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Sammendrag

KONFIDENSIELT

FALKHAMMER - IBESTAD MAGNETITE A.S.
ANDØRJA MAGNETITE PROJECT
SOUTHERN TROMS REGION
NORWAY

FEASIBILITY STUDY
VOLUME I

JULY, 1991.

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FALKHAMMER - IBESTAD MAGNETITE A.S.

ANDORJA MAGNETITE PROJECT

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KONFIDENSIELT

SECTION 1.0

INTRODUCTION

FALKHAMMER - IBESTAD MAGNETITE A.S.
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1.0 INTRODUCTION

1.0 GENERAL

In March 1991, Falkhammner-Ibestad Magnetite A.S. commissioned Kilborn Inc. to determine the most suitable concept of a mining and processing facility for the Andørja Magnetite Project in order to produce 400 540 tonnes of magnetite and 81 600 tonnes of apatite as major products in the initial phases with provision to expand these tonnages as future demand requires. Included in this work was the assessment and utilization of previous work carried out by various consultants which was pertinent to the work.

The rich magnetite deposit is located on the island of Andørja in the southern Troms region of Northern Norway. The site is 50 km east of Harstaad and approximately 320 Km north of the arctic circle. Access is by Highway E-6 to Bjerkvik, county highway 19 and 83 to Harstaad, next by ferry to the island of Rolla then along county highway 848 to Hamnvik and continuing by ferry to the island of Andorja.

The nearest airport is at Evenes, approximately 50km to the southwest which provides daily service to Tromsø, Bodø and Oslø.

The nearest port city is Harstad with a population of about 20,000. The port itself has capability to handle 50 000 tonne ships but has no bulk handling facilities. The city has two medium sized shipyards.

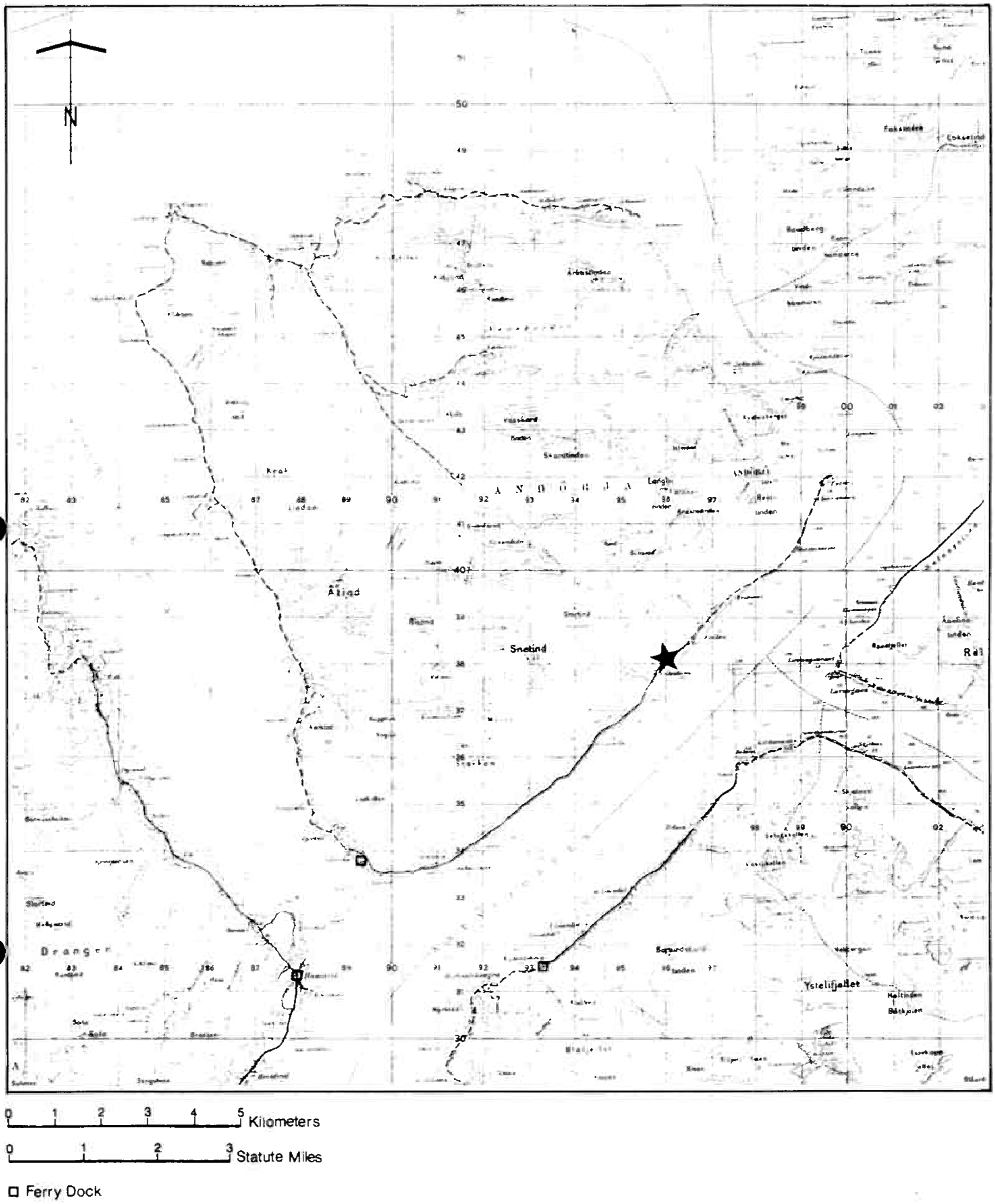
The local community of Ibestad is located on the island of Rolla in Hamnvik which also possesses a modern shipyard, machine shop and an offshore metal fabrication shop which can be used to provide maintenance services to the mine.

In the years 1912 and 1962, diamond drilling was carried out by West Fjord Co and A/S Rodsand Gruber respectively for a total depth of approximately 20,000 meters. Outcrop mapping was carried out by Eng. L. Noess in 1944, metallurgical testing by Dr. C.W. Carsten Nit also in 1944. Mining concessions and claims covering the Gropa and Kuliberget deposits are now held by Falkhammer Ibestad Magnetite A/S.

In the fall of 1988, laboratory scale testing was carried out by the Mineral Dressing Laboratories of the Norwegian Institute of Technology in Trondheim.

In 1990 a further 60 tonne pilot plant test was carried out by Minpro laboratories of the Swedish Mineral Processing AB of Sweden. This test was to verify the apatite flotation process at a 1/10th scale and a pigment/toner production process.

At the commencement of 1991, Falkhammer-Ibestad Magnetite A.S. decided to proceed with a full scale feasibility study to confirm the technical and economic viability of the Andorja Magnetite Project.



FIMAS
Andorja Magnetite Project
Island of Andorja
Project Location

FIMAS
Andorja Magnetite Project
Vicinity Map

KONFIDENSIELT

SECTION 2.0

SUMMARY

FALKHAMMER - IBESTAD MAGNETITE A.S.
ANDØRJA MAGNETITE PROJECT
FEASIBILITY STUDY - VOLUME 1

2.0 SUMMARY

2.1 GENERAL

The feasibility study describes the preliminary design, capital and operating costs for the production of magnetite in various forms and apatite from the Falkhammer-Ibestad A/S (FIMAS) property located in Andørja Island in Northern Norway. In addition the Ibestad Kommune will be constructing a multi-purpose industrial site utilizing the stripped material taken from the minesites, and a marine dock which will service both the FIMAS mine and the future industrial site tenants.

The location of the plant is east of the Kuliberget deposit and west of the Hammnhage Point. The concentrator plant and its ancillary building and equipment will be located so as to utilize the sloping terrain to maximum advantage. The fjord shoreline down to the minus 15 metre contour will be filled from the marine dock area toward Hammnhage in order to form an area which will be utilized for industrial purposes.

The study assessed the feasibility and economics of the project on a combination of open pit mining of the Kuliberget and Gropa deposits and then underground mining of the Kuliberget deposit. The economic evaluation of the project has been based on pre-stripping waste rock by the Ibestad Kommune from the Kuliberget open pit for industrial purposes.

The preliminary design and layout of the crushing and concentration plant provides for the yearly production of the following products.

Tonnage produced:

Magnetite	325,000 tonnes/year
Apatite	81,600 tonnes/year
Superslig	75,000 tonnes/year
Pigment & Toner	540 tonnes/year
TOTAL	**482,140 tonnes/year**
Capital Cost	**$29,121,000 U.S. (excluding infrastructure)**
Operating Cost/Yr	**$7.71 per tonne/product (average)**

Mapping and Sounding Datum

Due to the differing mapping coordinate systems that have been used to map the proposed mine site area on Andørja, a revised survey of the area based on the new Norwegian mapping system and tied into the system datum will be required for the final engineering and location of the marine dock and plant.

For the purposes of this study, the various maps have been collated in a computer model and subsequently matched to each other in order to attain a reasonable geographic fit. No attempt has been made to rationalise the apparent discrepancies in horizontal and vertical datums registered on the various map sheets. The various topographic maps are considered to be correct within the respective limits of coverage and the accuracy of the feasibility study.

Geotechnical

SINTEF was retained to carry out the rock mechanics evaluations of Andorja deposits as required for the design of underground mine openings. Their report is included as Appendix A.

Environmental

The environmental impact that the location of the mine workings and the concentration plant would have on Andørja Island is recognized as being a major component to be addressed in the initial design and construction of the plant. These concerns and the environmental guidelines to be followed have been addressed in Section 4.0 Environmental.

Geology and Mineral Inventory

The Foundation for Scientific and Industrial Research at the Norwegian Institute of Technology (SINTEF) was selected by FIMAS to provide the geological description and in situ mineral inventory of the Andørja magnetite deposit. Results were reported in two stages with a report on the main zone followed by the Multiseam Model Addendum Report. SINTEF's reports are excerpted in Section 3 and reproduced in full in Appendix A.

Banded magnetite-apatite layers occur within a 100m thick amphibole-mica-schist formation. The layers dip at 10 to 20 degrees towards the east from the Gropa area (some 350m above sea level), through the sub-economic Lia area, to the Kuliberget area (near and below sea level). Six zones of mineralization have been identified within the formation, numbered 1 to 6 in ascending order. The ore reserves are concentrated in Zone 3 of the Gropa and Kuliberget areas.

SINTEF prepared polygonal estimates of the in situ mineral inventory above cutoff grades, selected by Kilborn, of 20% and 25% magnetite over a minimum thickness of 3 metres. These resources, classified as Demonstrated (i.e. proven plus probable) are summarized below:

Table 1. Total demonstrated in situ resources for Gropa, Lia and Kuliberget.

Cut-off	% Magnetite	% P	Specific Gravity	Average thickness	Tonnes x 10^3
20% Magn.	27.72	1.13	3.35	11.59	74,665
25% Magn.	30.36	1.23	3.40	10.48	51,449

Ore Reserves

Kilborn estimated the diluted, mineable reserves in three groupings based on mining method, cost and cut-off grade. Results are summarized below:

Table 2. Diluted Mineable Reserves.

Area	Method	Cut-off Grade	Tonnes x 10^3	% Magnetite	% P
Kuliberget	Pit	20%	700	27.71	1.06
Kuliberget	U/G	20%	10,650	28.07	1.22
Gropa	Pit	20%	7,910	28.21	1.03
Total			19,260	28.12	1.13

The 20% cut-off grade was used in each case. The anticipated mix of underground methods results in a total average operating cost of $7.90/t which corresponds to a break-even cut-off grade of 19.3% magnetite. The 25% cut-off would apply to room and pillar mining in narrow zones such as the Lia area where operating costs would increase to approximately $10/t.

