facility Location Identifier (Hawk Inlet Federal Aviation Administration)	HWI Private Airport	09/06/01		Transportation
FCC	Radio Station Authorization (FCC Registration Number (FRN) 0008396178)	WNMG649	02/24/09	07/07/14	Other
FCC	Radio Station Authorization	WPLY665	02/24/09	04/15/13	Other
FCC	Radio Station Authorization	WPMJ594	02/24/09	08/13/13	Other

Agency	Description	Number	Issue Date	Expiration Date	Category
FCC	Radio Station Authorization	WQBL479	02/24/09	10/29/14	Other
FCC	Radio Station Authorization	WRV305	02/24/09	08/12/14	Other
Multi-Agency	Memorandum of Understanding (USFS, ADEC, ADNR MOU for single bond) Amendment	Reclamation Bond	05/05/07; Amended 06/08/09 for name change	09/30/11; (renewal in progress)	Other
NRC	Radioactive Material License (Radioactive materials license (Fixed & mobile))	50-23276-01 Amendment 12	05/23/08; Amended 09/12/11	08/31/13	Other
USCG	Certificate Of Adequacy Waiver (Waiver to the Oil & Garbage requirements of 30 CFR 158.150)	16450	01/27/92	08/02/12 or as long as the facility does not perform any operations which would require a revocation	Transportation
USCG	Certificate Of Documentation (Miss Rene - Hawk Inlet off-load barge)	616206	06/28/11	06/30/12; Annual Renewal	Transportation
USCG	Certificate Of Documentation (UMTB 165 Replacement Young Bay Breakwater (in Juneau)	642888	06/28/11	06/30/12; Annual Renewal	Transportation
USCG	Special Permit-Bulk Shipments	SP 7-95	07/08/09	07/31/13	Transportation
USDJ	ATF Explosives Permit	9-AK-110-33-8G-91620			Other
USDOT	Hazardous Materials Certificate Of Registration	050109 550 058RT	05/19/12	06/30/15	Transportation
USFS	Lease-Mine Portal/Mill Site (61.19 acres or 24.76 ha)	4050-03; Amendment 6	Original 08/12/86;Amend 6 issued 04/27/94	Until mineral deposit is exhausted or upon failure to use the leased site for two years unless waived by the Forest Supervisor	Land
USFS	Lease for Milling - 1350 Portal and Campsite (9.82 acres or 3.97 ha)	4050-09	12/31/86	Until mineral deposit is exhausted or upon failure to use the leased site for two years unless waived by the Forest Supervisor	Land

Agency	Description	Number	Issue Date	Expiration Date	Category
USFS	Communications Site (microwave tower) Special Use Permit (0.18 acres or 0.07 ha) Amendment 2	ADM113 (renum.4050-11); Amendment 2 name change ADM227	06/15/09	12/31/19	Land/Comm
USFS	Special Use Permit-Road (146 acres or 59 ha) Amendment 1	ADM4050-02; ADM228	12/31/97; 06/15/09	Life of project need	Land
USFS	Waste Area E (10.8 acres or 4.4 ha) Amendment 3	4050-08; Amendment 1; Amendment 2; Amendment 3 number changed to ADM229	10/27/87; 11/23/87; 01/24/01; 06/15/09	Until mineral deposit is exhausted or upon failure to use the leased site for two years unless waived by the Forest Supervisor	Land
USFS	Lease for Mining (123 acres or 50 ha) Tailings & Pipeline – Stage II Expansion Amendment 2	ADM 4050-10; Amendment 1: Amendment 2 number changed to ADM230	09/01/88; 04/05/04; 06/15/09	Until mineral deposit is exhausted or upon failure to use the leased site for two years unless waived by the Forest Supervisor	Land
USFS	DM - Approval of Surface Exploration Work Plan 2013	Decision Memo		12/31/2013	Land/Exploration
USFS	General Plan Of Operations (2 Binder document. Approved update to 1984 GPO document)	GPO	11/14/95	Life Of Project	
USFS	GPO Appendices Appendix 1 Appendix 2 Appendix 3 Appendix 4 Appendix 5 Appendix 6 Appendix 7 Appendix 8 Appendix 9 Appendix 10 Appendix 11 Appendix 12 Appendix 13 Appendix 14 Appendix 15	GPOs	10/06/00 05/02 04/23/04 08/95 09/21/07 09/09/06 11/08 12/05 09/18/06 07/96 08/31/00 03/95 12/20/05 10/03 12/05	various	
Other	Joint Venture Agreement - Hawk Inlet Warranty Deed		01/10/78; Effective 09/30/84		

20.7 Considerations of Social and Community Impacts

20.7.1 Community Consultation

Consultation Strategy

In partnership with the appropriate internal and external resources, Hecla staff develop and implement a communities relations plan by determining the communities and stakeholders potentially impacted; defining issues that are important to stakeholders; establishing objectives consistent with what Hecla and the affected communities want to accomplish; determining the consultation methods to best build stakeholder partnerships; developing an annual budget sufficient to support the communities relations plan; and determining and implementing methods for measuring the effectiveness of the communities relations plan.

Consultation Methodologies

For communities relations plan efforts, Hecla staff consults with a variety of sources to identify and ensure an understanding of the needs of the surrounding communities and to determine appropriate programs for filling those needs. These include community leaders; educators; private and public sector professional counterparts; environmental organizations and Hecla employees.

Hecla management, in conjunction with external consultants such as the McDowell Group as required, monitors socio-economic trends, community perceptions and impacts. These consultations are in part analyzed to establish appropriate community programs. The involvement of third-party professional assistance for consultation provides an independent view for the stakeholders.

Hecla executes the charitable contribution aspects of the communities relations plan by handling new requests for assistance and maintaining existing programs. In addition, Hecla encourages employee membership in civic and business-related groups, and conducts research on surrounding community attitudes toward the Greens Creek mine by utilizing internal and external resources.

Baseline information is used to make enhancements to the communities relations plan and where possible provide additional focus on Native Alaskan stakeholders within the operational area to ensure any concerns and interests about Hecla activities are understood and addressed. Many activities, including employment opportunities and environmental compliance, are important to these groups.

20.8 Community Advisory Group

The Hecla Greens Creek Mining Company Community Advisory Group (CAG) has been convened by Greens Creek to ensure its business and community relations planning processes incorporate the input and values of our multi-faceted community.

The community advisory group is part of a collaborative effort between Hecla and its affected stakeholder constituencies to ensure representative community input is considered in the social, economic and environmental aspects of the planning process.

The mission of the CAG is to provide Hecla with thoughtful and informed recommendations related to the social, economic and environmental issues. It is understood that the CAG’s viewpoint and subsequent recommendations are intended to be a reflection of the public’s various positions. CAG input will include viewpoints on municipal, academic, environmental, philanthropic and civic issues and opportunities.

The CAG workgroup represents a balance of community interests. Each member of the CAG will attend quarterly CAG meetings and actively participate in the development of CAG recommendations to Greens Creek.

The CAG has 10–12 members, representing informed views from stakeholder constituencies including

- Juneau and Angoon: administrators responsible for community well-being and taxes;
- Environmental community:
- Groups concerned with land, air and water use;
- Business community: vendors, suppliers, shippers and labor sources;
- Educational community: academic and technical institutions at all levels;
- Human services community: civic, arts, culture and charitable organizations.

The guiding principles of the CAG are to:

- Consider opportunities for Hecla to enhance the economic, social and environmental well-being of the local communities;
- Recognize the legitimacy of each other’s goals and opinions;
- Seek a constructive format for providing input;
- Commit to listen carefully and ask clarifying questions;
- Articulate interests, problems and opportunities – not positions;
- Agree to keep respective constituencies informed of CAG progress.

Specific objectives for the CAG in the next two years include continuing review of the 2013 community perception surveys in Juneau and Angoon, and input on how to better target mutually beneficial business partnerships and educational efforts.

20.8.1 Land Usage Considerations

The land comprising the Greens Creek mine, inclusive of all Admiralty Island facilities, consists of both publicly and privately owned uplands and tidelands. Hecla leases parcels from the United States on both the Monument and non-Monument lands. Hecla also uses other public lands pursuant to special use permits issued by the USFS and leases issued by the State of Alaska (refer to Table 20-2).

20.9 Comments on Environmental Studies, Permitting, and Social or Community Impact

In the opinion of the QPs:

- Hecla has sufficiently addressed the environmental impact of the operation, and subsequent closure and remediation requirements that Mineral Resources and Mineral Reserves can be declared, and that the mine plan is appropriate and achievable. Closure provisions are appropriately considered. Monitoring programs are in place;
- The mine currently holds the appropriate social licenses to operate;
- Hecla has developed a communities' relations plan to identify and ensure an understanding of the needs of the surrounding communities and to determine appropriate programs for filling those needs. The company appropriately monitors socio-economic trends, community perceptions and mining impacts.
- Permits held by Hecla for the Project are sufficient to ensure that mining activities are conducted within the regulatory framework required by Alaskan State and Federal regulations. Applications have been made for permitting a TSF expansion;
- Exploration permits are dependent on USFS annual renewal. Although, for the past 10 years, Hecla has received the appropriate permits, there is a risk that future permit grant could be delayed.
- There are no currently known risks to estimation of Mineral Resource or Mineral Reserves that are not discussed in this Report. Development of the Gallagher zone is dependent upon additional understanding of extralateral rights.

21.0 CAPITAL AND OPERATING COSTS

21.1 Capital Cost Estimates

21.1.1 Basis of Estimate

Total LOM remaining capital costs are estimated at $316.6 M. Future capital costs are estimated based on expected sustaining capital requirements of the mine. Development costs are estimated based on past experience and are adjusted for any future anticipated changes in factors which would affect cost and amount of development. The timing of equipment replacement and rebuilds are based on replacement and rebuild schedules, and the anticipated cost is based on actual experience. In the later years of the LOM, costs are estimated for estimated equipment required to sustain production.

21.1.2 Mine Capital Costs

Mine capital costs consist predominantly of replacement of equipment and major equipment rebuilds to sustain production through LOM, as well as anticipated underground development and capitalized drilling and infrastructure needs. Total LOM capital related to the mine is estimated at $187.9 M. This figure includes $56.3 M for mine mobile equipment, $10.7 M for other mining equipment, $94.1 M for mine rehabilitation and development, and $26.8 M for mine definition drilling.

Capital development costs have been estimated based on the expected amount development in each year and the anticipated costs of development. This is derived from past experience with updates to the cost based on projected changes in items that would affect costs. Total LOM mine development is estimated at $94.1 M.

Included within the mine capital cost estimate is provision for mine rehabilitation; these costs are primarily ground support and labor costs, which are estimated based on expected rehabilitation activities to be performed in specific years.

Capitalized drilling expenditures are estimated based on the anticipated amount of drilling in a specific year and an expected cost for the drilling program for each specific year. Total LOM capitalized drilling costs are projected to be $26.7 M.

21.1.3 Process Capital Costs

Process capital costs are estimated based on specific projects which are anticipated to be undertaken. In these cases cost estimates are provided by project management, and long-term capital is anticipated based on prior experience regarding the amount of sustaining capital which is expected for the mill to maintain anticipated production levels.

Specific projects which are expected to be completed include:

- Replacement of the lead side bulk cells ($3.8 M),
- Tails thickener bridge ($0.2 M)
- Reagent tanks ($0.1 M)
- Conveyer belt pans and links ($0.3 M).

In addition, it is anticipated that upgrades will take place to the mill building including replacement of the roof ($0.3 M), shop doors ($0.1 M) and an upgrade to the ventilation system ($0.4 M).

21.1.4 Infrastructure Capital Costs

Various surface infrastructure and environmental capital costs are anticipated to maintain operation of the mine and total $78.6 M over the LOM. During this period a tailings expansion project is budgeted to take place and is expected to cost $37.0 M over the LOM. The remaining $41.6 M is composed of various surface infrastructure and environmental projects and other sustaining capital items.

Major projects within the $46.1 M allocation include:

- An upgrade to the barge loading facilities at Hawk Inlet, and remodel work on the Hawk Inlet camp facilities ($3.2 M);
- Improvements to the warehouse at Hawk Inlet and the main warehouse ($3.8 M),
- Upgrades to the site-wide fire suppression systems ($1.1 M);
- Corrosion abatement work on the marine facilities ($2.7 M);
- Concrete overlay work to be completed ($5.6 M).

21.1.5 General and Administrative Capital Costs

General and administrative (G&A) capital costs are anticipated to be $3.7 M over the LOM, and the estimate is primarily composed of sustaining capital items.

21.1.6 Owner (Corporate) Capital Costs

Owners costs are included in the estimate of certain construction and development costs; these are primarily composed of labor, however, other costs are included such as internally-procured supplies, fuel and electricity,

21.1.7 Sustaining Capital

Included within each department above are costs related to other sustaining capital which is an estimate made for items not specifically planned. However it is expected that capital costs will be incurred to maintain anticipated production levels. The LOM other sustaining capital estimate totaled $76.9 M and consists of:

- Mine Mobile Equipment $21.6 M;
- Other Mine Equipment $4.8 M;
- Process $15.5 M;
- Surface Infrastructure $12.5 M;
- Surface Equipment $13.5 M;
- Environmental $6.1 M;
- General and Administrative $2.9 M.

21.1.8 Contingency

Contingency is added to the planned capital estimates. Contingency percentages typically applied range from 5% to 30% based on the characteristics of the underlying work program.

21.1.9 Capital Cost Summary

The LOM capital cost estimate is summarized in Table 21-1.