Kilborn's estimate of 19.2 million mineable tonnes is much less than SINTEF's 74.6 million in-situ tonnes for several reasons. First, it is confined to the main Zone 3 which is the thickest, most continuous seam. Reference to Table 3.1 in the next section shows that

SINTEF's estimate for Zone 3 is 50.7 million tonnes. Thus 23.9 million tonnes of geological resources in other seams have been ignored in this study (except within the open pits). Second, the Kuliberget area mineable total of 11.35 million tonnes is a little less than half of the 24.5 million tonne geological total because of the barrier pillars between pit and mine and between ocean and mine, and because of the need to leave pillars between rooms (or stopes). Third, the Gropa area 7.9 million mineable tonnes are only 55% of the 14.4 million geological tonnes because only open pit mining was considered and was limited by the break-even stripping ratio of about 0.8:1. Approximately 3 million tonnes of the remaining resource could probably be mined by underground methods. Four, the Lia area, between Gropa and Kuliberget, has been ignored. It is thinner and lower grade than the other two areas. At the 20% cut-off the geological resource is 11.8 million tonnes at 25.76% magnetite. For this area, the 25% cut-off would be more suitable: 7.6 million tonnes at 28.35% before dilution. (These resource figures by area are taken from the Appendix of SINTEF's Multiseam Model Addendum Report). Finally, these zones are open to the north and could be continuous to the north coast of Andørja where they are known to outcrop.

In summary, if the 14 year mine plan from Kilborn's 19.2 million tonne reserve is viable, then further exploration and assessment could extend the life to about 20 years from the current resources and possibly much longer from other areas.

Mining

The mining methods have been selected to minimize costs in this large tonnage, relatively low grade deposit. The production rate of 1,360,000 tonnes of ore per year is governed by marketing considerations and the anticipated average ore grade. The mines are scheduled to operate 3 shifts per day, 7 days per week with four rotating crews producing 3,900 tonnes of ore per day.

For the first six years, mining will be from open pits. At low strip ratios (less than 0.8 tonnes of waste per tonne of ore) this is the cheapest mining method in terms of capital as well as operating costs. Fortunately, the waste rock above the Kuliberget open pit is required for construction of an industrial site along the edge of the fjord. Since a significant portion of this work will be financed by others, the effective stripping ratio on the Kuliberget pit is reduced from 0.58:1 to 0.08:1.

Mining of the Kuliberget pit will be completed in 6 months and the crews and equipment will be moved up to the Gropa pit. At a strip ratio of 0.57:1, the Gropa pit contains 7.91 million tonnes of ore, sufficient for 5.8 years of production. This ore will be dumped down an orepass into the pre-developed Kuliberget underground main haulage decline then transferred by truck to the mill crusher.

Underground mining methods will be room and pillar in the narrow areas (4m to 7m), room and pillar with benching (up to 13m), and longhole open stoping in rooms more than 13m high. All stope development will be in ore. Access drifts and rooms will be driven cross pitch to limit the gradients to 15% (8.6 deg.) despite dips of up to 20 deg. Mining equipment will be selected for optimum productivity and minimum operating costs. An underground crushing and conveying system will reduce haulage costs when the mine workings have progressed too far from the portal. Underground mineable reserves provide approximately 8 years life.

The ventilation flow will be in through the main haulage, ducted to room and pillar headings, up through open stopes and out via drill drifts to a hanging wall portal in the pit or through the ore pass which will be converted to an exhaust raise.

Processing

The processing flowsheet is developed from proven technology in the industrial mineral processing industry.

The flowsheet incorporates large pieces of equipment which reduce the number of units to process large tonnages.

The selection of equipment, especially for handling and feeding of the ore, takes into account the characteristics of the ore body and the plant.

Included at the end of this section are simplified flowsheets for both Case 1 (Minpro) and Case 2 (Kilborn)

Plant and Ancillaries

The process plant has been designed to take advantage of the natural rock contours to maximize gravity flow from ore feed to the storage of the finished products.
Modular units are utilized for administration, laboratory, dry and warehouse.

There is no provision made for a sophisticated service/shop complex, as it is anticipated that the existing facilities in Ibestad will be utilized.

Shipboard Alternative

The shipboard concept for the processing of the ore and storage of the product was investigated. A world wide search for a ship with self unloading capability and sufficient storage area to hold the finished products proved to be negative. To acquire a cargo ship of sufficient size and to retrofit the structure to hold the process equipment, and install self unloading capability proved to be uneconomical and was therefore discarded.

Schedule

The scheduled 21 month construction period, from a decision to proceed to plant startup date, is dependent on weather windows. These windows control, to a large degree, the activities which can be economically carried out in northern Norway.

The immediate items to be constructed or undertaken will be the marine dock and the stripping of the Kuliberget mine and disposing of the waste to fill in the fjord shoreline in order to provide the land area for the future industrial site.

Marketing

The market for magnetite which has wide usage as an industrial mineral is largely controlled through mineral agents. The other major product Apatite is used by major chemical companies in the production of fertilizer products. FIMAS has been negotiating contracts with a mineral agent and a chemical company which define the minimum quantities and selling price of the products which the companies are willing to accept. The product quantities and prices have been used as a basis for the feasibility of the Andørja project.

2.2 CONCLUSIONS

Within the industrial mineral market, the initial plant size and its products share of the market must be carefully studied and defined in order to get into operation with a reasonable profit. Consequently, plants must be very basic and cannot have unnecessary items which could add to initial capital cost.

Generally the plant has to be able to demonstrate that it can produce a product or products to the required specification for todays market and that production can be readily expanded to meet any increased demand.

It is also important in developing the project that the scope, as defined within the study, is adhered to. Any changes to the study concept and scope must be dictated by economic reasons.

A 14.1% Discounted Cash Flow rate of Return at 100% equity and no inflation can be considered as indicative of a viable project. It is sufficient to warrant the work required to fully confirm the items mentioned in the recommendations. The expected favourable outcome of these items will expedite an early decision to proceed with the project.

2.3 RECOMMENDATIONS

1. In order to reduce water consumption, testwork should be initiated to determine the applicability of using a tailings thickener to increase the density of the tailings and make decanted water available for re-use. A serious concern, is the effect of contaminating and intermixed reagents, on the efficiency of the process.

2. Testing of Andørja ore should be conducted on the Multi-Gravity Separator, MGS, patented and marketed by Richard Mozely Limited of Redruth, Cornwall, U.K. This relatively new unit could potentially increase the efficiency of producing superslig in a more compact layout than concentrating tables. A Norwegian magnetite producer has already had tests done on its ore and the results, as published in a technical paper are, encouraging.

3. The initial testwork carried out by Hazen Research Inc. in Golden, Colorado for grindability of the ore should be further extended to cover the testing of the flotation properties of the apatite.

4. The economics of pumping the slurried magnetite and apatite concentrate directly from the mill into vacuum filters located on the storage building roofs should be investigated. This would remove excess moisture and feed the concentrate directly down into storage. Moisture content of the products would need to be matched with the requirements of product specification and shipping criteria.

5. During the feasibility study, efforts were made to locate used equipment which would be suitable for Andørja. Due to the time constraints, only a few major items were located. It is recommended that on commencement of detail engineering, immediate steps be taken to search out and inspect any operations in Scandinavia which have closed down and may have equipment available and compatible to the proposed FIMAS process.

   An international search is recommended for used mining equipment, particularly off-highway trucks in the 45 to 60 tonne capacity range.

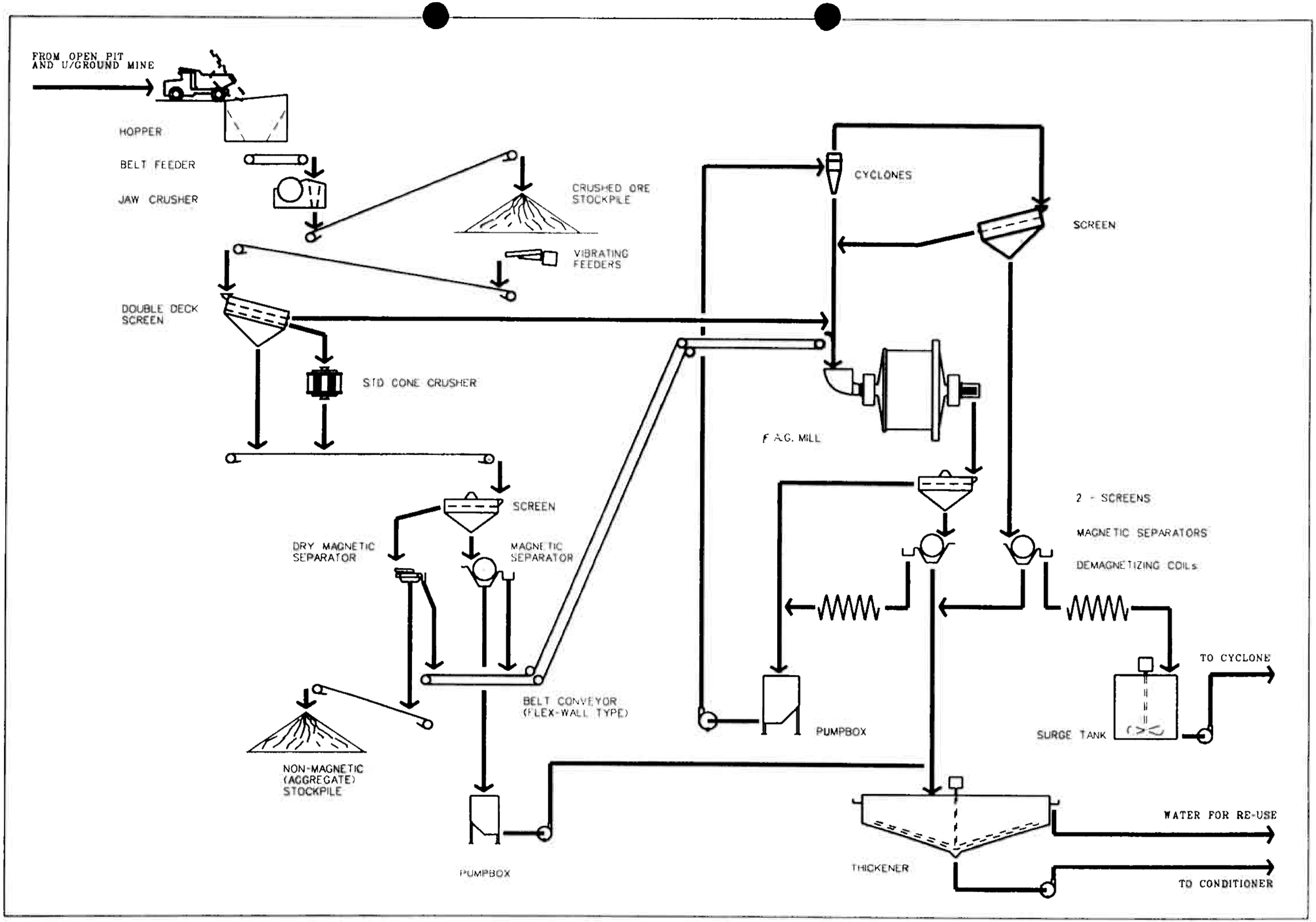
6. Closer spaced drilling is required within the Gropa pit area prior to detailed pit design and production scheduling. This program should include sampling and analysis for all relevant data, including specific gravity and porosity, and should be combined with geotechnical testing to define the probable fault, pit slope angles and possible ground water.

To fully determine the magnitude and location of reserves in the project area, further drilling should be carried out once the plant is operational.

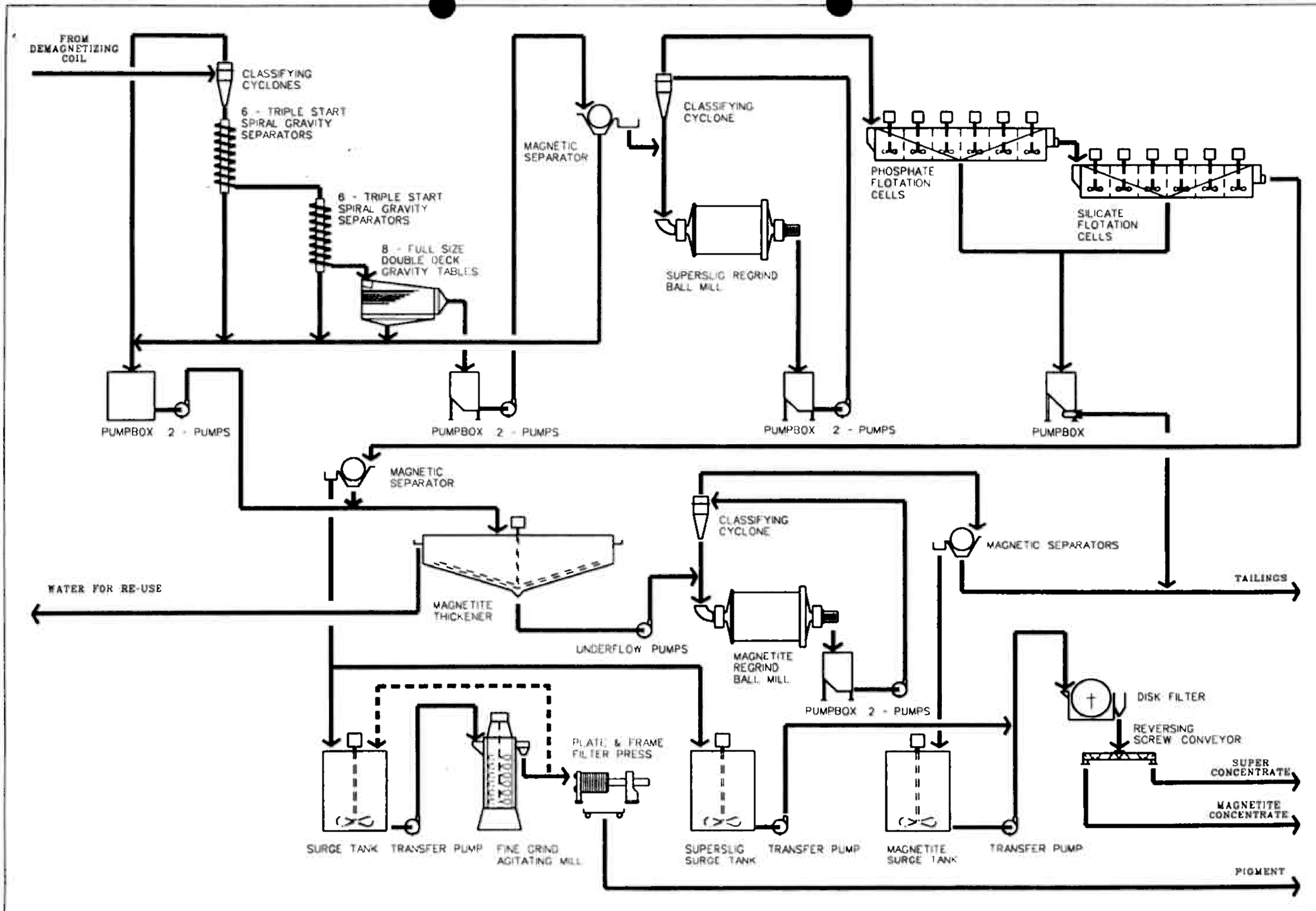
7. Cost saving ideas which warrant further investigation include the shortening of the Gropa pit ore haul and rehandle distances by reorienting the ore pass, and the use of larger pit equipment with less operators on a more flexible shift system (such as four 10 hour shifts on and four off) to cover seven days per week.

8. A geotechnical investigation of the rock underlying the crushing and concentration plant facilities should be made before the foundation design is implemented.

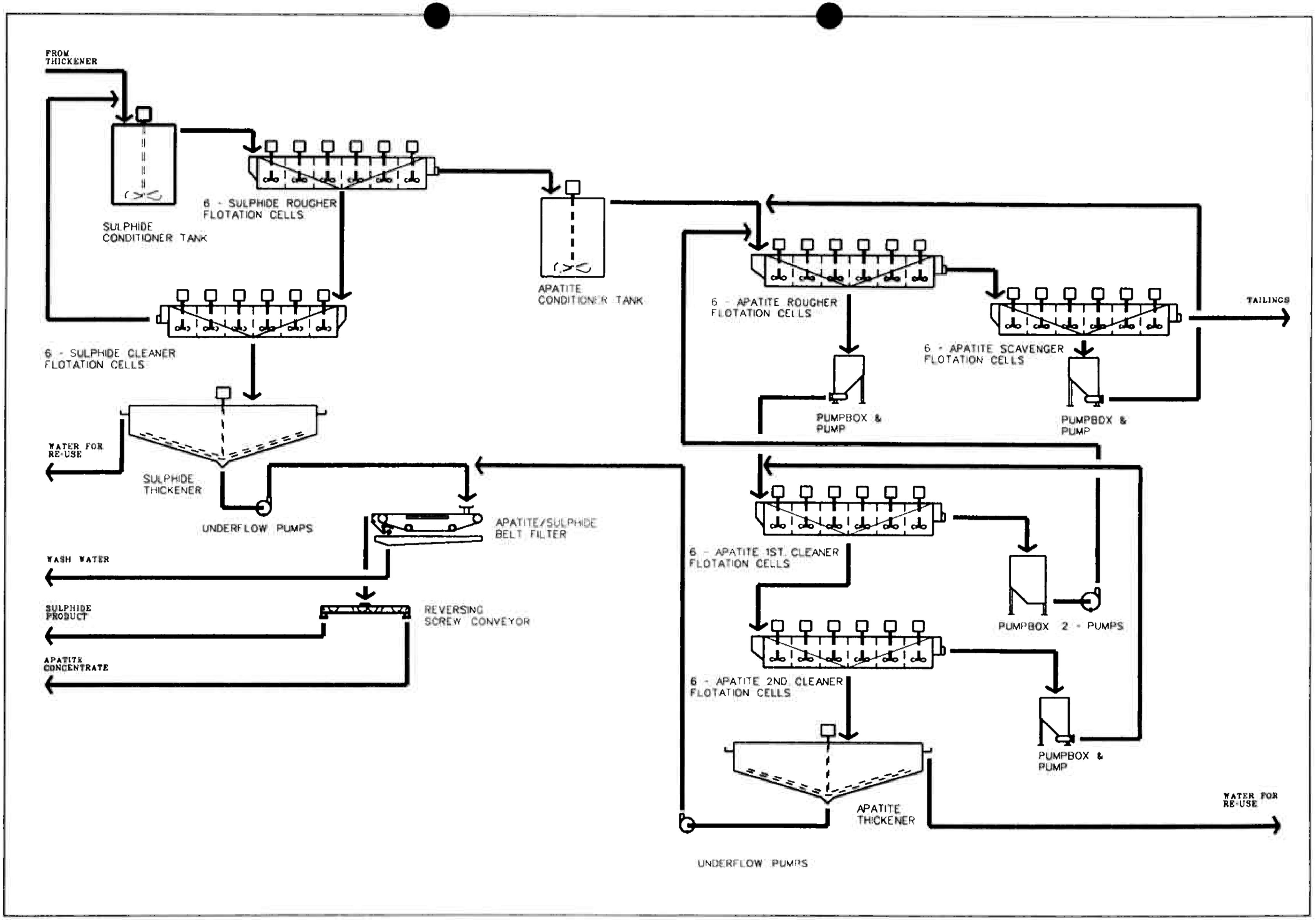
9. Survey work is urgently required to correlate topographic data, borehole locations and the various grid systems. Based on one of the mapping systems, it appears that the property boundary cuts through the Gropa pit.