Table 21-1: Capital Cost Estimate (Figures in $000)

Item	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	LOM Total
Mine Mobile Equipment	9,244	6,771	12,617	7,981	6,104	5,000	4,000	2,500	1,500	590	56,308
Other Mine Equipment	1,310	5,100	630	630	630	600	600	500	500	197	10,697
Total Mine	10,554	11,871	13,247	8,611	6,734	5,600	4,600	3,000	2,000	787	67,004
Process	4,159	3,370	2,850	2,800	2,500	2,000	1,500	1,000	667	262	21,108
Surface Infrastructure - Amortizable Assets	1,845	13,054	9,000	6,150	3,000	3,000	1,000	—	—	—	37,050
Surface Infrastructure - Other Assets	11,109	8,325	2,355	2,000	2,000	1,500	1,000	1,000	667	262	30,218
Surface Mobile Equipment	7,097	4,124	3,304	2,843	2,483	2,000	1,500	1,000	667	262	25,279
Environmental	3,363	3,000	1,000	1,000	1,000	750	500	375	188	188	11,363
Administration	931	500	500	500	500	300	200	150	75	75	3,731
Surface, Environmental and Administration	*24,345*	*29,003*	*16,159*	*12,493*	*8,983*	*7,550*	*4,200*	*2,525*	*1,597*	*787*	*107,641*
Capital Excluding Mine Development, Rehab and Development	*39,058*	*44,245*	*32,256*	*23,904*	*18,216*	*15,150*	*10,300*	*6,525*	*4,263*	*1,836*	*195,753*
Capitalized Mine Development and Rehabilitation Costs	32,828	27,275	15,153	5,008	5,164	3,550	2,364	1,833	927	0	94,103
Capitalized Definition Drilling Costs	5,174	5,546	5,545	5,253	5,254	—	—	—	—	—	26,772
Total Capital Costs	***77,060***	***77,066***	***52,954***	***34,166***	***28,634***	***18,700***	***12,664***	***8,358***	***5,190***	***1,836***	***316,628***

21.2 Operating Cost Estimates

21.2.1 Basis of Estimate

Total LOM operating costs are anticipated to be $154.94/ton ($170.79/tonne) milled. The operating costs included in the LOM are derived from the 2013 budget for the near-term and adjusted for factors regarding expected cost changes in the later years. The budget is built using various cost inputs including operating experience, quotes from various service providers, anticipated personnel changes, and changes in production.

Fuel and power costs are variable by year, averaging about 6% each of total production costs in 2012, but ranged from 4-13% each in the last five years. A key driver of the cost fluctuation is the unpredictable availability of less expensive hydroelectric power to the site. When precipitation in southeastern Alaska is low, and hydroelectric power is unavailable or reduced, the mine must generate electricity on-site using diesel generators.

21.2.2 Mine Operating Costs

The LOM mining cost per ton is anticipated to be $66.32/ton ($73.11/tonne) milled. These costs include expected direct cost for the mining process (drilling, blasting, mucking, hauling) such as labor, ground support, explosives, and diesel fuel. Diesel fuel was estimated at $3.75/gallon ($0.99/liter) in the LOM; however, fluctuations in the price of diesel fuel will affect operating costs.

In addition, mining costs include production drilling costs, ore access development costs, backfill, equipment and electrical maintenance, underground service crews and mine management and technical service costs. Mining costs in the final three years of production were increased by 10% (included in the $66.32/ton ($73.11/tonne) LOM average annual cost), in order to maintain the projected 2,200 tons/day (1,996 tonnes/day) mining rates near the end of the mine life.

21.2.3 Process Operating Costs

LOM milling cost per ton is anticipated to be $33.43/ton ($36.85/tonne) milled. These costs include labor, maintenance, reagents and grinding media, and electricity. Mill consumables and electricity were estimated based on an expected usage rate per ton milled; other costs such as labor were estimated as fixed costs.

Power is both purchased from the local utility company at a rate of approximately $0.10 per kWh, and generated onsite for an expected LOM rate of $0.36 per kWh.

The LOM plan estimates purchasing 464 million kWh of power from the locally utility and generating 240 million kWh onsite.

21.2.4 Infrastructure Operating Costs

Surface infrastructure costs are estimated at $24.17/ton ($26.64/tonne) milled. These costs primarily consist of labor, surface maintenance costs, fuel, and power usage. Activities included in these costs include concentrate and tailings haulage, road maintenance, tailings placement, buildings maintenance, concentrate ship loading, freight haulage and water treatment operations.

21.2.5 General and Administrative Operating Costs

G&A operating costs are estimated to be $31.02/ton ($34.19/tonne) milled over the LOM. This includes $3.02/ton ($3.32/tonne) milled for the environmental department operating costs. These costs mainly consist of labor for accounting, human resources, purchasing, health and safety, management, various insurance costs, property taxes, communications and IT services. In addition to these costs, G&A costs include costs for providing camp facilities and transportation services for the Greens Creek workforce.

21.2.6 Owner (Corporate) Operating Costs

Included within the G&A costs are Owner management costs paid to the corporate entity.

21.2.7 Operating Cost Summary

The LOM operating cost estimate is summarized in Table 21-2.

Table 21-2: LOM Operating Cost Estimate

Item	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Total
Mine	50,809	50,314	52,037	51,991	52,301	53,763	53,611	57,025	57,633	21,063	500,546
Process	25,089	25,393	25,674	26,198	26,525	27,899	28,147	28,448	28,663	10,270	252,306
Surface Operations	19,435	19,054	19,204	19,231	19,332	19,574	19,618	19,671	19,709	7,578	182,405
Environmental	2,423	2,423	2,423	2,423	2,423	2,423	2,423	2,423	2,423	953	22,759
Administration	22,668	22,585	22,548	22,436	22,455	22,455	22,455	22,455	22,455	8,836	211,347
Total Production Costs	*120,423*	*119,769*	*121,886*	*122,279*	*123,036*	*126,113*	*126,253*	*130,021*	*130,882*	*48,700*	*1,169,363*
	Note: Figures above in $000										
Tons of Ore Milled	803,000	803,000	803,000	805,200	803,000	803,000	803,000	805,200	803,000	315,980	7,547,380

Cost per Ton Milled	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Total
Mine	63.27	62.66	64.80	64.57	65.13	66.95	66.76	70.82	71.77	66.66	66.32
Process	31.24	31.62	31.97	32.54	33.03	34.74	35.05	35.33	35.69	32.50	33.43
Surface Operations	24.20	23.73	23.92	23.88	24.08	24.38	24.43	24.43	24.54	23.98	24.17
Environmental	3.02	3.02	3.02	3.01	3.02	3.02	3.02	3.01	3.02	3.02	3.02
Administration	28.23	28.13	28.08	27.86	27.96	27.96	27.96	27.89	27.96	27.96	28.00
Total Cost per Ton Milled	***149.97***	***149.15***	***151.79***	***151.86***	***153.22***	***157.05***	***157.23***	***161.48***	***162.99***	***154.12***	***154.94***

Tonnes of Ore Milled	728,470	728,470	728,470	730,465	728,470	728,470	728,470	730,465	728,470	286,652	6,846,870

Cost per Tonne Milled	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Total
Mine	69.75	69.07	71.43	71.17	71.80	73.80	73.59	78.07	79.12	73.48	73.11
Process	34.44	34.86	35.24	35.87	36.41	38.30	38.64	38.94	39.35	35.83	36.85
Surface Operations	26.68	26.16	26.36	26.33	26.54	26.87	26.93	26.93	27.05	26.44	26.64

Cost per Tonne Milled	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Total
Environmental	3.33	3.33	3.33	3.32	3.33	3.33	3.33	3.32	3.33	3.33	3.32
Administration	31.12	31.00	30.95	30.71	30.82	30.82	30.82	30.74	30.82	30.82	30.87
Total Cost per Tonne Milled	***165.31***	***164.41***	***167.32***	***167.40***	***168.90***	***173.12***	***173.31***	***178.00***	***179.67***	***169.89***	***170.79***

21.3 Comments on Capital and Operating Costs

The QP has reviewed the capital and operating cost provisions for the LOM plan that supports Mineral Reserves and consider that the basis for the estimates that include mine budget data, vendor quotes, and operating experience, is appropriate to the known mineralization, mining and production schedules, marketing plans, and equipment replacement and maintenance requirements. Appropriate provision has been made in the estimates for the expected mine operating usages including labor, fuel and power and for closure and environmental considerations. Capital cost estimates include appropriate Owner, sustaining and contingency estimates.

Capital costs over the LOM total $316.6 M; operating costs total $1.1 B, or $154.94/ton ($170.79/tonne) milled.

22.0 ECONOMIC ANALYSIS

22.1 Methodology Used

The results of the economic analysis to support Mineral Reserves represent forward-looking information that is subject to a number of known and unknown risks, uncertainties and other factors that may cause actual results to differ materially from those presented here.

Forward-looking statements in this Report include, but are not limited to, statements with respect to future metal prices and concentrate sales contracts, the estimation of Mineral Reserves and Mineral Resources, the realization of Mineral Reserve estimates, the timing and amount of estimated future production, costs of production, capital expenditures, costs and timing of the development of new ore zones, permitting time lines for the tailings storage expansion requirements for additional capital, government regulation of mining operations, environmental risks, unanticipated reclamation expenses, title disputes or claims and limitations on insurance coverage.

Additional risk can come from actual results of current reclamation activities; conclusions of economic evaluations; changes in Project parameters as mine and process plans continue to be refined, possible variations in ore reserves, grade or recovery rates; geotechnical considerations during mining; failure of plant, equipment or processes to operate as anticipated; shipping delays and regulations; accidents, labor disputes and other risks of the mining industry; and delays in obtaining governmental approvals.

22.1.1 Basis of Financial Analysis

To support declaration of Mineral Reserves, Hecla prepared an economic analysis to confirm that the economics based on the Mineral Reserves could repay life-of-mine operating and capital costs.

Operating costs were developed by Project personnel, based on a combination of actual 2012 costs, previous operating experience over the past 24 years, and 2013 budget figures and trends. Capital costs were based on operating experience, 2013 budget figures, and vendor quotes.

The Project was evaluated on an after-tax, project stand-alone, 100% equity-financed basis at the Project level, using a 5% discount rate, and all costs prior to 31 December 2012 were treated as sunk costs. Metal prices used in the evaluation were:

- Gold: $1,500.00/oz;
- Silver: $27.00/oz;

- Lead: $0.80/lb;
- Zinc: $0.80/lb.

At the time the financial evaluation was completed, these prices represented applicable three-year trailing average.

Results of this assessment indicated positive Project economics until the end of mine life, and supported Mineral Reserve declaration.

22.1.2 Sensitivity Analysis

Sensitivity analysis was performed on the base case net cash flow. Positive and negative variations were applied independently to each of the following parameters:

- Metal prices;
- Metal grades;
- Metal recoveries;
- Capital costs;
- Operating costs.

The results of the sensitivity analysis demonstrate that the Mineral Reserve estimates are most sensitive to variations in metal price, less sensitive to changes in metal grade and recoveries, and least sensitive to fluctuations in operating and capital costs.

22.2 Comments on Economic Analysis

The QP has reviewed the financial analysis and confirm that the Project has positive economics until the end of mine life, which supports Mineral Reserve declaration.

The QP note that there is upside for the Project if some or all of the Inferred Mineral Resources estimated for the Project can be upgraded to higher confidence Mineral Resource categories and eventually to Mineral Reserves.

23.0 ADJACENT PROPERTIES

There are no adjacent properties that are relevant to the Report.

24.0 OTHER RELEVANT DATA AND INFORMATION

There are no additional data that are relevant to this Report.

25.0 INTERPRETATION AND CONCLUSIONS

The QPs, as authors of this Report, have reviewed the data for the Project and have made the following conclusions and interpretations.

25.1 Mineral Tenure, Surface Rights, Royalties, Environment, Social and Permits

- Mining tenure held by Hecla in the areas for which Mineral Resources and Mineral Reserves are estimated is valid;
- Royalties are payable on USFS lands and to Bristol;
- Development of the Gallagher zone is dependent upon additional understanding of extralateral rights;
- Hecla holds, or has the right to obtain, sufficient surface rights to support mining operations over the underground planned life-of-mine that was developed based on the year-end 2012 Mineral Reserves. Hecla leases parcels from the United States on both the Monument and non-monument lands. Hecla uses other public lands pursuant to special use permits issued by the USFS and leases issued by the State of Alaska;
- Permits held by Hecla for the Project are sufficient to ensure that mining activities are conducted within the regulatory framework required by Alaskan State and Federal regulations;
- Exploration permits are dependent on USFS annual renewal. Although, for the past 10 years, Hecla has received the appropriate permits, there is a risk that future permit grant could be delayed;
- A tailings storage facility expansion is planned. A request for an expansion of the TSF was requested from the USFS in 2010, with the intent to have the permitting process completed a few years prior to reaching capacity at the existing facility. A Record of Decision is expected from the USFS in 2013, which will state whether the proposed expansion is approved, or whether a new TSF at a different location will be approved;
- Hecla has sufficiently addressed the environmental impact of the operation, and subsequent closure and remediation requirements that Mineral Resources and Mineral Reserves can be declared, and that the mine plan is appropriate and achievable. Closure provisions are appropriately considered. Monitoring programs are in place;

- The existing infrastructure, availability of staff, the existing power, water, and communications facilities, the methods whereby goods are transported to the mine, and any planned modifications or supporting studies are sufficiently well-established, or the requirements to establish such, are well understood by Hecla, and can support the declaration of Mineral Resources and Mineral Reserves and the current mine plan;
- The mine currently holds the appropriate social licenses to operate;
- Hecla has developed a communities' relations plan to identify and ensure an understanding of the needs of the surrounding communities and to determine appropriate programs for filling those needs. The company monitors socio-economic trends, community perceptions and mining impacts.

25.2 Geology and Mineralization

- The geological understanding of the settings, lithologies, and structural and alteration controls on mineralization in the different zones is sufficient to support estimation of Mineral Resources and Mineral Reserves. The geological knowledge of the area is also considered sufficiently acceptable to reliably inform mine planning;
- The mineralization style and setting is well understood and can support declaration of Mineral Resources and Mineral Reserves. The deposit displays a range of syngenetic, diagenetic, and epigenetic features that are typical of volcanic-hosted massive sulfide deposits, sedimentary exhalative, and Mississippi Valley-type genetic models. The QPs concur with the interpretation of a hybrid model style and consider the model and interpreted deposit genesis to be appropriate to support exploration activities.