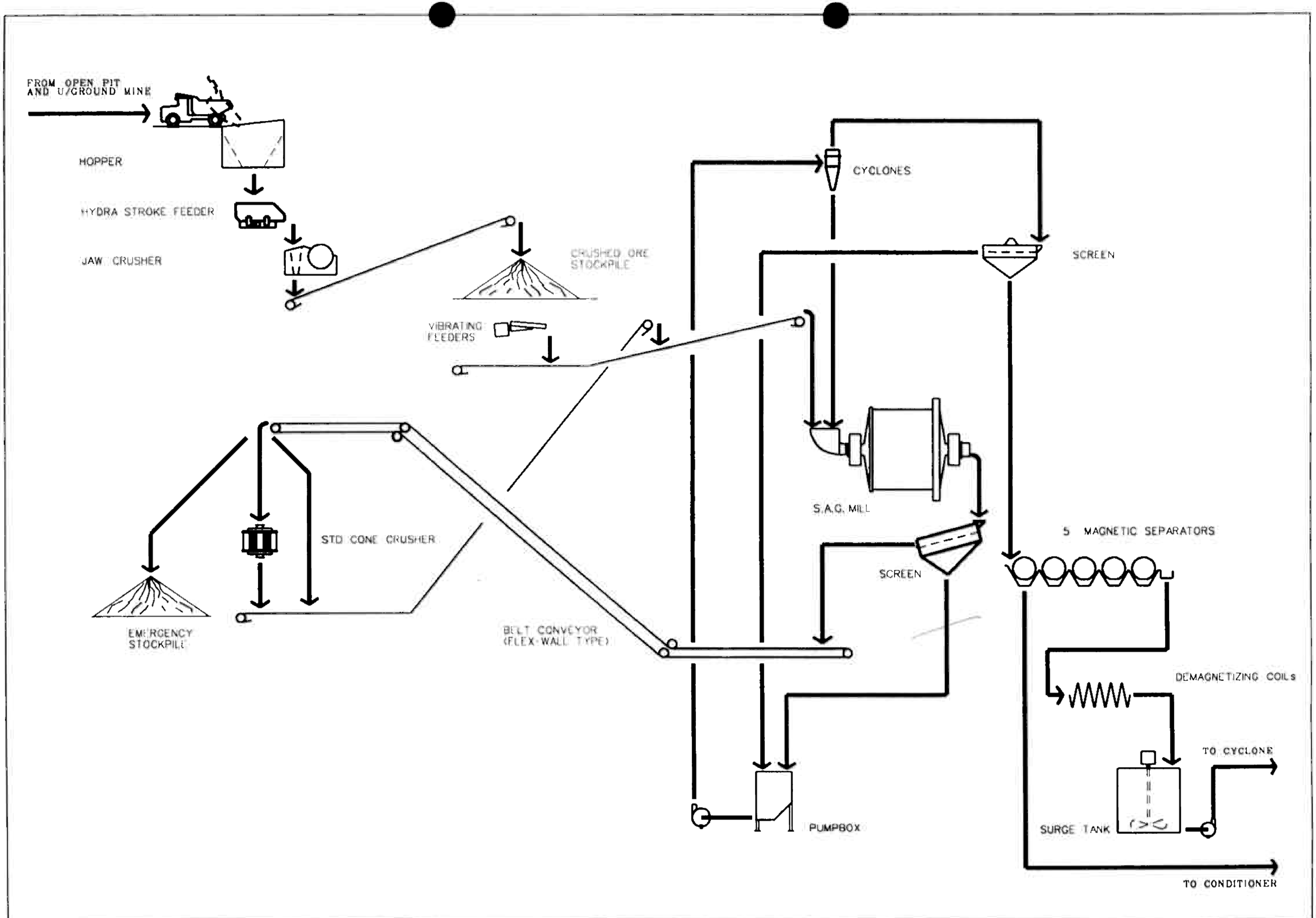


ORE RECEIVING , CRUSHING & GRINDING CASE 1 SK 1

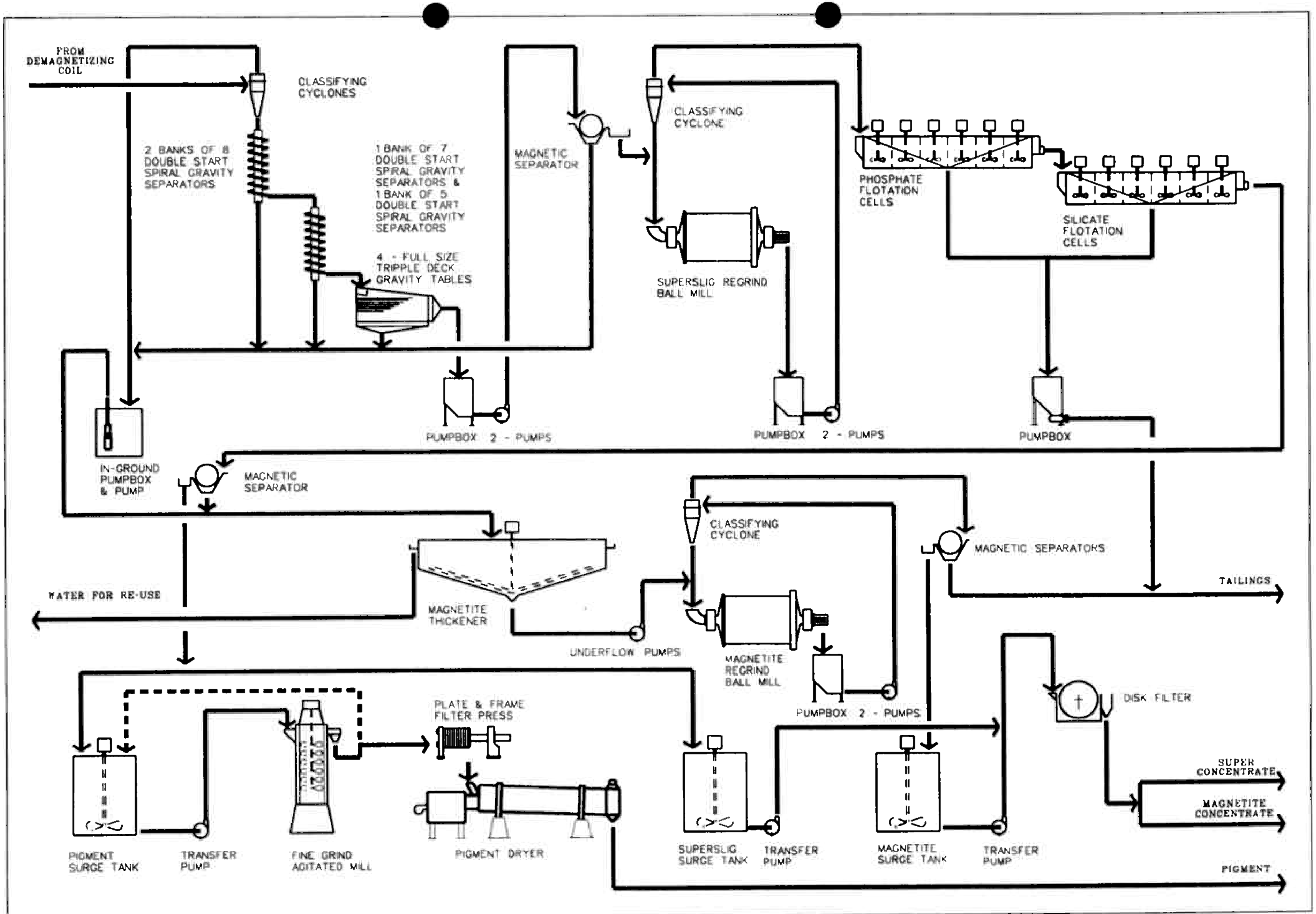


MAGNETITE & SUPERSLIC PRODUCTION CASE 1 SK 2

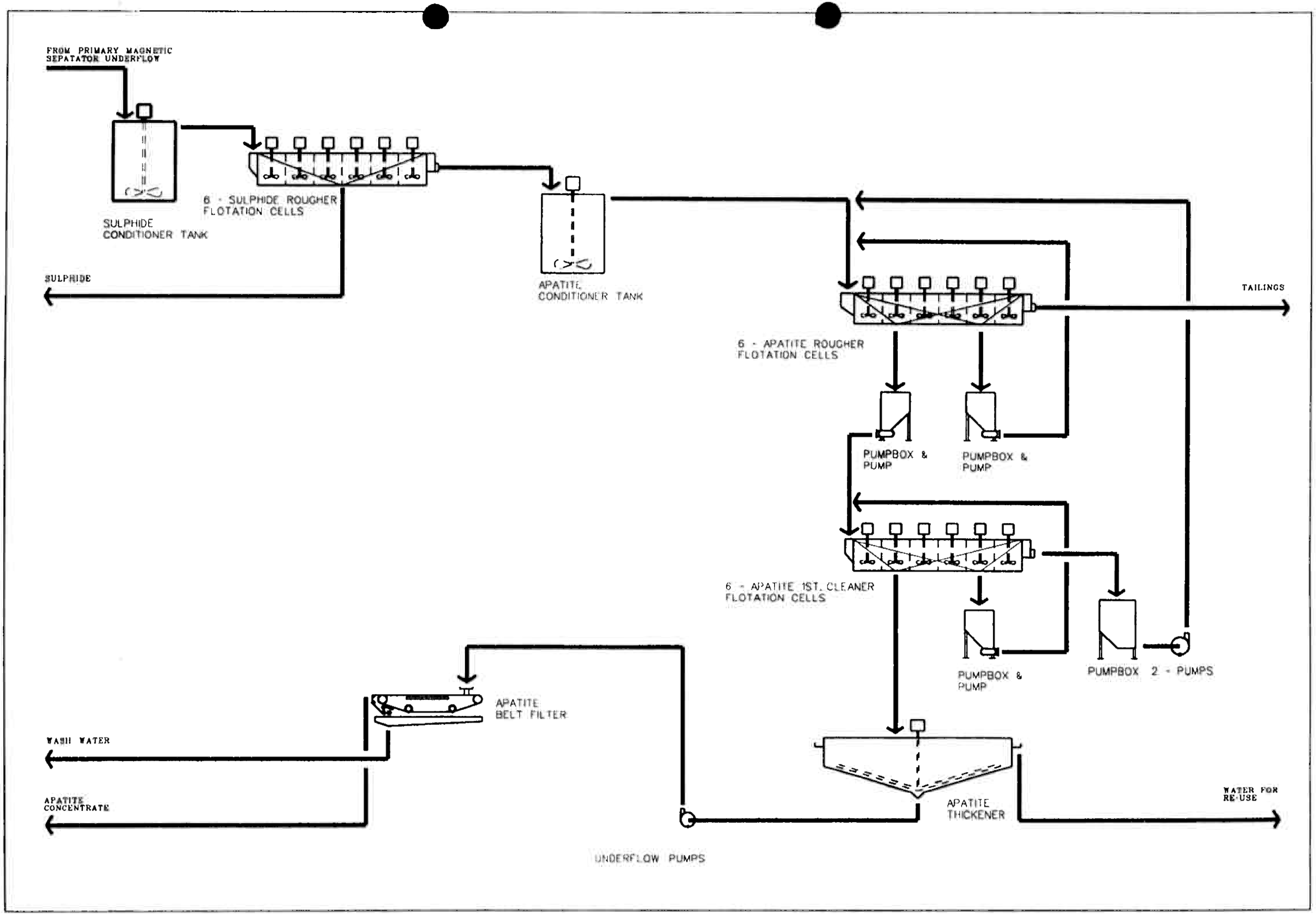

FROM THICKENER
SULPHIDE CONDITIONER TANK
6 - SULPHIDE ROUGHER FLOTATION CELLS
APATITE CONDITIONER TANK
6 - APATITE ROUGHER FLOTATION CELLS
6 - APATITE SCAVENGER FLOTATION CELLS
TAILINGS
6 - SULPHIDE CLEANER FLOTATION CELLS
PUMPBOX & PUMP
PUMPBOX & PUMP
WATER FOR RE-USE
SULPHIDE THICKENER
UNDERFLOW PUMPS
APATITE/SULPHIDE BELT FILTER
6 - APATITE 1ST. CLEANER FLOTATION CELLS
WASH WATER
SULPHIDE PRODUCT
REVERSING SCREW CONVEYOR
PUMPBOX
2 - PUMPS
APATITE CONCENTRATE
6 - APATITE 2ND CLEANER FLOTATION CELLS
PUMPBOX & PUMP
WATER FOR RE-USE
APATITE THICKENER
UNDERFLOW PUMPS



ORE RECEIVING , CRUSHING & GRINDING CASE 2 SK 1



MAGNETITE & SUPERSLIG PRODUCTION CASE 2 SK 2


FROM PRIMARY MAGNETIC SEPATATOR UNDERFLOW
SULPHIDE CONDITIONER TANK
6 - SULPHIDE ROUGHER FLOTATION CELLS
SULPHIDE
APATITE CONDITIONER TANK
TAILINGS
6 - APATITE ROUGHER FLOTATION CELLS
PUMPBOX & PUMP
PUMPBOX & PUMP
6 - APATITE 1ST. CLEANER FLOTATION CELLS
PUMPBOX & PUMP
PUMPBOX 2 - PUMPS
APATITE BELT FILTER
WASH WATER
APATITE CONCENTRATE
APATITE THICKENER
WATER FOR RE-USE
UNDERFLOW PUMPS

KONFIDENSIELT

SECTION 3.0

GEOLOGY AND MINERAL RESOURCES

FALKHAMMER - IBESTAD MAGNETITE A.S.
ANDØRJA MAGNETITE PROJECT
FEASIBILITY STUDY - VOLUME 1

3.0 GEOLOGY AND MINERAL RESOURCES

The descriptions of exploration, geology and sampling in sub-sections 3.1 to 3.3 are excerpted from the report entitled "Feasibility Study at Andorja Iron ore deposit - In situ resources" prepared by the Foundation for Scientific and Industrial Research at the Norwegian Institute of Technology (SINTEF). The tabulations of in-situ mineral resources in Sub-Section 3.4 are summarized from SINTEF's Multiseam Model Addendum Report. Both complete reports are reproduced in Appendix A.

3.1 DISCOVERY AND EXPLORATION

The discovery date and early exploration history of the Andørja deposit are not well known. Some 550m were drilled in 7 holes back in 1911, but little more was done until ~~Elkem~~ Chr. Spigerverk acquired the property in 1958.

From 1958 to 1962 Chr. S.p.v. Elkem drilled 93 holes totalling 12,404m in the contiguous Gropa/Lia/-Kuliberget areas, plus an additional 14 holes (877m) in the Masan area 1.5 km northeast of Gropa. An exploration adit was driven into the Kuliberget Zone 2 for a distance of 130m and a bulk sample was extracted for testing.

3.2 GEOLOGICAL DESCRIPTION

The Andørja magnetite-apatite deposits are situated in the highly metamorphosed upper allocthon of the Caledonian mountain range on the island of Andørja in Troms. Banded magnetite layers occur within a 100m thick amphibole-mica-schist formation in a group of mica schists. 2-20m thick calcite marble marker horizons occur both over and under the amphibole-mica-schist formation. The main ore zones, Gropa in the west and Kuliberget in the east, are probably the same ore horizon divided by a thin, lower grade mineralization referred to as Zone 3 or Lia.

Several magnetite rich zones occur within the amphibole-schist. Geis (1962d) divided them into six different zones, named by numbers increasing upwards. All these zones can be divided into subunits. Ore zone 2 or Kuliberget in the east and Ore zone 3 or Gropa in the west are the only zones with both high grades (>25% magnetite) and thicknesses (>20m). Zones 1 and 5 have less than 15% magnetite but are up to 17 meters thick. Zones 4 and 6 are mostly less than 10 meters thick, the magnetite grade is up to 35% but is variable.

Total iron grades are up to 45%. The hematite:magnetite ratio decreases with increasing metamorphosis. Common gangue minerals are quartz, calcite, biotite, epidote, hornblendes and garnet. Apatite occurs with variable grades, average is around 0.2%P. The same amphibole schist with magnetite zones crops out 6-7 km to the north at the north side of the Trollan mountain. The Andorja deposits thus have large potential resources.

3.2.1 Structural Geology

The ore layers dip from 10 to 20 degrees towards the east. Strike is approximately N10W in the Gropa area to N70W in the Kuliberget area. Regionally, three phases of deformation are identified. Folding is not important in the structural control of the deposits. The folds on Andorja have large wavelengths and are gentle. Small isoclinal folds can be seen in the drillhole cores. Locally small tight to isoclinal folds occur but they are not significant.

Fault movements have occurred in several periods in this region, also in post-glacial times.

There are several fracture and faulting systems, two of which are the most important: (1) striking ESE-WNW and (2) striking NE-SW both with high angle faces. The Astafjord fault is parallel to (2) and is a vertical fault (Gustavsen 1972). One fault parallel to (2) in the test drift has a throw of about 5 meters. This fault is supposed to continue up to drillhole "L". There is however, no evidence of faults with large throws in the drill holes from the Kuliberget and Gropa area.

3.3 DIAMOND DRILLING and SAMPLING

100 drill holes with a total length of 12 954 m were drilled in the Kuliberget and Gropa area in 1911 and 1958 to 1961. In addition 14 holes with a total length of 877 meters of drilling were done in the Masan area 1.5 km northeast of Gropa in 1961. The limits of Gropa and Masan magnetite zones are said to be found, but the Kuliberget Zone is open to the north and northeast. The Masan area did not show up interesting reserve figures: 6.9 million metric tons at 20% magnetite plus 0.3 M tons at 30.4 % magnetite reported at Masan west.

Seven holes with a length of 550m (drillhole nr. 1 to 8 (?) and 9 to 12) were drilled in 1911. The mineralized parts were analyzed for magnetite, total iron, sulphur and phosphorous. Bulk samples were assayed for hydrochloric acid soluble iron and total iron.

Most of the drilling was done during the summers of 1958 to 1962 by Chr. Sp. verk ~~Elkem~~ after taking over the deposits in 1958: 5 holes with a total length of 620m were drilled in 1958, 8 holes with a total length of 1918 m in 1959, 57 holes with a total of 5024 m in 1960 and 23 holes with total of 4842 m were drilled in 1962. These cores were assayed for magnetic minerals by "Dings tube separator" at the Rodsand mine and phosphorous at Cristiania Spikeverk. The magnetic fraction is reported to contain 70-72% iron. Not all the assays were found. Missing grades of magnetite or phosphorous were calculated from the formula

$$\%P = 0.25 + 0.04 * \% \text{ Magnetite}$$

which was derived from a regression line between plots of phosphorous against magnetite.

Assay reports for some of the drill holes were missing, but in such cases the average for the zones were found from the section maps. The assaying interval is generally coincident with the different zones. Only two drill holes OE (OE for Norwegian letter 0) and 5H are assayed in detail including waste rock.

Specific gravity was not generally measured. Only three measurements of specific gravities versus magnetite are known, all taken from the Kuliberget Ore zone, which plot in a straight line intersecting the zero percent magnetite axis at a specific gravity of about 2.8.

The missing specific gravities are calculated from the formula

$$\textit{spec. gravity} = 2.8 + 0.02 * \%\ \textit{Magnetite}$$

Specific gravity was included in the ore calculation to avoid an underestimation of the ore. However, the numbers used are considered to be conservative. One test with Clericis liquid on ore from the test drift shows that most of the gangue minerals have a density between 2.7 and 4.0.

Phosphorous and magnetite grades of the waste rock are conservatively estimated to be 5% magnetite and 0.25 P. These values were used for compositing across two or more assayed samples separated by bands of waste.

No deviation measurements are known from Andorja. The core logs shows that the drill holes drift so that the foliation is perpendicular to the drill holes.

3.4 IN SITU GEOLOGICAL RESOURCES

The estimation is based on the polygonal method. The resources for two cutoffs, 20% and 25% magnetite, were calculated from the drillhole assays. The total demonstrated resources are presented by Zone in Tables 3.1 and 3.2

TABLE 3.1 DEMONSTRATED RESOURCES FOR GROPA, LIA AND KULIBERGET ABOVE A CUT-OFF GRADE OF 20% MAGNETITE					
Zone	Quantity Tonnes	Grade % Mag	Grade % P	Specific Gravity	Average Thickness
1	5,776,000	24.06	0.89	3.29	5.74
3	50,782,000	28.32	1.17	3.35	14.52
Above 3	6,329,000	28.58	1.12	3.36	4.40
4	7,124,000	25.61	1.04	3.30	5.55
5	358,000	35.30	0.88	3.51	3.65
6	4,296,000	27.19	1.09	3.34	6.13
Total > 20%	74,665,000	27.72	1.13	3.35	11.59

TABLE 3.2 DEMONSTRATED RESOURCES FOR GROPA, LIA AND KULIBERGET ABOVE A CUT-OFF GRADE OF 25% MAGNETITE					
Zone	Quantity Tonnes	Grade % Mag	Grade % P	Specific Gravity	Average Thickness
1	2,140,000	29.86	1.10	3.38	7.04
3	38,460,000	30.43	1.25	3.40	12.27
Above 3	5,520,000	29.19	1.16	3.37	4.49
4	2,678,000	30.63	1.18	3.39	4.66
5	358,000	35.30	0.88	3.51	3.65
6	2,293,000	31.47	1.21	3.42	5.94
Total > 25%	51,449,000	30.36	1.23	3.41	10.48

The content of phosphorous and magnetite is considered as far more important than the tonnage. The volume of the mineralization is not studied in detail.

The resource figures are conservative for the following reasons: (1) The range of influence for the drill holes is low at the outlines of the drilled area. The deposit is still open to the northeast and north. (2) The drill holes are assumed to drift so that the thickness observed may be close to true thickness. (3) The specific gravity is conservatively calculated. (4) Missing magnetite values are found via a conservative regression with phosphorous. As another consequence the same equation will over estimate the missing phosphorous grades from the magnetite grades.

The economic parts of the deposit are called Gropa and Kuliberget. SINTEF planned to analyze these parts of the ore in more detail, but found that the sampling routines were such that this study would not result in major improvements.

3.5 MINEABLE RESERVES

Kilborn calculated the mineable reserves by estimating what portion of the SINTEF in-situ resources, above a cut-off grade of 20% magnetite, could be recovered by high productivity mining methods, then adding waste dilution.

3.5.1 Kuliberget Pit Reserves

Since the Kuliberget Zones 1 and 3 outcrop on surface, some portion of those resources which are above sea level can be mined most economically from an open pit. Because the seams dip gently into a steep hill slope, the waste to ore stripping ratio tends to increase rapidly as the pit is widened. Reserves are based on a small pit with an average 0.58 : 1 strip ratio. The latest estimates of the amount of waste rock required for industrial site construction indicates that this ratio will be reduced to 0.08 : 1.

The Kuliberget pit design is shown on Drawing No. 50-05-1. The in-situ reserve within that pit outline, above sea level, is set out in Table 3-3. The total is 692,600 tonnes with average

Table 3 – 3

Calculation of the In situ Reserves for the Kuliberget Small Pit

Client Hole Number	Density	In Pit Area Sq. Metres	Seam Top Elevation	Seam Bottom Elevation	Intercept Details %Magnetite	% P	Thickness Metres	IN Pit Thickness	Insitu Calculations Volume Cubic metres	Tonnes Metric
119	3.210	655	65.37	55.22	20.5	0.72	10.15	10.15	6,648	21,341
118	3.44	1000	59	51.09	31.8	1.52	7.91	7.91	7,910	27,210
117	3.41	1401	52	43.1	30.7	1.48	8.90	8.9	12,469	42,519
116	3.44	1327	39.68	29.56	33	1.56	9.98	9.98	13,243	45,558
102	3.44	1230	43	32.35	32.1	1.19	10.65	10.65	13,100	45,062
120	3.4	1130	38.6	24.83	30.1	1.08	13.77	13.77	15,560	52,904
121	3.44	1893	32	16.3	31.8	1.1	15.7	15.7	29,720	102,237
122	3.33	2115	27	7.35	26.3	0.59	19.65	19.65	41,560	138,394
115	3.37	2280	20	0.08	28.3	1.2	19.92	19.92	45,418	153,057
114	3.43	1500	11.25	0	32.1	1.51	11.25	11.25	16,875	57,881
113	3.43	640	2.93	0	31.4	1.51	18.95	2.93	1,875	6,432
112	3.42	380	–1.24	–20.5	31.2	1.2	19.26	0	0	0
Small Pit Averages and Totals					29.50	1.13			204,378	692,596

Notes:
1. Hole 115 has another intercept below pit bottom.
2. Assays for hole 114 are from top of intercept to pit bottom, not total intercept.
3. Assays for hole 113 are for total intercept length of 18.95 meters.
4. File: kuliberg.wk3

grades of 29.48% magnetite and 1.13% phosphorus. When pit benches are blasted, some of the ore is scattered or mixed with waste rock. It is estimated that 95% of the broken ore will be recovered, i.e. 657,966 tonnes at the in-situ grades. When mining near the ore/waste contacts, it is planned to doze the broken ore down dip to the loader in order to minimize dilution, but it is estimated that the amount of waste rock mixed with the ore hauled to the mill will be at least equal to the non-recovered ore. The estimate is summarized as follows:

Kuliberget Pit	Tonnes	% Mag.	% P
In-Situ Mineable	692,596	29.48	1.13
Recoverable (95%)	657,966	29.48	1.13
Dilution	42,034	0	0
Diluted Mineable	700,000	27.71	1.06

At the production rate of 1,360,000 tpy, this will provide mill feed for 6 months.

SINTEF used assumed grades of 5% Mag and 0.2% P for non-assigned internal dilution when compositing payable intercepts. However, zero grade was used for expanding narrow intercepts to the minimum 3.0 m thickness and was recommended for external mining dilution.

3.5.2 Gropa Pit Reserves

The Gropa Zone 3 also outcrops on surface, about 350m above sea level, and is amenable to open pit mining at a low strip ratio.