25.3 Exploration, Drilling, Analysis and Data Verification

- Greens Creek's historical exploration activities, prior to Hecla's acquisition of the land package in March 2008, are extensive. Exploration activities commenced in 1973 and to 2008 comprised surface reconnaissance exploration, geological and structural mapping, geochemical sampling, airborne, ground and down-hole geophysical surveys, surface and underground drilling, engineering studies and mine development;
- Since 2008, Hecla has continued geological and structural mapping programs, ground and down-hole geophysical surveys, surface and underground drilling, engineering studies and mining activities. In conjunction with the USGS, a professional paper describing the deposit characteristics has been completed. A number of research studies have also been undertaken;

- The exploration programs completed to date are appropriate to the style of the deposit and prospects. The research work supports Hecla's genetic and affinity interpretations for the deposits. Additional exploration has a likelihood of generating further exploration successes particularly down-dip of known orebodies;
- A total of 5,541 drill holes (2,722,950 ft or 829,955 m) have been completed over the entire Project area in the period 1975 to 2012 (Figure 14-1). Of these drill holes, 365 (403,279 ft or 122,919 m) are surface holes drilled for exploration or resource development purposes, 3,487 (1,967,811 ft or 599,789 m) are underground resource definition drill holes, which are typically drilled on 50 to 200 ft (15 m to 60 m) spaced vertical sections, and 1,689 (351,860 ft or 107,247 m) are underground pre-production drill holes that are drilled on cross- and plan-sections spaced from 20 to 50 ft (6 to 15 m);
- All bedrock drilling has been completed using core methods. Surface drill holes collared in unconsolidated sediments utilize RC methods until bedrock is encountered (typically less than 100 ft or 30 m), and are then completed using core methods;
- The quantity and quality of the lithological, geotechnical, collar and down hole survey data collected in the exploration, delineation, underground, and grade control drill programs are sufficient to support Mineral Resource and Mineral Reserve estimation;
- Sampling methods are acceptable, meet industry-standard practice, and are acceptable for Mineral Resource and Mineral Reserve estimation and mine planning purposes;
- The quality of the analytical data is reliable and sample preparation, analysis, and security are generally performed in accordance with exploration best practices and industry standards;
- Regular data verification programs undertaken by third-party consultants in the period 1995 to date on the data collected from the Project acceptably support the geological interpretations and the database quality, and therefore support the use of the data in Mineral Resource and Mineral Reserve estimation, and in mine planning.

25.4 Metallurgical Testwork

- Metallurgical testwork and associated analytical procedures were appropriate to the mineralization type, appropriate to establish the optimal processing routes, and were performed using samples that are typical of the mineralization styles found within the Project;

- Samples selected for testing were representative of the various types and styles of mineralization. Samples were selected from a range of depths within the deposit. Sufficient samples were taken so that tests were performed on sufficient sample mass. As mining progresses deeper and/or new mining zones are identified, additional variability tests are undertaken as required;
- Testwork results have been confirmed by production data;
- Since mill construction and startup, numerous internal and external studies have been performed to investigate metallurgical issues and support mill modifications;
- Mill process recovery factors are based on production data, and are considered appropriate to support Mineral Resource and Mineral Reserve estimation, and mine planning;
- Ore hardness, reagent consumptions and process conditions are based on both testwork and production data;
- Recovery factors vary on a day to day basis depending on grade and mineralization type being processed. These variations are expected to trend to the forecast LOM recovery value for monthly or longer reporting periods.

25.5 Mineral Resource and Mineral Reserve Estimates

- Mineral Resources and Mineral Reserves for the Project, which have been estimated using core drill data, have been performed to industry best practices, and conform to the requirements of CIM (2010). The Mineral Reserves are acceptable to support mine planning;
- Reviews of the environmental, permitting, legal, title, taxation, socio-economic, marketing and political factors and constraints for the Project support the declaration of Mineral Reserves using the set of assumptions outlined;
- Factors which may affect the estimates include: commodity price assumptions; changes to the assumptions used to construct the NSR values used to constrain the estimates; metallurgical recovery assumptions; changes to the geotechnical and hydrogeological parameters used for stope and mine design; dilution assumptions; changes to capital and operating cost estimates, in particular to fuel and power cost assumptions; changes to royalty payment assumptions; changes to the type and quantity of concentrates to be produced.

25.6 Life-of-Mine Plan

- Underground mine plans are appropriately developed to maximize mining efficiencies, based on the current knowledge of geotechnical, hydrological, mining and processing information on the Project;
- Production forecasts are achievable with the current equipment and plant, replacements have been acceptably scheduled;
- The predicted mine life to 2022 is achievable based on the projected annual production rate and the Mineral Reserves estimated;
- The current process facilities are appropriate to the mineralization styles in the underground operations and the existing process facilities will support the current life-of-mine plan;
- Hecla is able to market the gravity products, lead, zinc, and bulk concentrates produced from the Project. The terms contained within existing sales contracts are typical and consistent with standard industry practice, and are similar to contracts for the supply of gravity products and base metal concentrates elsewhere in the world;
- ISFs are being phased out which can affect long-term marketing of bulk concentrates. Hecla has existing frame contracts in place and relationships with other buyers for such concentrates, and it is a reasonable expectation that the bulk concentrates will be able to continue to be marketed;
- Infrastructure required to support mining activities is sufficient for the current LOM.

25.7 Financial Analysis Supporting Mineral Reserve Declaration

- As a producing issuer, Hecla's financial evaluation has been performed to support Mineral Reserve declaration. The QPs have reviewed the financial analysis and confirm that the Project has positive economics until the end of mine life, which supports Mineral Reserve declaration;
- The results of a sensitivity analysis demonstrate that the Mineral Reserve estimates are most sensitive to variations in metal price, less sensitive to changes in metal grade and recoveries, and least sensitive to fluctuations in operating and capital costs.

25.8 Conclusions

In the opinion of the QPs, the Project that is outlined in this Report has met its objectives. Mineral Resources and Mineral Reserves have been estimated for the

Project, a mine has been constructed, mining and milling operations are performing as expected, and reconciliation between mine production and the mineral resource model is acceptable. This indicates the data supporting the Mineral Resource and Mineral Reserve estimates were appropriately collected, evaluated and estimated, and the original Project objective of identifying mineralization that could support mining operations has been achieved.

25.9 Risks and Opportunities

The Greens Creek mine is a long-established operation with a clear understanding of challenges facing the company in exploiting the ore zones. The following risks and opportunities are noted.

25.9.1 Risks

Risks that can affect the mining operations, mine plan assumptions and therefore the Mineral Reserve estimates include:

- Loss of access travel ways (damaged inter-level ramps, slots, sublevels, or connection drifts is an ongoing problem but one that is kept well in hand through constant repair and maintenance in the active headings);
- Volumetric inadequacies in the ventilation system, which is currently under control but is dependent upon changes to the regulatory stance on diesel particulate matter. Production expansion is limited by ventilation but plans to rectify this situation and increase airflow volume mine-wide are being considered;
- Metal price forecasts are inherently difficult to rely upon. Actual prices will differ to some extent from the forecasts used herein
- The ability to continue to recruit skilled technical professionals and miners to meet operational needs;
- Ore grade assumptions may not be met due to structural or other unforeseen dilution;
- Mining costs may be higher or lower than expected;
- Environmental compliance may become cost or permit prohibitive;
- Smelter agreements may change, possibly substantially;
- Smelting capacity may become unavailable.

25.9.2 Opportunities

Project opportunities include:

- Upside potential if some or all of the Inferred Mineral Resources estimated for the Project can be upgraded to higher confidence Mineral Resource categories and eventually to Mineral Reserves. Additional potential exists where higher confidence Mineral Resource categories may be able to be upgraded to Mineral Reserves. There is existing exploration potential, which, with appropriate drilling, may also support future Mineral Resource estimation.
- Mine planning to allow the use of the more cost-effective long-hole stoping method may provide upside by increasing production tonnages while potentially decreasing mining costs. Investigations into other mining methods may result in adoption of a new approach that could improve future safety and profitability;
- Continued metallurgical testwork may show mineral treatment adjustments that could increase metal recoveries or create more attractive metal concentrates to the target smelters. Improvements made in the processing plant could have a positive impact on costs and recovery, improving the mine's profitability;
- A continued enhanced focus on safety may uncover new technology or processes that will further reduce incident frequency and severity.

26.0 RECOMMENDATIONS

The QPs have reviewed the information on the Greens Creek mining operation and have no meaningful recommendations to make for further work.

27.0 REFERENCES

27.1 Bibliography

Alaska Department of Revenue, 2012: Mining License Tax: information posted to Alaska Department of Revenue website, accessed 1 March 2013, http://www.tax.alaska.gov/programs/programs/index.aspx?60610.

Alaska Department of Natural Resources Division of Mining, Land and Water, 2009: Mining Laws and Regulations As Contained in the Alaska Statutes and Alaska Administrative Code: booklet produced by the Alaska Department of Natural Resources, 2009, 76 p.

AMEC, 2002: Letter Report – Review of Central West Zone Resource Model, Greens Creek, Alaska: unpublished internal report prepared by AMEC E&C Services Inc. for Kennecott Greens Creek Mining Company, November 2002.

AMEC, 2003: 2002 Resource and Reserve Audit, Greens Creek Mine, Alaska: unpublished internal report prepared by AMEC E&C Services Inc. for Kennecott Greens Creek Mining Company, February 2003.

AMEC, 2004: 2003 Review – 9A & Northwest West Zones, Greens Creek Mine, Alaska: unpublished internal report prepared by AMEC E&C Services Inc. for Kennecott Greens Creek Mining Company, March 2004.

AMEC, 2006: 2005 Review – 200S, 5250, NWW and SWB Zones, Greens Creek Mine, Alaska: unpublished internal report prepared by AMEC E&C Services Inc. for Kennecott Greens Creek Mining Company, March 2006.

AMEC, 2008: 2007 Reserve Audit, 5250N and Northwest West Deposits; Resource Audit, 5250N and Gallagher, Greens Creek Mine, Alaska: unpublished internal report prepared by AMEC E&C Services Inc. for Kennecott Greens Creek Mining Company, June 2008.

AMEC, 2008: Review of 2009 Life-of-Mine Plan, Greens Creek Mine, Alaska: unpublished internal report prepared by AMEC E&C Services Inc. for Hecla Mining Company, November, 2008.

AMEC, 2010: 2009 Review – 5250 and 9A Zones, Greens Creek Mine, Alaska: unpublished report prepared by AMEC E&C Services Inc. prepared for Hecla Greens Creek Mining Company, November, 2010.

AMEC, 2013: 2012 Reserve Audit: draft of unpublished internal report prepared by AMEC E&C Services Inc. prepared for Hecla Greens Creek Mining Company, March 2013.

Anderson, V.M., and Taylor, C.D., 2000: Alteration Mineralogy and Zonation in Host Rocks to the Greens Creek Deposit, Southeastern Alaska: Geological Society of American Cordilleran Section Meeting, Abstracts with Programs, v. 32. no. 6, p. A-2.

Armstrong, S., 2011: Cleaner Flotation Testing on a New Sample of Baritic Ore: Our Project P-4167: unpublished Dawson Metallurgical Laboratories Letter Report to John Ackerman, 2011.

Asarte, P., 2011: Backfill Acid Consumption: unpublished Hecla Greens Creek Mining Company internal memorandum, May 5, 2011.

Banning, S.W., 1983: Metallurgical Evaluation of the Greens Creek Orebody: internal memorandum, Noranda Mining Inc., 1983.

Blake, C., 2009: Greens Creek Mine: Silver and Base Metal Mineralogy of a Suite of Products from the Lead Circuit: unpublished internal memorandum prepared by Chris Blake of Clevedon, United Kingdom for Hecla Greens Creek Mining Company, 2009.

Bureau of Land Management, 2011a: Mining Claim Information: article posted to US Department of Interior, Bureau of Land Management website, accessed 1 March 2013, http://www.blm.gov/az/st/en/prog/mining/requirements.html.

Bureau of Land Management 2011b: Mining Claims and Sites on Federal Lands: publication by the Bureau of Land Management, 2011, 44 p.

Bureau of Land Management, 2012: BLM Alaska Minerals Program: information posted to Bureau of Land Management website, accessed 1 March 2013, http://www.blm.gov/ak/st/en/prog/minerals.html.

Canadian Institute of Mining, Metallurgy and Petroleum (CIM), 2003: Estimation of Mineral Resources and Mineral Reserves, Best Practice Guidelines: Canadian Institute of Mining, Metallurgy and Petroleum, November 23, 2003, http://www.cim.org/committees/estimation2003.pdf.

Canadian Institute of Mining, Metallurgy and Petroleum (CIM), 2005: CIM Standards for Mineral Resources and Mineral Reserves, Definitions and Guidelines: Canadian Institute of Mining, Metallurgy and Petroleum, December 2005, http://www.cim.org/committees/CIMDefStds_Dec11_05.pdf.

Canadian Institute of Mining, Metallurgy and Petroleum (CIM), 2010: CIM Standards for Mineral Resources and Mineral Reserves, Definitions and Guidelines: Canadian Institute of Mining, Metallurgy and Petroleum, November 2010, http://www.cim.org/UserFiles/File/CIM_DEFINITON_STANDARDS_Nov_2010.pdf.

Canadian Securities Administrators (CSA), 2011: National Instrument 43-101, Standards of Disclosure for Mineral Projects, Canadian Securities Administrators.

Department of Mining, Land and Water, 2012: Water Rights: information posted to Department of Mining, Land and Water webpage, accessed 1 March 2013, http://dnr.alaska.gov/mlw/water/wrfact.cfm.

Dressler, J.S., and Dunbire, J.C., 1981: The Greens Creek Ore Deposit, Admiralty Island, Alaska: Canadian Institute of Mining and Metallurgy Bulletin, v. 74, no. 833, p. 57.

Franklin, J.M., and McRoberts, S., 2009: Report on Analytical Reliability and Method Selection for Hecla Greens Creek Mining Company.

Freitag, K., 2000: Geology and Structure of the Lower Southwest Orebody, Greens Creek Mine, Alaska: Colorado School of Mines Thesis.

Fulton, R: Geology and Geochemistry of the Hanging Wall Argillite, Greens Creek VHMS Deposit, Alaska: Implications for Ore Genesis and Exploration: unfinished PhD thesis, University of Tasmania.

Hoy, T., 1995: Sedimentary Hosted Exhalative Deposits of British Columbia, in B.C. Ministry of Energy, Mines and Natural Resources, Paper 95-8, pages 1-59

Jankovic, A., and Valery, W. Jnr., 2003: Performance Assessment and Optimizations of the Greens Creek Grinding Circuit: unpublished report prepared by the Julius Kruttschnitt Mineral Research Centre, 2003.

Lefebure, D.V. and Alldrick, D.J. 1996, Sediment hosted Cu+/-Ag+/Co in British Columbia, in Selected British Columbia Mineral Deposits, edited Sangster, D., B.C., Paper 96-17, Ministry of Energy, Mines and Natural Resources, pages 45-91.

MacIntyre, Don, 1995, Sedimentary Exhalative Zn-Pb-Ag deposits, in Selected British Columbia Deposit Profiles, Volume 1 – Metallic and Coal, edited by Lefebure, D.V., pages 68-102.

Mineral Resources Development Incorporated, 1998: Review of Resource Model and Reconciliation to Production, Greens Creek Mine: unpublished report prepared by Mineral Resources Development Incorporated for Kennecott Greens Creek Mining Company, March 1998.

Mineral Resources Development Incorporated, 1998: Face Sampling Study, Greens Creek Mine: unpublished report prepared by Mineral Resources Development Incorporated for Kennecott Greens Creek Mining Company, May 1998.

Mineral Resources Development Incorporated, 1998: Resource Modelling for Southwest Zone, Northwest West Zone, 200 South Zone: unpublished report prepared by Mineral Resources Development Incorporated for Kennecott Greens Creek Mining Company, December 1998.

Mineral Resources Development Incorporated, 1999: Resource Audit, 5250 Zone: unpublished report prepared by Mineral Resources Development Incorporated for Kennecott Greens Creek Mining Company, February 1999.

Mineral Resources Development Incorporated, 1999: Standard Bank London Limited, Greens Creek Initial Status Report: unpublished Independent Engineer's report prepared by Mineral Resources Development Incorporated for Standard Bank London Limited, December, 1999.

Mineral Resources Development Incorporated, 1999: CIBC World Markets, Greens Creek Due Diligence: draft unpublished Independent Engineer's report prepared by Mineral Resources Development Incorporated for CIBC World Markets, December 1999.

Peterson, M., 2012: Report on Effects of Carbon Dioxide and Sulfuric Acid to Modify pH for Flotation of 90% Ore/10% Backfill Composite Flotation Feed: unpublished report prepared by Dawson Metallurgical Laboratories, 2012.

Phillips, R.J. 2011: Preparation of a Bulk Composite Sample for Greens Creek Mine: unpublished letter report from Phillips Enterprises, LLC, addressed to Dave Tahija, December 13, 2011.

Proffett, John M 2010: Geologis Structure of the Greens Creek Mine Area, Southeast Alaska: Geology, Geochemistry, and Genesis of the Greens Creek Massive Sulfide Deposit, Admiralty Island, Southeastern Alaska. USGS Professional Paper 1763, Chapter 7, pg. 141

Reynolds, I., 2007: Green's Creek Mine: A Mineralogical Characterization of Selected Ores and Plant Products: unpublished internal report, Rio Tinto Bundoora, Victoria, Australia, 2007.

Sack, P., 2009: Characterization of Footwall Lithologies to the Greens Creek Volcanic-Hosted Massive Sulfide (VHMS) Deposit, Alaska, USA: PhD thesis, University of Tasmania.

Sawyer, R.J., 1997: Recovery of Gold by Gravity Separation at the Greens Creek Mine Alaska: presentation at SME Annual Meeting, Denver, Colorado, 1997.

Scheding, B., 2000: Three-Stage Lead and Zinc Cleaning for the Greens Creek Concentrator. Juneau, Alaska: unpublished internal report, Kennecott Greens Creek Mining Company, 2000.

Tahija, D., 2012: Initial Evaluation of Carbon Dioxide Use for pH Control at Greens Creek: unpublished internal memorandum, Hecla Greens Creek Mining Company, 2012.

Tahija, D., 2011: Large Sample Description: unpublished internal memorandum, Hecla Greens Creek Mining Company, November 2, 2011.

Taylor, D.D., and A.L., Johnson, 2010: Geology, Geochemistry, and Genesis of the Greens Creek Massive Sulfide Deposit, Admiralty Island, Southeastern Alaska. USGS Professional Paper 1763.

Taylor, D.D., Newkirk, S.R., Hall, T.E., Lear, K.G., Premo, W.R., Leventhal, J.S., Meier, A.L., Johnson, C.A., and Harris, A.G., 1999: The Greens Creek Deposit Southeastern Alaska – A VMS-SEDEX Hybrid: in Stanley, D.J., and others, eds., Mineral Deposits – Processes to Processing, Rotterdam, Balkema, v. 1, p. 597–600.

Taylor, D.D., Premo, B.R., and Lear, K.G., 2000: The Greens Creek Massive Sulfide Deposit – Premier Example of the Late Triassic Metallogeny of the Alexander Terrane, Southeastern Alaska and British Columbia [abs.]: Geological Society of America Abstracts with Programs, v. 32, no. 6, p. A-71.

West, Andrew W, 2010: The History of Greens Creek Exploration: Geology, Geochemistry, and Genesis of the Greens Creek Massive Sulfide Deposit, Admiralty Island, Southeast Alaska, USGS Professional Paper 1763, Chapter 3 p. 65.

27.2 Abbreviations

27.2.1 Table of Abbreviations

Abbreviation	Explanation
®	registered name
AA	atomic absorption spectroscopy
ARD	acid-rock drainage
BLM	US Bureau of Land Management
CAG	Community Advisory Group
CIM	Canadian Institute of Mining, Metallurgy and Petroleum

Abbreviation	Explanation
E	east
GPS	global positioning system
ICP	inductively-couple plasma
ID	inverse distance interpolation; number after indicates the power, eg ID6 indicates inverse distance to the 6th power.
LOM	life-of-mine
N	north
NI 43-101	Canadian National Instrument 43-101 “Standards of Disclosure for Mineral Projects”
NN	nearest-neighbor/ nearest neighbour
NW	northwest
OK	ordinary kriging
QA/QC	quality assurance and quality control
QP	Qualified Person
RC	reverse circulation
RMR	rock mass rating
RQD	rock quality designation
S	south
SE	southeast
SEIS	Supplemental Environmental Impact Statement
SG	specific gravity
SMU	selective mining unit
SRM	standard reference material
USGS	United States Geological Survey
V	vertical
W	west

27.2.2 Chemical Symbols

Symbol	Element/Compound
Ag	silver
Al	aluminum
As	arsenic
Au	gold
Ba	barium
Bi	bismuth
C	carbon
Ca	calcium

Symbol	Element/Compound
$CaCO_3$	calcium carbonate
CaO	calcium oxide
$CaSO_4 \bullet 2H_2O$	calcium sulfide dehydrate
Cd	cadmium
CO	carbon monoxide
Co	cobalt
Cr	chromium
Cu	copper
Fe	iron
FeOx	iron oxides
H	hydrogen
Hf	hafnium
Hg	mercury
K	potassium
Li	lithium
Mg	magnesium
Mn	manganese
$Mn(OH)_2$	manganous hydroxide
MnO_2	manganese dioxide
N	nitrogen
Na	sodium
NH_3	ammonia
Ni	nickel
NOx	nitrogen oxide compounds
O_2	oxygen
Pb	lead
S	sulfur
Sb	antimony
Se	selenium
Sn	tin
SO_2	sulfur dioxide
Tl	thallium
Zn	zinc

27.2.3 US Customary Units Measurement Table

Symbol	Meaning
'	seconds (geographic)
'	foot/feet
"	minutes (geographic)
"	inches
#	number
%	percent
/	per

Symbol	Meaning
<	less than
>	greater than
µm	micrometer (micron)
a	annum/ year
Å	angstroms
asl	above sea level
BQ	1.44 inch core size
c.	circa
d	day
d/wk	days per week
dmt	dry metric tonne
fineness	parts per thousand of gold in an alloy
ft	feet
ft^3	cubic foot/cubic feet
ft^3/ton	cubic feet per ton
g	gram
Ga	billion years ago
HP	horsepower
HQ	2.5 inch core size
in	inches
km	kilometer
koz	thousand ounces
kV	kilovolt
kVA	kilovolt–ampere
kW	kilowatt
kWh	kilowatt hour
lb	pound
M	million
m	meter
Ma	million years ago
mesh	size based on the number of openings in one inch of screen
Mft	million feet
mi	mile/miles
Mlb	million pounds
Moz	million ounces
Mt	million tons
Mt/a	million tons per annum
MW	megawatts
NQ	1.87 inch core size
º	degrees
ºC	degrees Celsius
ºF	degrees Fahrenheit

Symbol	Meaning
oz	ounce/ounces (troy ounce)
oz/ton	ounces per ton
pH	measure of the acidity or alkalinity of a solution
pop	population
ppb	parts per billion
ppm	parts per million
PQ	3.35 inch core size
t	US ton (short ton), 2000 pounds
t/a	tons per annum (tons per year)
t/d	tons per day
t/h	tons per hour
TDS	total dissolved solids
TSS	total suspended solids
wt%	weight percent

27.2.4 Metric Units Measurement Table

Symbol	Meaning
'	seconds (geographic)
'	foot/feet
"	minutes (geographic)
"	inches
#	number
%	percent
/	per
<	less than
>	greater than
µm	micrometer (micron)
a	annum/ year
Å	angstroms
asl	above sea level
BQ	36.5 mm size core
c.	circa
d	day
d/wk	days per week
dmt	dry metric tonne
fineness	parts per thousand of gold in an alloy
g	gram
g/cm^3	Grams per cubic centimeter
g/m^3	Grams per cubic meter
Ga	billion years ago
ha	hectares

Symbol	Meaning
HP	horsepower
HQ	63.5 mm size core
kg/m^3	kilograms per cubic meter
km	kilometer
km^2	square kilometers
koz	thousand ounces
kV	kilovolt
kVA	kilovolt–ampere
kW	kilowatt
kWh	kilowatt hour
lb	pound
M	million
m	meter
m^3	cubic meter
m^3/hr	cubic meters per hour
Ma	million years ago
mesh	size based on the number of openings in one inch of screen
mi	mile/miles
Mlb	million pounds
Mm	million meters
mm	millimeter/millimeters
Moz	million ounces
Mt	million tonnes
Mt/a	million tonnes per annum
MW	megawatts
NQ	47.6 mm size core
º	degrees
ºC	degrees Celsius
oz	ounce/ounces (troy ounce)
oz/t	ounces per tonne
p	passing
pH	measure of the acidity or alkalinity of a solution
pop	population
ppb	parts per billion
ppm	parts per million
PQ	85 mm size core
t	metric tonne
t/a	tonnes per annum (tonnes per year)
t/d	tonnes per day
t/h	tonnes per hour
t/m^3	Tonnes per cubic meter
TDS	total dissolved solids

Symbol	Meaning
TSS	total suspended solids
wt%	weight percent

27.3 Glossary of Terms

Term	Definition
acid rock drainage/ acid mine drainage	Characterized by low pH, high sulfate, and high iron and other metal species.
adit	A passageway or opening driven horizontally into the side of a hill generally for the purpose of exploring or otherwise opening a mineral deposit. An adit is open to the atmosphere at one end, a tunnel at both ends.
adjacent property	A property in which the issuer does not have an interest; has a boundary reasonably proximate to the property being reported on; and has geological characteristics similar to those of the property being reported on
advanced argillic alteration	Consists of kaolinite + quartz + hematite + limonite. feldspars leached and altered to sericite. The presence of this assemblage suggests low pH (highly acidic) conditions. At higher temperatures, the mineral pyrophyllite (white mica) forms in place of kaolinite
advanced property	A means a property that has mineral reserves, or mineral resources the potential economic viability of which is supported by a preliminary economic assessment, a pre-feasibility study or a feasibility study.
alluvium	Unconsolidated terrestrial sediment composed of sorted or unsorted sand, gravel, and clay that has been deposited by water.
ANFO	A free-running explosive used in mine blasting made of 94% prilled aluminum nitrate and 6% No. 3 fuel oil.
aquifer	A geologic formation capable of transmitting significant quantities of groundwater under normal hydraulic gradients.
argillic alteration	Introduces any one of a wide variety of clay minerals, including kaolinite, smectite and illite. Argillic alteration is generally a low temperature event, and some may occur in atmospheric conditions
autogenous grinding	The process of grinding in a rotating mill which uses as a grinding medium large pieces or pebbles of the ore being ground, instead of conventional steel balls or rods.
azimuth	The direction of one object from another, usually expressed as an angle in degrees relative to true north. Azimuths are usually measured in the clockwise direction, thus an azimuth of 90 degrees indicates that the second object is due east of the first.
background concentration	Naturally-occurring concentrations of compounds of environmental concern
ball mill	A piece of milling equipment used to grind ore into small particles. It is a cylindrical shaped steel container filled with steel balls into which crushed ore is fed. The ball mill is rotated causing the balls themselves to cascade, which in turn grinds the ore.
beneficiation	Physical treatment of crude ore to improve its quality for some specific purpose. Also called mineral processing.
bullion	Unrefined gold and/or silver mixtures that have been melted and cast into a bar or ingot.
comminution/crushing/grinding	Crushing and/or grinding of ore by impact and abrasion. Usually, the word "crushing" is used for dry methods and "grinding" for wet methods. Also, "crushing" usually denotes reducing the size of coarse rock while "grinding" usually refers to the reduction of the fine sizes.
concentrate	The concentrate is the valuable product from mineral processing, as opposed to