The Gropa pit design is shown in plan on Dwg. No. 50-30-F1 and in a series of sections on Dwg. No. 50-05-F6. The in-situ reserve within that pit outline is set out in Table 3-4. The total is 7,910,700 tonnes with average grades of 29.69% magnetite and 1.08% phosphorus. As with the Kuliberget pit, it is assumed that 95% of the blasted ore will be recovered,

Table 3 – 4

Calculation of the in situ Reserves for the Gropa Final Pit design

Hole No.	Volume	Tonnes	% Magn	%P	Spg	Thickness	Seam Intercept Elevation Top	Seam Intercept Elevation Bottom
123	25685	93,495	42.20	1.24	3.64	6.00	376	370
124	57197	203,050	37.60	1.26	3.55	7.12	365.15	358.03
125	78375	269,610	32.74	1.01	3.44	15.39	356.94	341.55
126	133844	452,391	30.38	0.9	3.38	32.02	360	327.98
6D	3657	12,874	37.74	1.25	3.52	3.00	367.31	364.84
6E	58773	186,898	22.26	0.76	3.18	22.96	370.5	347.54
6F	67138	219,540	25.49	0.81	3.27	23.26	368.5	345.24
6G	112139	379,030	30.55	1.00	3.38	33.19	369	335.81
5D	138676	470,112	30.40	1.13	3.39	28.85	369	340.15
5E	86979	288,769	26.91	0.69	3.32	31.57	367	335.43
5F	108607	366,005	29.26	1.41	3.37	37.75	365	327.25
5G	65669	221,306	28.53	1.01	3.37	32.27	355.32	323.05
5H	162340	542,214	28.63	1.09	3.34	36.77	349	312.28
4D	119937	404,187	29.85	1.16	3.37	33.53	351.65	318.12
4E	96379	325,761	30.21	1.17	3.38	31.10	348.2	317.1
4F	126751	427,151	29.41	1.09	3.37	35.15	341.7	306.55
4G	152574	514,174	29.80	1.22	3.37	36.65	343.1	306.45
7H	9501	30,783	24.23	0.71	3.24	3.00	367	365.2
2I	121525	388,881	22.33	0.85	3.20	29.85	330.06	300.21
3I	149863	512,530	32.57	1.15	3.42	25.00	338	313
4	59552	197,713	27.06	1.31	3.32	21.85	335.85	314
3E	38626	130,942	31.17	1.17	3.39	31.02	333.12	302.1
3H	71238	236,510	27.28	1.05	3.32	32.95	335.95	303
3D	18531	62,449	29.43	1.16	3.37	10.00	341.58	304.76
4I	244031	837,026	32.8	1.14	3.43	18.5	340	321.5
5/6D	42117	137,301	25.85	0.88	3.26	28.44	371	342.56
	2,349,703	7,910,702	29.69	1.08		28.38		

mixed with about 5% waste rock at zero grade. The mineable estimate is summarized as follows:

Gropa Pit	Tonnes	% Mag.	% P
In-Situ Mineable	7,910,702	29.69	1.08
Recoverable (95%)	7,515,167	29.69	1.08
Dilution	394,833	0	0
Diluted Mineable	7,910,000	28.21	1.03

At the production rate of 1,360,000 t/y, this will provide mill feed for 5.8 years.

3.5.3 Kuliberget Underground Reserves

The underground mineable reserves were estimated from SINTEF's Zone 3 resources above the 20% magnetite cut-off. Drawing No. 50-05-4 shows the outline of the mineable polygons less an allowance for a barrier pillar behind the open pit and the coast line.

Table 3-5 sets out the derivation of the diluted mineable reserves from stoping, by polygon and mining method, totalling 10,376,000 tonnes at 28.11% magnetite and 1.22% phosphorus. Additional reserves are available from stope access development. The first seven columns are taken directly from SINTEF's database. The mining method is defined by ore thickness. The mineable ore is generally the percentage of each polygon lying inside the barrier pillar, but the two marginal polygons on holes H and M have been arbitrarily reduced.

Table 3 – 5

Kuliberget area Zone 3 Underground Resource Detail

Area	Hole	Tonnes	% Magn	%P	S.G.	Thick	Mining Method	Minable Area %	Dilution Percent	Dilution Tonnes	Recovered Tonnes	Diluted Minable Tonnes	Diluted Minable Grades % Magn	%P
Kuliberg.	A	615,068	29.59	1.03	3.37	18.96	L	25%	6.15%	4,731	72,153	76,883	27.77	0.97
Kuliberg.	D	1,165,311	28.36	1.32	3.36	21.61	L	95%	5.40%	29,883	523,640	553,523	26.83	1.25
Kuliberg.	F	895,197	31.30	1.25	3.43	19.38	L	60%	6.02%	16,167	252,392	268,559	29.42	1.17
Kuliberg.	J	1,068,025	27.81	1.42	3.34	21.86	L	100%	5.34%	28,500	505,512	534,013	26.33	1.34
Kuliberg.	K	1,121,878	27.89	1.26	3.34	19.40	L	100%	6.01%	33,733	527,206	560,939	26.21	1.18
Kuliberg.	L	1,287,805	30.30	1.16	3.41	24.03	L	100%	4.86%	31,262	612,641	643,903	28.83	1.10
Kuliberg.	S	1,359,545	32.21	1.40	3.44	24.33	L	100%	4.80%	32,596	647,176	679,772	30.67	1.33
Kuliberg.	T	927,874	27.80	1.36	3.36	19.88	L	100%	5.87%	27,226	436,711	463,937	26.17	1.28
Kuliberg.	U	1,323,518	29.50	1.19	3.39	19.62	L	100%	5.95%	39,350	622,409	661,759	27.75	1.12
Kuliberg.	Y	1,732,078	32.58	1.37	3.45	18.43	L	100%	6.33%	54,823	811,217	866,039	30.52	1.28
Kuliberg.	Z	1,287,013	32.72	1.48	3.46	26.77	L	100%	4.36%	28,045	615,462	643,507	31.29	1.42
Kuliberg.	28	986,407	31.20	1.25	3.42	21.90	L	100%	5.33%	26,274	466,929	493,203	29.54	1.18
Kuliberg.	29	1,260,882	30.60	1.32	3.41	23.11	L	100%	5.05%	31,827	598,614	630,441	29.06	1.25
Kuliberg.	AA	999,558	26.93	1.10	3.31	15.68	L	59%	7.44%	21,940	272,930	294,869	24.93	1.02
Kuliberg.	AE	1,109,005	28.95	1.23	3.38	22.65	L	100%	5.15%	28,562	525,941	554,502	27.46	1.17
Kuliberg.	OE	1,127,646	27.79	1.32	3.30	19.04	L	100%	6.13%	34,548	529,275	563,823	26.09	1.24
Kuliberg.	112	585030	31.20	1.20	3.42	19.26	L	38%	6.06%	6,733	104,423	111,156	29.31	1.13
Kuliberg.	113	186364	31.40	1.51	3.43	18.95	L	22%	6.16%	1,262	19,238	20,500	29.47	1.42
Sub Total Longhole Mining Method														
		19,038,205	29.95	1.29	3.39	21.11	L		5.54%	477,462	8,143,867	8,621,329	28.32	1.23
Kuliberg.	H	736,540	20.70	1.09	3.21	9.83	B	54%	5.85%	11,633	187,233	198,866	19.49	1.03
Kuliberg.	N	308,365	31.60	1.31	3.43	9.37	B	100%	6.14%	9,462	144,721	154,183	29.66	1.23
Kuliberg.	V	795,528	30.88	1.07	3.41	9.49	B	100%	6.06%	24,101	373,663	397,764	29.01	1.01
Kuliberg.	27	322,038	32.40	1.21	3.45	7.74	B	100%	7.43%	11,962	149,057	161,019	29.99	1.12
Kuliberg.	M	729,804	20.50	1.07	3.21	12.32	B	50%	4.67%	8,515	173,936	182,451	19.54	1.02
Kuliberg.	116	264426	33.00	1.56	3.44	10.21	B	60%	5.63%	4,468	74,860	79,328	31.14	1.47
Kuliberg.	118	305818	31.80	1.52	3.44	7.91	B	44%	7.27%	4,891	62,389	67,280	29.49	1.41
Kuliberg.	I	581,225	33.70	1.43	3.47	12.50	B	100%	4.60%	13,368	277,244	290,613	32.15	1.36
Sub total Bench Mining														
		4,043,744	27.94	1.2209	3.355	10.27439	B		5.77%	88,399	1,443,104	1,531,503	27.54	1.15
Kuliberg.	G	116,066	36.80	1.52	3.54	3.00	R	8%	19.17%	890	3,753	4,643	29.75	1.23
Kuliberg.	R	437,474	26.00	1.15	3.32	6.52	R	100%	8.82%	19,290	199,446	218,737	23.71	1.05
Sub Total Room and Pillar mining														
		553,540	28.26	1.23	3.37	5.78	R		9.03%	20,180	203,199	223,380	23.83	1.05
Grand Total Underground Resource														
		23,635,489	29.57	1.28	3.38	18.90			5.65%	586,041	9,790,170	10,376,211	28.11	1.22

File: kz3dat.wk3

The method of calculating dilution and recovery is explained with reference to Figure 3-1. For longhole stoping, the drill drift must be driven partly in waste in order to establish the hanging wall assay contact. (There is no budget for definition diamond drilling). After stope blasting, hanging wall material from the full 15m width will fall into the stope: an average thickness of 0.5m is assumed, or 7.5 sq.m in cross-section area. The draw drift is assumed to be driven flat with the footwall contact bisecting the floor. When the undercut is blasted, the resultant triangle of waste (7.5m x 2.7m) will have a cross section area of 10 sq.m. A corresponding 10 sq.m. area of ore will remain below the opposite side of the stope. Also, a layer of broken ore will remain as a level mucking floor on top of the saw tooth, blasted rock. More broken ore will be left, occasionally, beyond the reach of the remote controlled LHDs or trapped under a large slab of hanging-wall waste.

Thus, in a 20m high seam, with a stope cross section area of 300 sq.m., 17.5 sq.m. of waste dilution will be added: 5.8% of the ore section. However, a similar volume of ore is left behind in (and under) the stope, which is assumed to be of equal tonnage. If 5.8% of the ore remains, then the recovery is 94.2% of the ore cross-section. For different seam heights, the dilution and non-recovered quantities remain constant but are spread over varying stope tonnages. Thus for a 15m seam height, the 17.5 sq.m. dilution area will be 7.8% of the 225 sq.m. ore section, and recovery will be 92.2% (100-7.8).