	the tailing, which contains the waste minerals. The concentrate represents a smaller volume than the original ore
critical path	Sequence of activities through a project network from start to finish, the sum of whose durations determines the overall project duration. Note: there may be more than one such path. (The path through a series of activities, taking into account interdependencies, in which the late completion of activities will have an impact on the project end date or delay a key milestone.)
crosscut	A horizontal opening driven across the course of a vein or structure, or in general across the strike of the rock formation; a connection from a shaft to an ore structure.
crown pillar	An ore pillar at the top of an open stope left for wall support and protection from wall sloughing above
cut and fill stoping	If it is undesirable to leave broken ore in the stope during mining operations (as in shrinkage stoping), the lower portion of the stope can be filled with waste rock and/or mill tailings. In this case, ore is removed as soon as it has been broken from overhead, and the stope filled with waste to within a few feet of the mining surface. This method eliminates or reduces the waste disposal problem associated with mining as well as preventing collapse of the ground at the surface.
cut-off grade	A grade level below which the material is not “ore” and considered to be uneconomical to mine and process. The minimum grade of ore used to establish reserves.
data verification	The process of confirming that data has been generated with proper procedures, has been accurately transcribed from the original source and is suitable to be used for mineral resource and mineral reserve estimation
decline	A sloping underground opening for machine access from level to level or from the surface. Also called a ramp.
density	The mass per unit volume of a substance, commonly expressed in grams/ cubic centimeter.
depletion	The decrease in quantity of ore in a deposit or property resulting from extraction or production.
development	Often refers to the construction of a new mine or; Is the underground work carried out for the purpose of reaching and opening up a mineral deposit. It includes shaft sinking, cross-cutting, drifting and raising.
development property	a property that is being prepared for mineral production or a material expansion of current production, and for which economic viability has been demonstrated by a pre-feasibility or feasibility study.
diabase	US terminology for an intrusive rock whose main components are labradorite and pyroxene, and characterized by an ophiolitic texture. Corresponds to a diorite.
dilution	Waste of low-grade rock which is unavoidably removed along with the ore in the mining process.
disclosure	Any oral statement or written disclosure made by or on behalf of an issuer and intended to be, or reasonably likely to be, made available to the public in a jurisdiction of Canada, whether or not filed under securities legislation, but does not include written disclosure that is made available to the public only by reason of having been filed with a government or agency of government pursuant to a requirement of law other than securities legislation.
discounted cash flow	Concept of relating future cash inflows and outflows over the life of a project or operation to a common base value thereby allowing more validity to comparison of projects with different durations and rates of cash flow.
drift	A horizontal mining passage underground. A drift usually follows the ore vein, as distinguished from a crosscut, which intersects it.
early-stage exploration property	A property for which the technical report being filed has no current mineral resources or mineral reserves defined; and no drilling or trenching proposed

easement	Areas of land owned by the property owner, but in which other parties, such as utility companies, may have limited rights granted for a specific purpose.
effective date	With reference to a technical report, the date of the most recent scientific or technical information included in the technical report.
EM	Geophysical method, electromagnetic system, measures the earth's response to electromagnetic signals transmitted by an induction coil
encumbrance	An interest or partial right in real property which diminished the value of ownership, but does not prevent the transfer of ownership. Mortgages, taxes and judgements are encumbrances known as liens. Restrictions, easements, and reservations are also encumbrances, although not liens.
exploration information	Geological, geophysical, geochemical, sampling, drilling, trenching, analytical testing, assaying, mineralogical, metallurgical, and other similar information concerning a particular property that is derived from activities undertaken to locate, investigate, define, or delineate a mineral prospect or mineral deposit
feasibility study	A comprehensive study of a mineral deposit in which all geological, engineering, legal, operating, economic, social, environmental, and other relevant factors are considered in sufficient detail that it could reasonably serve as the basis for a final decision by a financial institution to finance the development of the deposit for mineral production.
flotation	Separation of minerals based on the interfacial chemistry of the mineral particles in solution. Reagents are added to the ore slurry to render the surface of selected minerals hydrophobic. Air bubbles are introduced to which the hydrophobic minerals attach. The selected minerals are levitated to the top of the flotation machine by their attachment to the bubbles and into a froth product, called the "flotation concentrate." If this froth carries more than one mineral as a designated main constituent, it is called a "bulk float". If it is selective to one constituent of the ore, where more than one will be floated, it is a "differential" float.
flowsheet	The sequence of operations, step by step, by which ore is treated in a milling, concentration, or smelting process.
footwall	The wall or rock on the underside of a vein or ore structure.
free milling	Ores of gold or silver from which the precious metals can be recovered by concentrating methods without resort to roasting or chemical treatment.
frother	A type of flotation reagent which, when dissolved in water, imparts to it the ability to form a stable froth
gangue	The fraction of ore rejected as tailing in a separating process. It is usually the valueless portion, but may have some secondary commercial use
geosyncline	A major downwarp in the Earth's crust, usually more than 1000 kilometers in length, in which sediments accumulate to thicknesses of many kilometers. The sediments may eventually be deformed and metamorphosed during a mountain-building episode.
gravity separation	Exploitation of differences in the densities of particles to achieve separation. Machines utilizing gravity separation include jigs and shaking tables.
greenschist facies	One of the major divisions of the mineral facies classification of metamorphic rocks, the rocks of which formed under the lowest temperature and pressure conditions usually produced by regional metamorphism. Temperatures between 300 and 450 °C (570 and 840 °F) and pressures of 1 to 4 kilobars are typical. The more common minerals found in such rocks include quartz, orthoclase, muscovite, chlorite, serpentine, talc, and epidote
hanging wall	The wall or rock on the upper or top side of a vein or ore deposit.
historical estimate	An estimate of the quantity, grade, or metal or mineral content of a deposit that an issuer has not verified as a current mineral resource or mineral reserve, and which was prepared before the issuer acquiring, or entering into an agreement to acquire, an interest in the property that contains the deposit. A Qualified Person

	has not done sufficient work to classify the historical estimate as current mineral resources or mineral reserves and the company is not treating the historical estimate as current mineral resources or mineral reserves.
Indicated Mineral Resource	An 'Indicated Mineral Resource' is that part of a Mineral Resource for which quantity, grade or quality, densities, shape and physical characteristics can be estimated with a level of confidence sufficient to allow the appropriate application of technical and economic parameters, to support mine planning and evaluation of the economic viability of the deposit. The estimate is based on detailed and reliable exploration and testing information gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drill holes that are spaced closely enough for geological and grade continuity to be reasonably assumed.
Inferred Mineral Resource	An 'Inferred Mineral Resource' is that part of a Mineral Resource for which quantity and grade or quality can be estimated on the basis of geological evidence and limited sampling and reasonably assumed, but not verified, geological and grade continuity. The estimate is based on limited information and sampling gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drill holes.
internal rate of return (IRR)	The rate of return at which the Net Present Value of a project is zero; the rate at which the present value of cash inflows is equal to the present value of the cash outflows.
IP	Geophysical method, induced polarization; used to directly detect scattered primary sulfide mineralization. Most metal sulfides produce IP effects, e.g. chalcopyrite, bornite, chalcocite, pyrite, pyrrhotite
liberation	Freeing, by comminution, of particles of specific mineral from their interlock with other constituents of the ore.
life of mine (LOM)	Number of years that the operation is planning to mine and treat ore, and is taken from the current mine plan based on the current evaluation of ore reserves.
lithogeochemistry	The chemistry of rocks within the lithosphere, such as rock, lake, stream, and soil sediments
Measured Mineral Resource	A 'Measured Mineral Resource' is that part of a Mineral Resource for which quantity, grade or quality, densities, shape, and physical characteristics are so well established that they can be estimated with confidence sufficient to allow the appropriate application of technical and economic parameters, to support production planning and evaluation of the economic viability of the deposit. The estimate is based on detailed and reliable exploration, sampling and testing information gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drill holes that are spaced closely enough to confirm both geological and grade continuity.
merger	A voluntary combination of two or more companies whereby both stocks are merged into one.
mill	Includes any ore mill, sampling works, concentration, and any crushing, grinding, or screening plant used at, and in connection with, an excavation or mine.
mineral project	Any exploration, development or production activity, including a royalty or similar interest in these activities, in respect of diamonds, natural solid inorganic material, or natural solid fossilized organic material including base and precious metals, coal, and industrial minerals
Mineral Reserve	A Mineral Reserve is the economically mineable part of a Measured or Indicated Mineral Resource demonstrated by at least a Preliminary Feasibility Study. This Study must include adequate information on mining, processing, metallurgical, economic and other relevant factors that demonstrate, at the time of reporting, that economic extraction can be justified. A Mineral Reserve includes diluting materials and allowances for losses that may occur when the material is mined.
Mineral Resource	A Mineral Resource is a concentration or occurrence of diamonds, natural solid

	inorganic material, or natural solid fossilized organic material including base and precious metals, coal, and industrial minerals in or on the Earth's crust in such form and quantity and of such a grade or quality that it has reasonable prospects for economic extraction. The location, quantity, grade, geological characteristics and continuity of a Mineral Resource are known, estimated or interpreted from specific geological evidence and knowledge.
mining claim	A description by boundaries of real property in which metal ore and/or minerals may be located.
net present value (NPV)	The present value of the difference between the future cash flows associated with a project and the investment required for acquiring the project. Aggregate of future net cash flows discounted back to a common base date, usually the present. NPV is an indicator of how much value an investment or project adds to a company.
net smelter return royalty (NSR)	A defined percentage of the gross revenue from a resource extraction operation, less a proportionate share of transportation, insurance, and processing costs.
open stope	In competent rock, it is possible to remove all of a moderate sized ore body, resulting in an opening of considerable size. Such large, irregularly-shaped openings are called stopes. The mining of large inclined ore bodies often requires leaving horizontal pillars across the stope at intervals in order to prevent collapse of the walls.
orogeny	A process in which a section of the earth's crust is folded and deformed by lateral compression to form a mountain range
ounce (oz) (troy)	Used in imperial statistics. A kilogram is equal to 32.1507 ounces. A troy ounce is equal to 31.1035 grams.
overburden	Material of any nature, consolidated or unconsolidated, that overlies a deposit of ore that is to be mined.
petrography	Branch of geology that deals with the description and classification of rocks.
phyllic alteration	Minerals include quartz-sericite-pyrite
plant	A group of buildings, and especially to their contained equipment , in which a process or function is carried out; on a mine it will include warehouses, hoisting equipment, compressors, repair shops, offices, mill or concentrator.
portal	The surface entrance to a tunnel or adit
potassic alteration	A relatively high temperature type of alteration which results from potassium enrichment. Characterized by biotite, K-feldspar, adularia.
preliminary economic assessment	A study, other than a pre-feasibility or feasibility study, that includes an economic analysis of the potential viability of mineral resources
preliminary feasibility study, pre-feasibility study	A comprehensive study of the viability of a mineral project that has advanced to a stage where the mining method, in the case of underground mining, or the pit configuration, in the case of an open pit, has been established and an effective method of mineral processing has been determined, and includes a financial analysis based on reasonable assumptions of technical, engineering, legal, operating, economic, social, and environmental factors and the evaluation of other relevant factors which are sufficient for a qualified person, acting reasonably, to determine if all or part of the mineral resource may be classified as a mineral reserve
Probable Mineral Reserve	A 'Probable Mineral Reserve' is the economically mineable part of an Indicated and, in some circumstances, a Measured Mineral Resource demonstrated by at least a Preliminary Feasibility Study. This Study must include adequate information on mining, processing, metallurgical, economic, and other relevant factors that demonstrate, at the time of reporting, that economic extraction can be justified.
producing issuer	An issuer with annual audited financial statements that disclose gross revenue, derived from mining operations, of at least $30 million Canadian for the issuer's most recently completed financial year; and gross revenue, derived from mining operations, of at least $90 million Canadian in the aggregate for the issuer's

	three most recently completed financial years
propylitic	Characteristic greenish color. Minerals include chlorite, actinolite and epidote. Typically contains the assemblage quartz-chlorite-carbonate
Proven Mineral Reserve	A 'Proven Mineral Reserve' is the economically mineable part of a Measured Mineral Resource demonstrated by at least a Preliminary Feasibility Study. This Study must include adequate information on mining, processing, metallurgical, economic, and other relevant factors that demonstrate, at the time of reporting, that economic extraction is justified.
raise	A vertical or inclined underground working that has been excavated from the bottom upward
reclamation	The restoration of a site after mining or exploration activity is completed.
refining	A high temperature process in which impure metal is reacted with flux to reduce the impurities. The metal is collected in a molten layer and the impurities in a slag layer. Refining results in the production of a marketable material.
Resistivity	Observation of electric fields caused by current introduced into the ground as a means of studying earth resistivity in geophysical exploration. Resistivity is the property of a material that resists the flow of electrical current
right-of-way	A parcel of land granted by deed or easement for construction and maintenance according to a designated use. This may include highways, streets, canals, ditches, or other uses
royalty	An amount of money paid at regular intervals by the lessee or operator of an exploration or mining property to the owner of the ground. Generally based on a specific amount per tonne or a percentage of the total production or profits. Also, the fee paid for the right to use a patented process.
run-of-mine	A term used to describe ore of average grade for the deposit.
shaft	A vertical or inclined excavation for the purpose of opening and servicing a mine. It is usually equipped with a hoist at the top, which lowers and raises a conveyance for handling men and material
specific gravity	The weight of a substance compared with the weight of an equal volume of pure water at 4°C.
stope	An excavation in a mine, other than development workings, made for the purpose of extracting ore.
strike length	The horizontal distance along the long axis of a structural surface, rock unit, mineral deposit or geochemical anomaly.
tailings	Material rejected from a mill after the recoverable valuable minerals have been extracted.
tunnel	A horizontal underground passage that is open at both ends; the term is loosely applied in many cases to an adit, which is open at only one end
World Geodetic Reference System of 1984 (WGS-84)	The United States Defense Mapping Agency's Datum. This datum is a global datum based on electronic technology which is still to some degree classified. Data on the relationship of as many as 65 different datums to WGS-84 is available to the public. As a result, WGS-84 is becoming the base datum for the processing and conversion of data from one datum to any other datum. The GPS is based on this datum.
written disclosure	Any writing, picture, map, or other printed representation whether produced, stored or disseminated on paper or electronically, including websites
XYZ coordinates	A grouping of three numbers which designate the position of a point in relation to a common reference frame. In common usage, the X and Y coordinate fix the horizontal position of the point, and Z refers to the elevation

28.0 EFFECTIVE DATE AND SIGNATURE PAGE

This report titled "Greens Creek Polymetallic Mine, Alaska NI 43-101 Technical Report on Operations", prepared for Hecla Mining Company and Aurizon Mines Ltd. with an effective date of March 28, 2013 and dated effective March 28, 2013, was prepared and signed by the following authors:

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March 28, 2013	Dr. Dean W.A. McDonald, P.Geo Vice President Hecla Mining Company
Dated at Juneau, Alaska	(Signed and Sealed) *"Bryan J Morgen "*
March 28, 2013	Mr. Bryan J Morgen, P.E. Senior Mine Engineer Hecla Limited Hecla Greens Creek Mine
Dated at Wilsonville, Oregon	(Signed and Sealed) "*Bill A Hancock* "
March 28, 2013	Bill A. Hancock, RM Principal Argo Consulting, LLC

Appendix A

Unpatented Lode and Mill Claims Tables

Summary, Unpatented Mill Claims

Claim Name	Certificate of Location Recorded in Juneau Recording District, State of Alaska at		BLM Serial Number
	Book	Page	
Big Sore Millsite No. 900	394	511-512	AA 77046
Big Sore Millsite No. 901	394	513	AA 77047
Big Sore Millsite No. 902	394	514	AA 77048
Big Sore Millsite No. 1001	394	515	AA 77049
Big Sore Millsite No. 1002	394	516	AA 77050
Big Sore Millsite No. 1003	394	517	AA 77051
Big Sore Millsite No. 1108	394	518	AA 77052
Big Sore Millsite No. 1505	394	519	AA 77053
Big Sore Millsite No. 1506	394	520	AA 77054
Big Sore Millsite No. 1507	394	521	AA 77055
Big Sore Millsite No. 1509	394	522	AA 77056
Big Sore Millsite No. 1510	394	523	AA 77057
Big Sore Millsite No. 1516	394	524	AA 77058
Big Sore Millsite No. 1517	394	525	AA 77059
Big Sore Millsite No. 1610	394	526	AA 77060
Big Sore Millsite No. 1611	394	527	AA 77061
Big Sore Millsite No. 1710	394	528	AA 77062
Big Sore Millsite No. 1711	394	529	AA 77063
Big Sore Millsite No. 1712	394	530	AA 77064
Big Sore Millsite No. 1713	394	531	AA 77065
Big Sore Millsite No. 1714	394	532	AA 77066
Big Sore Millsite No. 1715	394	533	AA 77067
Big Sore Millsite No. 1716	394	534	AA 77068
Big Sore Millsite No. 1717	394	535	AA 77069
Big Sore Millsite No. 1718	394	536	AA 77070
Big Sore Millsite No. 798	2002-005167-0		AA 84088
Big Sore Millsite No. 802	2002-005168-0		AA 84089
Big Sore Millsite No. 803	2002-005169-0		AA 84090
Big Sore Millsite No. 899	2002-005170-0		AA 84091
Big Sore Millsite No. 904	2002-005171-0		AA 84092
Big Sore Millsite No. 905	2002-005172-0		AA 84093
Big Sore Millsite No. 906	2002-005173-0		AA 84094
Big Sore Millsite No. 907	2002-005174-0		AA 84095
Big Sore Millsite No. 996	2002-005175-0		AA 84096
Big Sore Millsite No. 1004	2002-005176-0		AA 84097
Big Sore Millsite No. 1005	2002-005177-0		AA 84098
Big Sore Millsite No. 1006	2002-005178-0		AA 84099
Big Sore Millsite No. 1007	2002-005179-0		AA 84100

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Big Sore Millsite No. 1008	2002-005180-0		AA 84101
Big Sore Millsite No. 1009	2002-005181-0		AA 84102
Big Sore Millsite No. 1010	2002-005182-0		AA 84103
Big Sore Millsite No. 1096	2002-005183-0		AA 84104
Big Sore Millsite No. 1097	2002-005184-0		AA 84105
Big Sore Millsite No. 1103	2002-005185-0		AA 84106
Big Sore Millsite No. 1104	2002-005186-0		AA 84107
Big Sore Millsite No. 1105	2002-005187-0		AA 84108
Big Sore Millsite No. 1106	2002-005188-0		AA 84109
Big Sore Millsite No. 1107	2002-005189-0		AA 84110
Big Sore Millsite No. 1202	2002-005190-0		AA 84111
Big Sore Millsite No. 1203	2002-005191-0		AA 84112
Big Sore Millsite No. 1204	2002-005192-0		AA 84113
Big Sore Millsite No. 1205	2002-005193-0		AA 84114
Big Sore Millsite No. 1508	2002-005194-0		AA 84115
Big Sore Millsite No. 1511	2002-005195-0		AA 84116
Big Sore Millsite No. 1514	2002-005196-0		AA 84117
Big Sore Millsite No. 1612	2002-005197-0		AA 84118
Big Sore Millsite No. 1613	2002-005198-0		AA 84119
Big Sore Millsite No. 1614	2002-005199-0		AA 84120

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BIG SORE GROUP			
Big Sore 1321	125	423	AA 25819
Big Sore 1322	126	236	AA 25820
Big Sore 1323	126	237	AA 25821
Big Sore 1324	126	238	AA 25822
Big Sore 1421	126	239	AA 25845
Big Sore 1422	126	240	AA 25846
Big Sore 1423	126	241	AA 25847
Big Sore 1424	126	242	AA 25848
Big Sore 1521	125	437	AA 25867
Big Sore 1522	125	438	AA 25868
Big Sore 1523	125	439	AA 25869
Big Sore 1524	125	440	AA 25870
Big Sore 1623	125	448	AA 25888

Claim Name	Certificate of Location Recorded in Juneau Recording District, State of Alaska		BLM Serial Number
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Big Sore 1624	125	449	AA 25889
Big Sore 1625	125	450	AA 25890
Big Sore 1626	125	451	AA 25891
Big Sore 1627	125	452	AA 25892
Big Sore 1723	125	459	AA 25909
Big Sore 1724	125	460	AA 25910
Big Sore 1725	125	461	AA 25911
Big Sore 1726	125	462	AA 25912
Big Sore 1727	125	463	AA 25913
Big Sore 1728	125	464	AA 25914
Big Sore 1824	125	479	AA 25929
Big Sore 1825	125	480	AA 25930
Big Sore 1826	125	481	AA 25931
Big Sore 1827	125	482	AA 25932
MARIPOSITE GROUP			
Mariposite 1	254	238	AA 55244
Mariposite 2	254	239	AA 55245
Mariposite 3	254	240	AA 55246
Mariposite 4	254	241	AA 55247
Mariposite 5	254	242	AA 55248
Mariposite 6	279	233	AA 55249
Mariposite 7	279	234	AA 55250
Mariposite 8	251	962	AA 55251
Mariposite 9	251	963	AA 55252
Mariposite 10	251	964	AA 55253
Mariposite 11	279	235	AA 55254
Mariposite 12	279	236	AA 55255
Mariposite 13	279	237	AA 55256
Mariposite 14	279	238	AA 55257
Mariposite 15	251	969	AA 55258
Mariposite 16	254	245	AA 55259
Mariposite 17	254	246	AA 55260
Mariposite 18	254	247	AA 55261
Mariposite 19	254	248	AA 55262
Mariposite 20	254	249	AA 55263
Mariposite 21	254	250	AA 55264
Mariposite 22	251	976	AA 55265
Mariposite 23	251	977	AA 55266
Mariposite 24	251	978	AA 55267
Mariposite 25	279	239	AA 55268

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Mariposite 26	279	240	AA 55269
Mariposite 27	279	241	AA 55270
Mariposite 28	279	242	AA 55271
Mariposite 29	279	243	AA 55272
Mariposite 30	279	244	AA 55273
Mariposite 31	279	245	AA 55274
Mariposite 32	279	246	AA 55275
Mariposite 33	279	247	AA 55276
Mariposite 34	254	256	AA 55277
Mariposite 35	254	257	AA 55278
Mariposite 36	279	248	AA 55279
Mariposite 37	279	249	AA 55280
Mariposite 38	251	992	AA 55281
Mariposite 39	251	993	AA 55282
Mariposite 40	251	994	AA 55283
Mariposite 41	251	995	AA 55284
Mariposite 42	251	996	AA 55285
Mariposite 43	251	997	AA 55286
Mariposite 44	251	998	AA 55287
Mariposite 45	251	999	AA 55288
Mariposite 46	252	1	AA 55289
Mariposite 47	252	2	AA 55290
Mariposite 48	252	3	AA 55291
Mariposite 49	252	4	AA 55292
Mariposite 50	254	258	AA 55293
Mariposite 51	254	259	AA 55294
Mariposite 52	254	260	AA 55295
Mariposite 53	254	261	AA 55296
Mariposite 54	254	262	AA 55297
Mariposite 55	254	263	AA 55298
Mariposite 56	254	264	AA 55299
Mariposite 57	254	265	AA 55300
Mariposite 58	254	266	AA 55301
Mariposite 59	254	267	AA 55302
Mariposite 60	254	268	AA 55303
Mariposite 61	252	16	AA 55304
Mariposite 62	252	17	AA 55305
Mariposite 63	252	18	AA 55306
Mariposite 64	252	19	AA 55307
Mariposite 65	252	20	AA 55308

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Mariposite 66	252	21	AA 55309
Mariposite 67	254	269	AA 55310
Mariposite 68	254	270	AA 55311
Mariposite 69	254	271	AA 55312
Mariposite 70	254	272	AA 55313
Mariposite 71	252	26	AA 55314
Mariposite 72	252	27	AA 55315
Mariposite 73	254	273	AA 55316
Mariposite 74	254	274	AA 55317
Mariposite 75	254	275	AA 55318
Mariposite 76	254	276	AA 55319
Mariposite 77	252	32	AA 55320
Mariposite 79	254	278	AA 55322
Mariposite 80	254	279	AA 55323
Mariposite 81	252	36	AA 55324
Mariposite 82	254	280	AA 55325
Mariposite 83	254	281	AA 55326
Mariposite 84	254	282	AA 55327
Mariposite 85	254	283	AA 55328
Mariposite 86	254	284	AA 55329
Mariposite 87	292	664	AA 63033
Mariposite 100	320	601	AA 71489
Mariposite 101	320	602	AA 71490
Mariposite 102	320	603	AA 71491
Mariposite 103	320	604	AA 71492
Mariposite 104	320	605	AA 71493
Mariposite 105	320	606	AA 71494
Mariposite 106	320	607	AA 71495
Mariposite 107	320	608	AA 71496
Mariposite 108	320	609	AA 71497
Mariposite 109	320	610	AA 71498
Mariposite 110	320	611	AA 71499
Mariposite 111	320	612	AA 71500
Mariposite 112	320	613	AA 71501
Mariposite 113	320	614	AA 71502
Mariposite 114	320	615	AA 71503
FOWLER GROUP			
Fowler 543	262	546	AA 57281
Fowler 544	262	548	AA 57282
Fowler 545	262	549	AA 57283

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Fowler 546	262	550	AA 57284
Fowler 547	262	551	AA 57285
Fowler 548	262	552	AA 57286
Fowler 549	262	553	AA 57287
Fowler 550	262	554	AA 57288
Fowler 551	262	555	AA 57289
Fowler 552	262	556	AA 57290
Fowler 553	262	557	AA 57291
Fowler 554	262	558	AA 57292
Fowler 555	262	559	AA 57293
Fowler 556	262	560	AA 57294
Fowler 557	262	561	AA 57295
Fowler 558	262	562	AA 57296
Fowler 643	262	563	AA 57297
Fowler 644	262	564	AA 57298
Fowler 645	262	565	AA 57299
Fowler 646	262	566	AA 57300
Fowler 647	262	567	AA 57301
Fowler 648	262	568	AA 57302
Fowler 649	262	569	AA 57303
Fowler 650	262	570	AA 57304
Fowler 651	262	571	AA 57305
Fowler 652	262	572	AA 57306
Fowler 653	262	573	AA 57307
Fowler 654	262	574	AA 57308
Fowler 655	262	575	AA 57309
Fowler 656	262	576	AA 57310
Fowler 657	262	577	AA 57311
Fowler 658	262	578	AA 57312
Fowler 743	262	579	AA 57313
Fowler 744	262	580	AA 57314
Fowler 745	262	581	AA 57315
Fowler 746	262	582	AA 57316
Fowler 747	262	583	AA 57317
Fowler 748	262	584	AA 57318
Fowler 749	262	585	AA 57319
Fowler 750	262	586	AA 57320
Fowler 751	262	587	AA 57321
Fowler 752	262	588	AA 57322
Fowler 753	262	589	AA 57323

Claim Name	Certificate of Location Recorded in Juneau Recording District, State of Alaska Book	Page	BLM Serial Number
Fowler 754	262	590	AA 57324
Fowler 755	262	591	AA 57325
Fowler 756	262	592	AA 57326
Fowler 757	262	593	AA 57327
Fowler 758	262	594	AA 57328
Fowler 843	262	595	AA 57329
Fowler 844	262	596	AA 57330
Fowler 845	262	597	AA 57331
Fowler 846	262	598	AA 57332
Fowler 847	262	599	AA 57333
Fowler 848	262	600	AA 57334
Fowler 849	262	601	AA 57335
Fowler 850	262	602	AA 57336
Fowler 851	262	603	AA 57337
Fowler 852	262	604	AA 57338
Fowler 853	262	605	AA 57339
Fowler 854	262	606	AA 57340
Fowler 855	262	607	AA 57341
Fowler 856	262	608	AA 57342
Fowler 857	262	609	AA 57343
Fowler 858	262	610	AA 57344
Fowler 943	262	611	AA 57345
Fowler 944	262	612	AA 57346
Fowler 945	262	613	AA 57347
Fowler 946	262	614	AA 57348
Fowler 947	262	615	AA 57349
Fowler 948	262	616	AA 57350
Fowler 949	262	617	AA 57351
Fowler 950	262	618	AA 57352
Fowler 951	262	619	AA 57353
Fowler 952	262	620	AA 57354
Fowler 953	262	621	AA 57355
Fowler 954	262	622	AA 57356
Fowler 955	262	623	AA 57357
Fowler 956	262	624	AA 57358
Fowler 957	262	625	AA 57359
Fowler 958	262	626	AA 57360
Fowler 1043	262	627	AA 57361
Fowler 1044	262	628	AA 57362
Fowler 1045	262	629	AA 57363