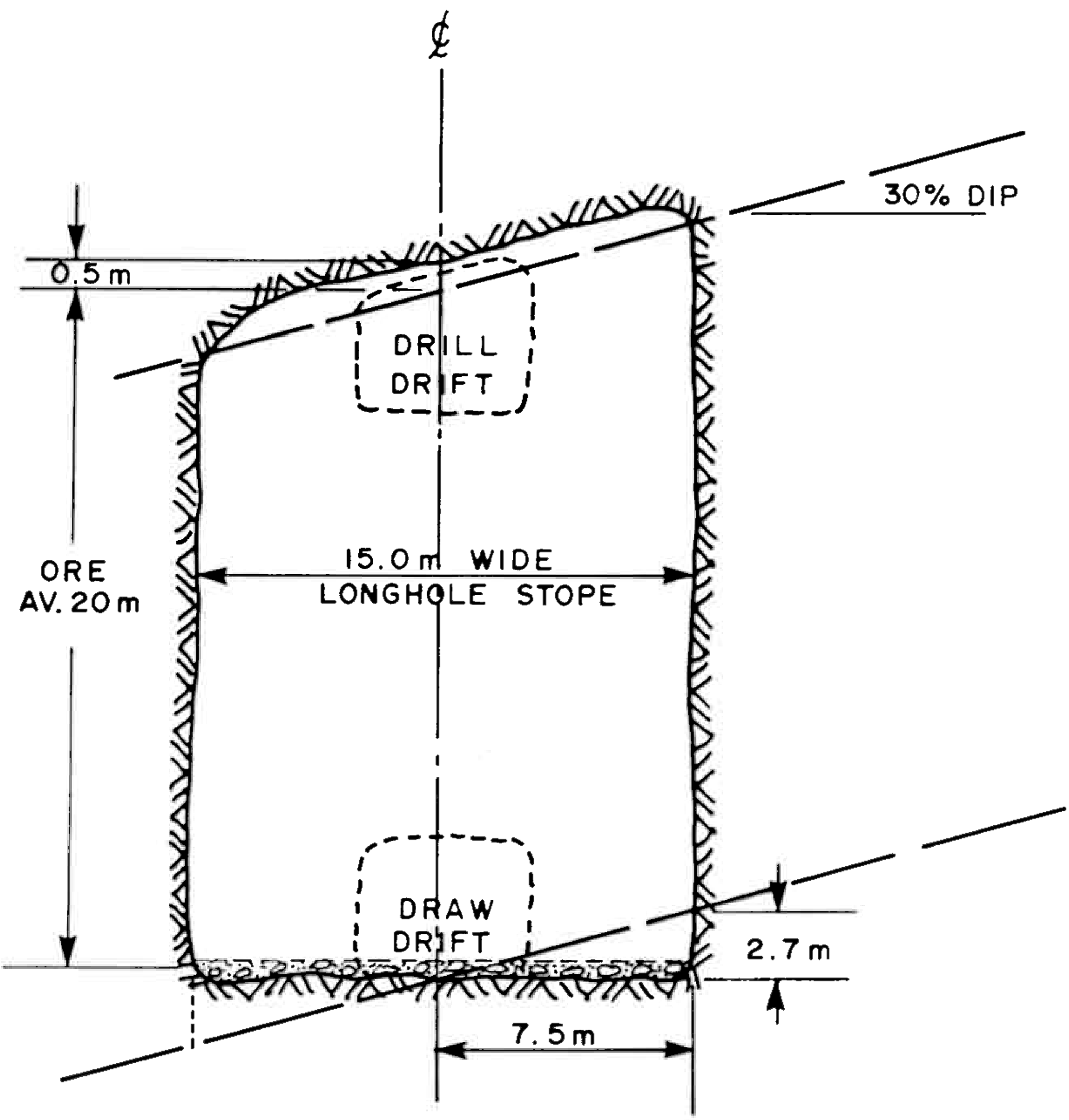


ILLUSTRATION OF
DILUTION & RECOVERY

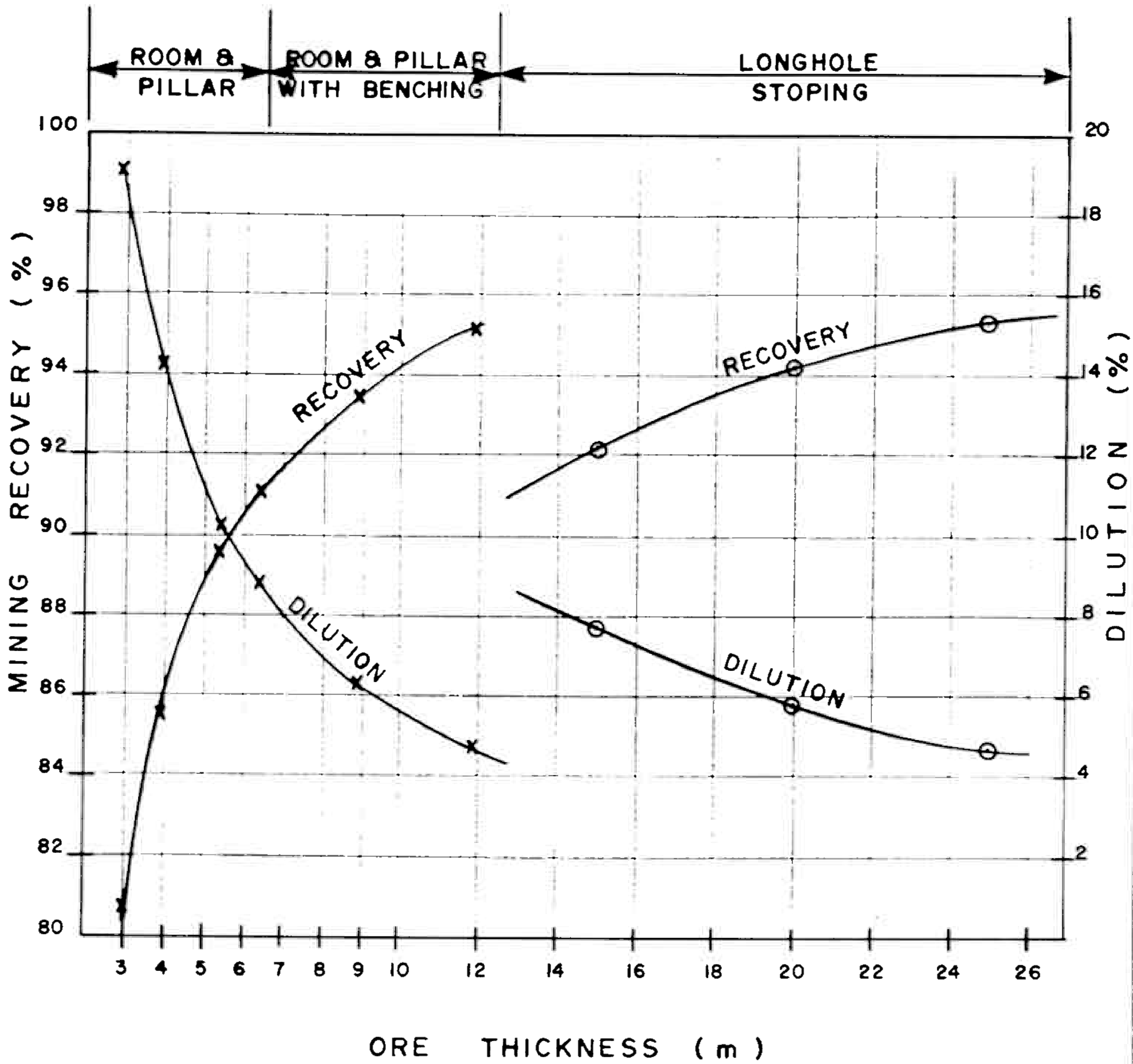
FIGURE 3 – 1

The relationship between dilution, recovery and ore thickness is shown graphically in Figure 3-2. The discontinuity between benching and longhole stoping is due to the fact that the rooms are only 6m wide and the footwall waste triangles are therefore much smaller, although the average dip tends to be steeper.

In Table 3.5, the Dilution Percent is calculated as described above. The Diluted Mineable tonnes are calculated as the SINTEF in-situ tonnes times the percent Mineable Area times 50% Extraction, which is discussed in Section 6.0 Mining. Since dilution is expressed as a percent of the total ore sections, the Dilution Tonnes are the product of Diluted Mineable Tonnes and Dilution Percent. Recovered tonnes are the Diluted Mineable Tonnes less Dilution tonnes. The Diluted Mineable Grades are the SINTEF grades times the Recovered (undiluted) tonnes divided by the Diluted Mineable tonnes.

The Table 3-5 total of 10,376,000 tonnes is from within room or longhole stope outlines. However, the development headings to access those stopes are all driven in ore. It is estimated that 4000 metres of access drifting will be required, equivalent to 274,000 tonnes at 26.88% magnetite and 1.16% phosphorus. The grades are the mine average in-situ values diluted 10% at zero grade.

Ore from development brings the Kuliberget underground diluted mineable reserves to an estimated total of 10,650,000 tonnes at 28.07% Mag. and 1.22% P.



GRAPH OF DILUTION AND RECOVERY VS. ORE THICKNESS

FIGURE 3 — 2

SECTION 4.0

ENVIRONMENTAL

FALKHAMMER - IBESTAD MAGNETITE A.S.
ANDØRJA MAGNETITE PROJECT
FEASIBILITY STUDY - VOLUME 1

4.0 ENVIRONMENTAL

4.1 INTRODUCTION

FIMAS and Kilborn Inc. recognize the sensitivity of environmental components relating to this project and will endeavour to address these to the satisfaction of the environmental and permitting authorities and the inhabitants of the island.

Because of the presence of homes in the area of the proposed mine site and the concentrator plant, there are specific concerns which have to be addressed in excess of those that regulations would require for a more remote site.

Throughout this study there has been a continual emphasis to develop an operational scenario which will have the least negative impact on the natural environment and the residents of the area and at the same time provide the greatest positive socioeconomic benefit.

Also, during this study, considerable efforts were taken to minimize noise impacts. These efforts included the setting down and sculpting into the rock of the primary crusher, concentrator building and storage facilities. This also minimizes dust emissions which occur during the initial crushing of the ore at the primary jaw crusher location and the storage of the final finished products.

A complete report on the environmental baseline conditions, and documentation addressing permitting for the Andørja magnetite project, will be required in order to obtain full approval to proceed with development. The report will need to describe the physical and biological environment, likely impacts of the project, and planned mitigative measures.

In the interim, a brief description is given in this section of the report on what is known, or in some cases assumed, on the existing environmental setting, and the estimated affect of the project on Andørja Island.

4.2 TERRAIN CONDITIONS

The FIMAS magnetite project is located on Andørja Island. This 142.3 square kilometre island is located in the Ibestad district of Southern Troms region of Northern Norway.

In the vicinity of the proposed mine, on the southeast side of the island, the terrain is mountainous. The mountains rise steeply from the fjords to an elevation of up to 1,000 meters. The elevation of the Gropa mine is some 320 meters and the Kuliberget mine 10 meters above sea level at their lowest points. Soundings taken along the shoreline indicate that there is no shelf, and the slope on land continues into the fjord.

4.3 CLIMATE

As a result of the Gulf Stream, despite its northern location, winter temperatures rarely drop below -15°C. The moderating effect of the ocean also results in a relatively cool and wet summer.

Summaries of monthly temperatures and precipitation records for two regional weather stations are given on Tables 4.1 and 4.2.

A frequent problem for road transportation is the alternating rain, snow and freezing rain experienced during the winter months.

4.4 WATER QUALITY

The existing fresh water quality from the lake on Andørja Island was analyzed during the feasibility study and is good. Streams and lakes on the island report low suspended solids and heavy metals. The water analysis report is included at the end of this section.

4.5 FISHERIES, WILDLIFE and FLORA

Commercial fishing is the main source of industry for inhabitants living on Andørja Island and is mainly concentrated on the Atlantic side of the Island. However, over the last decade the catch has been decreasing. The subsequent reduction in revenue has had a detrimental effect on the living standard for the local fishermen and associated fishing industries.

Wildlife on the island consists of moose and small fur bearing animals; resident and migratory birds.

Flora on the island is considered to be fragile and precautions would need to be taken to ensure that the mining operation does not affect or harm such plant life.

4.6 TAILINGS DISPOSAL

During the study development, consideration was given to a number of different scenarios regarding tailings disposal. Four basic scenarios were considered. These were:

1) Develop a conventional tailings impoundment area using waste mine rock materials and appropriate granular filter zones for embankment construction.

2) Deposit the tailings within an existing fresh water lake basin on the island.

3) Deposit the tailings in a dyked impoundment area constructed along the shore in the Krakrohamn area.

4) Deposit the tailings in a controlled manner at the deepest point of the fjord's floor via a submarine outfall and diffusers.

While the ore feed does contain sulphides, these will be removed during the processing to leave a tailings which will not be deleterious to the environment.

A further discussion of the alternate scenarios is given in Section 7.

4.7 NOISE ABATEMENT

Potential sources of noise emissions include: vehicles, blasting, ore crushing, power generation and milling. Power generation is by hydroelectric power, thereby eliminating diesel generation as a noise source.

Noise from inside the mill derives mainly from the grinding, together with pump and compressor operation. The mill building is fully enclosed and is sculpted down into the rock. These measures provide effective noise buffering.

Estimates of noise emissions from this and other sources would be determined, and modeled, as a part of the permit application to the Ministry of the Environment.

Blasting, crushing and vehicles are considered to be the primary sources of noise emissions for the Andørja Magnetite. Specific steps would be planned in each case to minimize noise.

Blasting, for example, would have two phases, that connected with the quarry, and that connected with underground operations. Blasting in the quarry would be restricted, to occur only during the week and at a time acceptable to local residents. Noise emissions from blasting would be further controlled through the use of rapid/delayed detonation. Blasting underground would occur twice per day, at the end of each shift. Noise from this source would be muffled by virtue of its underground location.

Noise emissions from crushing operations will be controlled through appropriate placement of the crusher.

Vehicle noise emissions are controlled primarily as a result of the small number of vehicles involved in the operation. The operation as proposed entails the use of only two trucks and one loader.

4.8 VISUAL IMPAIRMENT

With respect to visual impairment, the ore storage area, being sculpted into the rock, will be screened from view. The mill building itself, will measure 36 meters wide by 68 meters long, and stand 16 meters in height. To minimize visual impact, a 15 foot earthen berm will also be created if found necessary between the mill building and the road to screen the property and to further block noise. The effectiveness of any earthen berm would be enhanced by planting a tree screen on its crest.