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Fowler 1046	262	630	AA 57364
Fowler 1047	262	631	AA 57365
Fowler 1143	262	632	AA 57366
Fowler 1144	262	633	AA 57367
Fowler 1145	262	634	AA 57368
Fowler 1146	262	635	AA 57369
Fowler 1147	262	636	AA 57370
LIL SORE GROUP			
Lil Sore 41	443	333-335	AA 78220
Lil Sore 42	443	336-338	AA 78221
Lil Sore 43	443	339-341	AA 78222
Lil Sore 44	443	342-344	AA 78223
Lil Sore 45	443	345-347	AA 78224
Lil Sore 46	443	378-350	AA 78225
Lil Sore 47	443	351-353	AA 78226
Lil Sore 48	443	354-356	AA 78227
EAST FOWLER GROUP			
East Fowler 538	443	357-359	AA 78228
East Fowler 539	443	360-362	AA 78229
East Fowler 540	443	363-365	AA 78230
East Fowler 541	443	366-368	AA 78231
East Fowler 542	443	369-371	AA 78232
East Fowler 641	443	372-374	AA 78233
East Fowler 642	443	375-377	AA 78234
East Fowler 741	443	378-380	AA 78235
East Fowler 742	443	381-383	AA 78236
East Fowler 841	443	384-386	AA 78237
East Fowler 842	443	387-389	AA 78238
East Fowler 941	443	390-392	AA 78239
East Fowler 942	443	393-395	AA 78240
East Fowler 1042	443	396-398	AA 78241
WEST MARIPOSITE GROUP			
West Mariposite 115	443	162-164	AA 78242
West Mariposite 116	443	165-167	AA 78243
West Mariposite 117	443	168-170	AA 78244
West Mariposite 118	443	171-173	AA 78245
West Mariposite 119	443	174-176	AA 78246
West Mariposite 120	443	177-179	AA 78247
West Mariposite 121	443	180-182	AA 78248
West Mariposite 122	443	183-185	AA 78249

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West Mariposite 123	443	186-188	AA 78250
West Mariposite 128	443	201-203	AA 78255
West Mariposite 129	443	204-206	AA 78256
West Mariposite 130	443	207-209	AA 78257
West Mariposite 131	443	210-212	AA 78258
West Mariposite 132	443	213-215	AA 78259
West Mariposite 133	443	216-218	AA 78260
West Mariposite 134	443	219-221	AA 78261
West Mariposite 135	443	222-224	AA 78262
West Mariposite 136	443	225-227	AA 78263
West Mariposite 137	443	228-230	AA 78264
West Mariposite 138	443	231-233	AA 78265
West Mariposite 139	443	234-236	AA 78266
West Mariposite 140	443	237-239	AA 78267
West Mariposite 141	443	240-242	AA 78268
West Mariposite 142	443	243-245	AA 78269
West Mariposite 143	443	246-248	AA 78270
West Mariposite 144	443	249-251	AA 78271
West Mariposite 145	443	252-254	AA 78272
West Mariposite 146	443	255-257	AA 78273
West Mariposite 147	443	258-260	AA 78274
West Mariposite 148	443	261-263	AA 78275
West Mariposite 149	443	264-266	AA 78276
West Mariposite 150	443	267-269	AA 78277
West Mariposite 151	443	270-272	AA 78278
West Mariposite 152	443	273-275	AA 78279
West Mariposite 153	443	276-278	AA 78280
West Mariposite 154	443	279-281	AA 78281
West Mariposite 155	443	282-284	AA 78282
West Mariposite 156	443	285-287	AA 78283
West Mariposite 159	443	294-296	AA 78286
West Mariposite 160	443	297-299	AA 78287
West Mariposite 161	443	300-302	AA 78288
West Mariposite 162	443	303-305	AA 78289
West Mariposite 163	443	306-308	AA 78290
West Mariposite 164	443	309-311	AA 78291
West Mariposite 165	443	312-314	AA 78292
West Mariposite 168	443	321-323	AA 78295
West Mariposite 169	443	324-326	AA 78296
West Mariposite 170	443	327-329	AA 78297

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WEST FOWLER GROUP			
West Fowler 559	443	399-401	AA 78299
West Fowler 560	443	402-404	AA 78300
West Fowler 561	443	405-407	AA 78301
West Fowler 659	443	411-413	AA 78303
West Fowler 660	443	414-416	AA 78304
West Fowler 661	443	417-419	AA 78305
West Fowler 662	443	420-422	AA 78306
West Fowler 663	443	423-425	AA 78307
West Fowler 664	443	426-428	AA 78308
West Fowler 759	443	429-431	AA 78309
West Fowler 760	443	432-434	AA 78310
West Fowler 761	443	435-437	AA 78311
West Fowler 762	443	438-440	AA 78312
West Fowler 763	443	444-446	AA 78313
West Fowler 764	443	447-449	AA 78314
West Fowler 765	443	450-452	AA 78315
West Fowler 766	443	453-455	AA 78316
West Fowler 767	443	456-458	AA 78317
West Fowler 859	443	462-464	AA 78319
West Fowler 860	443	465-467	AA 78320
West Fowler 861	443	468-470	AA 78321
West Fowler 862	443	471-473	AA 78322
West Fowler 863	443	474-476	AA 78323
West Fowler 864	443	477-479	AA 78324
West Fowler 865	443	480-482	AA 78325
West Fowler 959	443	492-494	AA 78329
West Fowler 960	443	495-497	AA 78330
West Fowler 961	443	498-500	AA 78331
West Fowler 962	443	501-503	AA 78332
West Fowler 963	443	504-506	AA 78333
West Fowler 964	443	507-509	AA 78334
West Fowler 965	443	510-512	AA 78335
West Fowler 966	443	513-515	AA 78336
NORTH FOWLER GROUP			
North Fowler 41	442	882-884	AA 78341
North Fowler 141	442	885-887	AA 78342
North Fowler 142	442	888-890	AA 78343
North Fowler 143	442	891-893	AA 78344

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North Fowler 226	442	912-914	AA 78351
North Fowler 227	442	915-917	AA 78352
North Fowler 228	442	918-920	AA 78353
North Fowler 229	442	921-923	AA 78354
North Fowler 230	442	924-926	AA 78355
North Fowler 231	442	927-929	AA 78356
North Fowler 232	442	930-932	AA 78357
North Fowler 233	442	933-935	AA 78358
North Fowler 234	442	936-938	AA 78359
North Fowler 235	442	939-941	AA 78360
North Fowler 236	442	942-944	AA 78361
North Fowler 237	442	945-947	AA 78362
North Fowler 238	442	948-950	AA 78363
North Fowler 239	442	951-953	AA 78364
North Fowler 240	442	954-956	AA 78365
North Fowler 241	442	957-959	AA 78366
North Fowler 242	442	960-962	AA 78367
North Fowler 243	442	963-965	AA 78368
North Fowler 244	442	966-968	AA 78369
North Fowler 245	442	969-971	AA 78370
North Fowler 246	442	972-974	AA 78371
North Fowler 336	442	990-992	AA 78377
North Fowler 337	442	993-995	AA 78378
North Fowler 338	442	996-998	AA 78379
North Fowler 339	0442/0443	999/001-002	AA 78380
North Fowler 340	443	003-005	AA 78381
North Fowler 341	443	006-008	AA 78382
North Fowler 342	443	009-011	AA 78383
North Fowler 343	443	012-014	AA 78384
North Fowler 344	443	015-017	AA 78385
North Fowler 345	443	018-020	AA 78386
North Fowler 346	443	021-023	AA 78387
North Fowler 347	443	024-026	AA 78388
North Fowler 348	443	027-029	AA 78389
North Fowler 349	443	030-032	AA 78390
North Fowler 350	443	033-035	AA 78391
North Fowler 351	443	036-038	AA 78392
North Fowler 352	443	039-041	AA 78393
North Fowler 353	443	042-044	AA 78394

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North Fowler 355	443	048-050	AA 78396
North Fowler 356	443	051-053	AA 78397
North Fowler 357	443	054-056	AA 78398
North Fowler 358	443	057-059	AA 78399
North Fowler 436	443	075-077	AA 78405
North Fowler 437	443	078-080	AA 78406
North Fowler 438	443	081-083	AA 78407
North Fowler 439	443	084-086	AA 78408
North Fowler 440	443	087-089	AA 78409
North Fowler 441	443	090-092	AA 78410
North Fowler 442	443	093-095	AA 78411
North Fowler 443	443	096-098	AA 78412
North Fowler 444	443	099-101	AA 78413
North Fowler 445	443	102-104	AA 78414
North Fowler 446	443	105-107	AA 78415
North Fowler 447	443	108-110	AA 78416
North Fowler 448	443	111-113	AA 78417
North Fowler 449	443	114-116	AA 78418
North Fowler 450	443	117-119	AA 78419
North Fowler 451	443	120-122	AA 78420
North Fowler 452	443	123-125	AA 78421
North Fowler 453	443	126-128	AA 78422
North Fowler 454	443	129-131	AA 78423
North Fowler 455	443	132-134	AA 78424
North Fowler 456	443	135-137	AA 78425
North Fowler 457	443	138-140	AA 78426
North Fowler 458	443	141-143	AA 78427
North Fowler 459	443	144-146	AA 78428
North Fowler 460	443	147-149	AA 78429
North Fowler 461	443	150-152	AA 78430
NORTH YOUNG GROUP			
North Young 1106	2008-008884-0		AA 90475
North Young 1107	2008-008885-0		AA 90476
North Young 1108	2008-008886-0		AA 90477
North Young 1109	2008-008887-0		AA 90478
North Young 1110	2008-008888-0		AA 90479
North Young 1111	2008-008889-0		AA 90480
North Young 1112	2008-008890-0		AA 90481
North Young 1113	2008-008891-0		AA 90482

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North Young 1114	2008-008892-0		AA 90483
North Young 1115	2008-008893-0		AA 90484
North Young 1116	2008-008894-0		AA 90485
North Young 1117	2008-008895-0		AA 90486
North Young 1118	2008-008896-0		AA 90487
North Young 1119	2008-008897-0		AA 90488
North Young 1120	2008-008898-0		AA 90489
North Young 1206	2008-008899-0		AA 90490
North Young 1207	2008-008900-0		AA 90491
North Young 1208	2008-008901-0		AA 90492
North Young 1209	2008-008902-0		AA 90493
North Young 1210	2008-008903-0		AA 90494
North Young 1211	2008-008904-0		AA 90495
North Young 1212	2008-008905-0		AA 90496
North Young 1213	2008-008906-0		AA 90497
North Young 1214	2008-008907-0		AA 90498
North Young 1215	2008-008908-0		AA 90499
North Young 1216	2008-008909-0		AA 90500
North Young 1217	2008-008910-0		AA 90501
North Young 1218	2008-008911-0		AA 90502
North Young 1219	2008-008912-0		AA 90503
North Young 1220	2008-008913-0		AA 90504
North Young 1306	2008-008914-0		AA 90505
North Young 1307	2008-008915-0		AA 90506
North Young 1308	2008-008916-0		AA 90507
North Young 1309	2008-008917-0		AA 90508
North Young 1310	2008-008918-0		AA 90509
North Young 1311	2008-008919-0		AA 90510
North Young 1312	2008-008920-0		AA 90511
North Young 1313	2008-008921-0		AA 90512
North Young 1314	2008-008922-0		AA 90513
North Young 1315	2008-008923-0		AA 90514
North Young 1316	2008-008924-0		AA 90515
North Young 1317	2008-008925-0		AA 90516
North Young 1318	2008-008926-0		AA 90517
North Young 1319	2008-008927-0		AA 90518
North Young 1320	2008-008928-0		AA 90519
North Young 1406	2008-008929-0		AA 90520
North Young 1407	2008-008930-0		AA 90521
North Young 1408	2008-008931-0		AA 90522

Claim Name	Certificate of Location Recorded in Juneau Recording District, State of Alaska Book	Page	BLM Serial Number
North Young 1409	2008-008932-0		AA 90523
North Young 1410	2008-008933-0		AA 90524
North Young 1411	2008-008934-0		AA 90525
North Young 1412	2008-008935-0		AA 90526
North Young 1413	2008-008936-0		AA 90527
North Young 1414	2008-008937-0		AA 90528
North Young 1415	2008-008938-0		AA 90529
North Young 1416	2008-008939-0		AA 90530
North Young 1417	2008-008940-0		AA 90531
North Young 1418	2008-008941-0		AA 90532
North Young 1419	2008-008942-0		AA 90533
North Young 1420	2008-008944-0		AA 90534
North Young 1506	2008-008945-0		AA 90535
North Young 1507	2008-008946-0		AA 90536
North Young 1508	2008-008947-0		AA 90537
North Young 1509	2008-008948-0		AA 90538
North Young 1510	2008-008949-0		AA 90539
North Young 1511	2008-008950-0		AA 90540
North Young 1512	2008-008951-0		AA 90541
North Young 1513	2008-008952-0		AA 90542
North Young 1514	2008-008953-0		AA 90543
North Young 1515	2008-008954-0		AA 90544
North Young 1516	2008-008955-0		AA 90545
North Young 1517	2008-008956-0		AA 90546
North Young 1518	2008-008957-0		AA 90547
North Young 1519	2008-008958-0		AA 90548
North Young 1520	2008-008959-0		AA 90549
North Young 1606	2008-008960-0		AA 90550
North Young 1607	2008-008961-0		AA 90551
North Young 1608	2008-008962-0		AA 90552
North Young 1609	2008-008963-0		AA 90553
North Young 1610	2008-008964-0		AA 90554
North Young 1611	2008-008965-0		AA 90555
North Young 1612	2008-008966-0		AA 90556
North Young 1613	2008-008967-0		AA 90557
North Young 1614	2008-008968-0		AA 90558
North Young 1615	2008-008969-0		AA 90559
North Young 1616	2008-008970-0		AA 90560
North Young 1617	2008-008971-0		AA 90561
North Young 1618	2008-008972-0		AA 90562

Claim Name	Certificate of Location Recorded in Juneau Recording District, State of Alaska		BLM Serial Number
	Book	Page	
North Young 1619	2008-008973-0		AA 90563
North Young 1620	2008-008974-0		AA 90564
North Young 1706	2008-008975-0		AA 90565
North Young 1707	2008-008976-0		AA 90566
North Young 1708	2008-008977-0		AA 90567
North Young 1709	2008-008978-0		AA 90568
North Young 1710	2008-008979-0		AA 90569
North Young 1711	2008-008980-0		AA 90570
North Young 1712	2008-008981-0		AA 90571
North Young 1713	2008-008982-0		AA 90572
North Young 1714	2008-008983-0		AA 90573
North Young 1715	2008-008984-0		AA 90574
North Young 1716	2008-008985-0		AA 90575
North Young 1717	2008-008986-0		AA 90576
North Young 1718	2008-008987-0		AA 90577
North Young 1719	2008-008988-0		AA 90578
North Young 1720	2008-008989-0		AA 90579
North Young 1806	2008-008990-0		AA 90580
North Young 1807	2008-008991-0		AA 90581
North Young 1808	2008-008992-0		AA 90582
North Young 1809	2008-008993-0		AA 90583
North Young 1810	2008-008994-0		AA 90584
North Young 1811	2008-008995-0		AA 90585
North Young 1812	2008-008996-0		AA 90586
North Young 1813	2008-008997-0		AA 90587
North Young 1814	2008-008998-0		AA 90588
North Young 1815	2008-008999-0		AA 90589
North Young 1816	2008-009000-0		AA 90590
North Young 1817	2008-009001-0		AA 90591
North Young 1818	2008-009002-0		AA 90592
North Young 1819	2008-009003-0		AA 90593
North Young 1820	2008-009004-0		AA 90594
North Young 1906	2008-009005-0		AA 90595
North Young 1907	2008-009006-0		AA 90596
North Young 1908	2008-009007-0		AA 90597
North Young 1909	2008-009008-0		AA 90598
North Young 1910	2008-009009-0		AA 90599
North Young 1911	2008-009010-0		AA 90600
North Young 1912	2008-009011-0		AA 90601
North Young 1913	2008-009012-0		AA 90602

Claim Name	Certificate of Location Recorded in Juneau Recording District, State of Alaska Book	Page	BLM Serial Number
North Young 1914	2008-009013-0		AA 90603
North Young 1915	2008-009014-0		AA 90604
North Young 1916	2008-009015-0		AA 90605
North Young 1917	2008-009016-0		AA 90606
North Young 1918	2008-009017-0		AA 90607
North Young 1919	2008-009018-0		AA 90608
North Young 1920	2008-009019-0		AA 90609
North Young 2008	2008-009020-0		AA 90610
North Young 2009	2008-009021-0		AA 90611
North Young 2010	2008-009022-0		AA 90612
North Young 2011	2008-009023-0		AA 90613
North Young 2012	2008-009025-0		AA 90614
North Young 2013	2008-009026-0		AA 90615
North Young 2014	2008-009027-0		AA 90616
North Young 2015	2008-009028-0		AA 90617
North Young 2016	2008-009029-0		AA 90618
North Young 2017	2008-009030-0		AA 90619
North Young 2018	2008-009031-0		AA 90620
North Young 2019	2008-009032-0		AA 90621
North Young 2020	2008-009033-0		AA 90622
North Young 2111	2008-009034-1		AA 90623
North Young 2112	2008-009035-0		AA 90624
North Young 2113	2008-009036-0		AA 90625
North Young 2114	2008-009037-0		AA 90626
North Young 2115	2008-009038-0		AA 90627
North Young 2116	2008-009039-0		AA 90628
North Young 2117	2008-009040-0		AA 90629
North Young 2118	2008-009041-0		AA 90630
North Young 2119	2008-009042-0		AA 90631
North Young 2120	2008-009043-0		AA 90632
North Young 2212	2008-009044-0		AA 90633
North Young 2213	2008-009045-0		AA 90634
North Young 2214	2008-009046-0		AA 90635
North Young 2215	2008-009047-0		AA 90636
North Young 2216	2008-009048-0		AA 90637
North Young 2217	2008-009049-0		AA 90638
North Young 2218	2008-009050-0		AA 90639
North Young 2219	2008-009051-0		AA 90640
North Young 2220	2008-009052-0		AA 90641
North Young 2312	2008-009053-0		AA 90642

Claim Name	Certificate of Location Recorded in Juneau Recording District, State of Alaska Book	Page	BLM Serial Number
North Young 2313	2008-009054-0		AA 90643
North Young 2314	2008-009055-0		AA 90644
North Young 2315	2008-009056-0		AA 90645
North Young 2316	2008-009057-0		AA 90646
North Young 2317	2008-009058-0		AA 90647
North Young 2318	2008-009059-0		AA 90648
North Young 2319	2008-009060-0		AA 90649
North Young 2320	2008-009061-0		AA 90650
North Young 2412	2008-009062-0		AA 90651
North Young 2413	2008-009063-0		AA 90652
North Young 2414	2008-009064-0		AA 90653
North Young 2415	2008-009065-0		AA 90654
North Young 2416	2008-009066-0		AA 90655
North Young 2417	2008-009067-0		AA 90656
North Young 2418	2008-009068-0		AA 90657
North Young 2419	2008-009069-0		AA 90658
North Young 2420	2008-009070-0		AA 90659
North Young 2512	2008-009071-0		AA 90660
North Young 2513	2008-009072-0		AA 90661
North Young 2514	2008-009073-0		AA 90662
North Young 2515	2008-009074-0		AA 90663
North Young 2516	2008-009075-0		AA 90664
North Young 2517	2008-009076-0		AA 90665
North Young 2518	2008-009077-0		AA 90666
North Young 2519	2008-009078-0		AA 90667
North Young 2520	2008-009079-0		AA 90668
North Young 2613	2008-009080-0		AA 90669
North Young 2614	2008-009081-0		AA 90670
North Young 2615	2008-009082-0		AA 90671
North Young 2713	2008-009083-0		AA 90672
North Young 2714	2008-009024-0		AA 90673
EAST RIDGE GROUP			
East Ridge 1011	2009-007170-0		AA 91926
East Ridge 1012	2009-007171-0		AA 91927
East Ridge 1013	2009-007172-0		AA 91928
East Ridge 1014	2009-007173-0		AA 91929
East Ridge 1015	2009-007174-0		AA 91930
East Ridge 1111	2009-007175-0		AA 91931
East Ridge 1112	2009-007176-0		AA 91932
East Ridge 1113	2009-007177-0		AA 91933

Claim Name	Certificate of Location Recorded in Juneau Recording District, State of Alaska Book	Page	BLM Serial Number
East Ridge 1114	2009-007178-0		AA 91934
East Ridge 1115	2009-007179-0		AA 91935
East Ridge 1210	2009-007180-0		AA 91936
East Ridge 1211	2009-007181-0		AA 91937
East Ridge 1212	2009-007182-0		AA 91938
East Ridge 1213	2009-007183-0		AA 91939
East Ridge 1214	2009-007184-0		AA 91940
East Ridge 1215	2009-007185-0		AA 91941
East Ridge 1310	2009-007186-0		AA 91942
East Ridge 1311	2009-007187-0		AA 91943
East Ridge 1312	2009-007188-0		AA 91944
East Ridge 1313	2009-007189-0		AA 91945
East Ridge 1314	2009-007190-0		AA 91946
East Ridge 1315	2009-007191-0		AA 91947
East Ridge 1408	2009-007192-0		AA 91948
East Ridge 1409	2009-007193-0		AA 91949
East Ridge 1410	2009-007194-0		AA 91950
East Ridge 1411	2009-007195-0		AA 91951
East Ridge 1412	2009-007196-0		AA 91952
East Ridge 1413	2009-007197-0		AA 91953
East Ridge 1414	2009-007198-0		AA 91954
East Ridge 1415	2009-007199-0		AA 91955
East Ridge 1416	2009-007200-0		AA 91956
East Ridge 1417	2009-007201-0		AA 91957
East Ridge 1510	2009-007202-0		AA 91958
East Ridge 1511	2009-007203-0		AA 91959
East Ridge 1512	2009-007204-0		AA 91960
East Ridge 1513	2009-007205-0		AA 91961
East Ridge 1514	2009-007206-0		AA 91962
East Ridge 1515	2009-007207-0		AA 91963
East Ridge 1611	2009-007208-0		AA 91964
East Ridge 1612	2009-007209-0		AA 91965
East Ridge 1613	2009-007210-0		AA 91966
East Ridge 1614	2009-007211-0		AA 91967
East Ridge 1615	2009-007212-0		AA 91968

Appendix B

Certificates of Qualified Persons

CERTIFICATE OF QUALIFIED PERSON

To accompany the report entitled: Technical Report for the Greens Creek Mine, Juneau, Alaska, USA, dated effective March 28, 2013 (the Technical Report).

I, Bryan J Morgen, P.E., residing in Juneau, Alaska, do hereby certify that:

1) I am a Senior Mining Engineer for the Greens Creek Mine, with an office at the Greens Creek mine site outside of Juneau, Alaska, USA;
2) I graduated with a B.Sc. in Mining Engineering from Montana Tech of the University of Montana in 2005. I have practiced my profession continuously since 2005. I have worked at operating mines in Nevada, Wyoming, Colorado, Montana, and Alaska;
3) I am a Professional Engineer certified in Mining and Mineral Processing registered with the Alaska Board of Professional Engineers and Land Surveyors, registration number 13196;
4) I have read the definition of “qualified person” set out in National Instrument 43-101 – *Standards of Disclosure for Mineral Projects* (NI 43-101) and certify that by virtue of my education, affiliation to a professional association and past relevant work experience, I fulfill the requirements to be a “qualified person” for the purposes of NI 43-101;
5) I have personally inspected the Greens Creek Mine, and continue to do so on an ongoing basis as a function of my normal duties at the mine;
6) I am an author of the Technical Report and responsible for Sections 15 and 16 of the Technical Report;
7) I am independent of Aurizon Mines Ltd. but not independent of Hecla Limited as described in Section 1.5 of the NI 43-101;
8) I have been employed by Hecla at the Greens Creek Mine since June of 2007 and have been directly involved in mine design, scheduling, rock mechanics, and operations;
9) I have read NI 43-101 and the Sections of the Technical Report for which I am responsible have been prepared in compliance with NI 43-101 and Form 43-101F1; and
10) As of the effective date of the Technical Report, to the best of my knowledge, information and belief, the Sections of the Technical Report for which I am responsible for contain all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

Juneau, Alaska
March 28, 2013

<u>(Singed and Sealed) “*Bryan J Morgen*”</u>
Bryan J Morgen, P.E.
Senior Mine Engineer
Hecla Greens Creek Mine

CERTIFICATE OF QUALIFIED PERSON

To accompany the report entitled: Technical Report for the Greens Creek Mine, Juneau, Alaska, USA, dated effective March 28, 2013 (the Technical Report).

I, Bill A. Hancock, RM, residing in Wilsonville, OR, do hereby certify that:

1) I am the Principal of Argo Consulting, LLC, with an office at 9450 SW Commerce Circle, #314, Wilsonville, OR 97070. I graduated with a B.Sc. in Mineral Engineering from the University of Minnesota in 1977;
2) I have practiced my profession for 36 years. My experience includes process evaluations, testing, audits and plant optimization studies on mineral process circuits, flotation, water treatment, solids-liquids separations and training programs for a range of minerals including lead-zinc, gold-silver, copper, platinum-palladium, iron ore, chromite, calcium carbonate and soda ash;
3) I am a Qualified Professional with registrations with the Society of Mining Engineers (SME #1311450RM) and the Mining and Metallurgical Society of America (MMSA # 01177QP);
4) I have read the definition of “qualified person” set out in National Instrument 43-101 – *Standards of Disclosure for Mineral Projects* (NI 43-101) and certify that by virtue of my education, affiliation to a professional association and past relevant work experience, I fulfill the requirements to be a “qualified person” for the purposes of NI 43-101;
5) I have visited the Greens Creek operation numerous times since prior to startup in 1989, with my latest visit conducted on October 31, 2012. I have toured the plant regularly and am familiar with the flowsheet, the handling and separation methods employed, the process facilities and the reagents and other materials used. In addition, I have reviewed metallurgical test work for the mill;
6) I am a reviewer of the Technical Report and responsible for Sections 13 and 17 of the Technical Report;
7) I am independent of Aurizon Mines Ltd. and the issuer applying all of the tests in Section 1.5 of National Instrument 43-101;
8) I have read NI 43-101 and the Sections of the Technical Report for which I am responsible have been prepared in compliance with NI 43-101 and Form 43-101F1; and
9) As of the effective date of the Technical Report, to the best of my knowledge, information and belief, the Sections of the Technical Report for which I am responsible for contain all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

Wilsonville, OR USA
March 28, 2013

(Signed and Sealed) “*Bill A. Hancock*”
Bill A. Hancock
Principal
Argo Consulting, LLC

CERTIFICATE OF QUALIFIED PERSON

To accompany the report entitled: Technical Report for the Greens Creek Mine, Juneau, Alaska, USA, dated effective April 28, 2013 (the Technical Report).

I, Dr. Dean W.A. McDonald, P.Geo., residing in Vancouver, British Columbia, Canada, do hereby certify that:

1) I am the Vice President, Exploration for Hecla Mining Company, with an office at Suite 970, 800 West Pender Street, Vancouver, British Columbia, V6C 2V6 Canada;
2) I graduated with a B.Sc. in Science (Geology) from McMaster University in 1981, MSc in Science, from University of New Brunswick, 1984, PhD in Science (Mineral Deposits), from University of Western Ontario, 1990. I have practiced my profession continuously since 1981. I have worked at operating mines in Canada, and worked on exploration and development programs in the U.S., Canada, Mexico, Australia, Argentina and Chile. I have extensive experience with base and precious metal deposits such as the Lucky Friday;
3) I am a Professional Geologist registered with the Association of Professional Engineers and Geoscientists of British Columbia (APEGBC), registration number 24217;
4) I have read the definition of "qualified person" set out in National Instrument 43-101 – *Standards of Disclosure for Mineral Projects* (NI 43-101) and certify that by virtue of my education, affiliation to a professional association and past relevant work experience, I fulfill the requirements to be a "qualified person" for the purposes of NI 43-101;
5) I have personally inspected the Greens Creek Mine, and continue to do so on an ongoing basis as a function of my normal duties with the company. I most recently visited the mine on February 13, 2013 for one day;
6) I am an author of the Technical Report and responsible for Sections 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27 and Appendix A, of the Technical Report;
7) I am independent of Aurizon Mines Ltd. but not independent of Hecla Mining Company as described in Section 1.5 of NI 43-101;
8) I have been employed by Hecla since September 1, 2006 and have made regular site visits to Lucky Friday since that time. I have been closely involved in the review of exploration programs, resource and reserve estimates and related external audits;
9) I have read NI 43-101 and the Sections of the Technical Report for which I am responsible have been prepared in compliance with NI 43-101 and Form 43-101F1; and
10) As of the effective date of the Technical Report, to the best of my knowledge, information and belief, the Sections of the Technical Report for which I am responsible for contain all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

Vancouver, B.C. Canada
April 28, 2013

(Signed and Sealed) "*Dean McDonald*"
Dean McDonald, P.Geo
Vice President
Hecla Mining Company