The Gropa quarry area will be screened from public view by virtue of its location. In the Kuliberget pit, steps will be taken to screen off the quarry area and the underground opening to minimize visual impairment.

4.9 SOCIOECONOMIC IMPACTS

Negative aspects of socioeconomic impacts would be dealt with in other sections of the environmental report, and relate primarily to concerns over disturbance. Socioeconomic impacts dealt with would be those concerned with deriving maximum benefits for local residents. This essentially entails job creation and economic spin-offs.

With approximately 48,145,069 tons of mineable reserves, this production rate translates to a mine life of 20 years, based on 350 operating days per year. Thus an attractive scenario is provided to local residents, in terms of job creation and economic spin-offs, especially if the life of the mine can be extended. Such an extension can be achieved through increasing mine reserves during operation.

Two other aspects of the proposed development plan also have economic significance. These are job training and quarrying during early phases of the operation and the leading to subsequent underground operations in the third year of production.

4.10 SITE RESTORATION FOLLOWING CLOSE-OUT

Site restoration following close-out is accomplished through stabilization of the tailings area, sealing the underground workings, flooding and/or stabilizing and revegetating the quarry, and securing and/or removal of buildings.

4.11 CONSIDERATIONS RELATING TO LOCAL PERCEPTIONS

A majority of local residents, are unfamiliar with the specifics of mining, and will consequently view the project from the perspective of their impressions. Such impressions are likely to include images of northern mining communities where widespread visual impacts of mining are much in evidence.

A major task facing the Company and its consultants is to reassure local residents that a small mining operation, of the type proposed, can be carried out in an environmentally sound manner, with minimal inconvenience and disturbance. To accomplish this task a public information programme would be developed. Its objectives would be to:

(1) provide residents with a detailed description of the project, focusing on measures taken to protect the natural and socio-economic environment

(2) to listen to concerns that residents might have, both real and perceived

(3) to consider modifications to the project, where appropriate, in recognition of legitimate concerns

(4) to detail to residents, steps that would be taken by the company to protect the environment, and

(5) to accentuate the positive socio-economic benefits that this project would bring to local communities and businesses.

The consultation programme planned would have one or possibly two open house meetings, wherein the company and its consultants would use poster displays and a slide presentation to outline the scope of the project, and then entertain questions on the materials presented, as well as on the project at large.

This approach has worked well in the past, and it is anticipated that it will prove effective in this case.

4.12 APPROVALS

In order to obtain approvals for local and state regulatory authorities, it will be necessary, as stated in the introduction, to prepare first a full scale environmental document outlining all of the environmental baselines, a description of the project summarized from this feasibility study, an estimation of the project impacts, and planned mitigation and decommissioning measures. Following acceptance of this report, the preparation of supporting documentation for permitting, required prior to the property being put into production, would be put underway. Of particular importance in this regard, are materials required for approval of the tailings management system.

To facilitate approval, meetings would be held between company representatives and the Ministry of the Environment and other permitting authorities. At this meeting, details of the mill process and waste management system would be reviewed as an introduction prior to formal submission.

Since noise has also been flagged as a potential concern because of the regional environment, this aspect will have to be dealt with in the application as part of the approval required for air emissions. Such applications require the use of sophisticated computer models to ensure that Norwegian noise standards are met.

The subjects which will be addressed in preparation of the environmental document include:

Baseline Environmental Data

(a) Air Quality - existing data on air quality in proximity to the planned open pit/underground mines and concentrator site.

(b) Archaeology/Cultural resources - evidence of any historic buildings/artifacts at the proposed mining and processing sites which may need to be preserved or relocated.

(c) Aquatic resources - baseline data on any fish in the water supply lake, and the fisheries resources in the fjord area near the dock site, and potential tailings outfall.

(d) Biological data - inventory of species type and distribution including any rare or endangered species of plants or wildlife - birds or animals resident on the island.

(e) Groundwater hydrology - an indication of the groundwater location, direction of movement and water quality in the vicinity of the mining operations.

(f) Geology - a summary of the geological history of the island, the ore geneses, mineralogy, and ore reserves, geomorphology.

(g) Site Topography - a description of the mountainous terrain, shoreline, presence of lakes, streams, etc., and bathometric soundings in fjord.

(h) Socioeconomics - the population profile of Ibestad, employment by sector, local government and services, etc.

(i) Surface Water Hydrology- stream flow measurements on the local creeks in the vicinity of the mine and process plant. Water quality parameters.

(j) Transportation and Utilities - summary of local ferry service, schedule of air services, road system on island, water and sewage system, hydroelectric power.

<u>Environmental Impact Assessment</u>

An assessment of the anticipated impact on the environment would include:

(a) Air quality - expected dust created by mining and milling operations from equipment both stationary and mobile - stack emissions from the concentrate dryer.

(b) Aesthetic - visual impact of open pit mining and waste dumps. Plans (if any) to minimize dump heights and revegetate.

(c) Noise - anticipated noise levels from mining/milling equipment and blasting. Measured to reduce noise level.

(d) Water quality - expected change in surface and ground water quality is a result of mining and tailings storage. Measures to monitor and treat any discharges.

(e) Socioeconomic - expected employment creation, impaction existing services and utilities, increase in transportation facilities.

Decommissioning Plans

A description of the plans proposed for shutdown of the mining and milling operation including:

- long term water course diversion, if required
- Revegetation of waste areas
- dismantling of mill buildings, if required
- turn over of any landfill created along the shoreline to the local government

TABLE 4.1

WEATHER INFORMATION

LENVIK, NORWAY

69 DEG 21'N, 18 DEG 05'E

Temp °C	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
Mean Mthly	-3.7	-4.0	-2.5	1.0	4.9	9.5	13.1	11.9	7.9	3.4	-0.1	-2.0	3.3
Max. Mean	0.5	1.6	1.9	4.1	9.2	13.8	16.2	14.2	10.5	7.5	3.1	2.4	5.0
Min. Mean	-8.9	-10.0	-7.1	-1.6	2.9	6.1	9.5	9.3	5.2	-0.9	-3.1	-7.9	1.4
Abs.Max.	8.0	7.0	9.4	15.1	23.5	28.1	29.4	26.7	22.8	19.1	11.8	10.2	29.4
Abs.Min	-19.7	-19.5	-19.0	-14.2	-7.5	-2.2	2.4	1.1	-4.3	-14.3	-15.8	-19.0	-19.7
Prec.(MM)													
Mean Mthly	92	81	89	58	53	51	51	74	99	102	80	109	934 36.8"
Max Mthly	265	157	189	140	133	123	114	159	196	291	274	220	1307 51.5"
Min. Mthly	15	8	3	4	6	6	4	19	24	3	4	9	621 24.5"
24 hr. Max Daily	48	65	41	32	36	22	35	33	40	57	36	40	65 2.56"
Max. Mthly Snowfall cm	166	160	140	148	96	10	-	-	35	69	70	135	166

TABLE 4.2

WEATHER INFORMATION

KVAEFJORD, NORWAY

68 DEG 46'N, 16 DEG 05'E

Temp °C	Jan.	Feb	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
Mean Mthly	-2.2	-2.5	-1.2	1.7	5.8	9.9	13.8	12.2	8.9	4.6	1.4	-0.7	4.3
Max. Mean	1.5	1.6	1.6	5.2	9.2	13.2	15.3	14.9	11.0	8.7	4.0	3.5	5.4
Min.Mean	-5.7	-8.5	-4.6	-0.5	3.6	6.7	9.8	9.9	5.0	0.0	-2.2	-5.8	2.6
Abs. Max	9.3	8.5	10.7	15.4	23.4	29.4	29.8	26.5	21.5	17.6	12.7	10.9	29.8
Abs. Min	-17.4	-19.4	-14.7	-10.5	-5.5	0.0	3.4	1.5	-4.5	-10.2	-13.0	-16.32	-19.4
Prec.(MM)													
Mean Mthly	90	75	78	54	40	42	39	60	74	94	83	91	820 32.3"
Max. Mthly	241	167	126	133	111	83	148	156	185	201	209	195	1226 48.3"
Min.Mthly	16	6	2	1	5	10	8	12	18	30	18	18	533 21"
Max. 24 hr daily	51	37	23	21	20	24	71	25	60	50	41	32	71 2.8"
Max. Mthly Snowfall cm	117	105	108	124	60	-	-	-	15	35	66	95	124

KJEMISK ANALYSELABORATORIUM HOLT, POSTBOKS 190, 9001 TROMSØ

TLF (083) 84875 - POSTGIRO 5 05 43 90

DATO 13.5.1991

ANALYSEBEVIS Vann

REKVNR 919081 LØPENR 9190485 - 9190485
PROSJEKTNR 0 ANTALL PRØVER 1

TIL Barlindhaug A/S v/Magne Nesse, postboks 57 9001 Tromsø
GJENPART

MERKNADER: Prøve fra Lifjellvatn, mrk."Bergverksanlegg Ibestad, 44.4419.42 C3"
UV-trans: målt i 50 mm kvartskyvette

MERKE	Farge mgPt/l	pH	Konduktivitet mS/m	Turbiditet FTU	Alkalitet mmol/l	Klorid mg/l	Sulfat mg/l	Ca mg/l	Mg mg/l	K mg/l	Na mg/l	Jern mg/l	UV-transmisjon %
18.04	<5	7.0	5.20	0.19	0.19	5.0	3.0	5.20	0.82	0.48	3.00	<0.05	88

15 MAI 1991

Herbjørn Lysnes

KJEMISK ANALYSELABORATORIUM

KONFIDENSIELT

SECTION 5.0

GEOTECHNICAL

FALKHAMMER - IBESTAD MAGNETITE A.S.
ANDØRJA MAGNETITE PROJECT
FEASIBILITY STUDY - VOLUME I

5.0 GEOTECHNICAL

This Section summarizes the findings of the SINTEF geotechnical study. The full report entitled "Rock Mechanics Investigations at the Andørja Iron Ore Deposit", dated 1991-04-08, is reproduced in Appendix A.

The investigation program, set up by Dr. Johannes Soyland, was as follows:

* Site visit in the existing investigation adit
* Triaxial in-situ rock stress measurements
* Laboratory tests to determine rock parameters
* Boundary element (BEM) modelling to evaluate stability conditions and dimensions of stopes and pillars
* Final evaluation and report

This study considered only Kuliberget underground requirements because at that time, the Gropa open pit was not considered for early production and the Kuliberget pit, being long and shallow, would be only marginally affected by wall slope considerations.

The in-situ stress measurements and rock strength samples were taken by drilling into the hanging wall of the Kuliberget Zone 2 from the end of the exploration adit at a depth of approximately 85m below surface. SINTEF personnel also carried out RQD analysis on this hole and on stored core from four old surface holes.

SINTEF's conclusions are quoted as follows:

> "From the model studies it follows that tensile stresses may occur in the roofs of stopes when the span exceeds 20m. Taking a certain safety factor into consideration the span should therefore not exceed 15m. If the experience obtained during the first period of mining is positive with regard to waste dilution from the hanging wall, the span may be increased in the case of V.C.R. (but not above 20m). If conventional room-and-pillar mining is adopted, the hanging wall must be systematically supported by rock bolting. A span of 15m will in this case require quite heavy support and must be regarded as absolute maximum.
>
> The length of the stopes along the dip may be adjusted according to the practical mining situation, as the length is not affecting the stress conditions significantly.
>
> The effective width of the pillars should not be less than half of the ore thickness i.e. approximately 10m. With conventional room-and-pillar mining when smooth blasting may be adopted against the final pillar walls, a practical width of 12m may be adopted. With V.C.R. using fan drilling with the ends of the holes perpendicular to the pillar walls, a much higher degree of blast damage may be expected. In this case the pillar width should be 15m".

KONFIDENSIELT

SECTION 6.0

MINING

FALKHAMMER - IBESTAD MAGNETITE A.S.
ANDØRJA MAGNETITE PROJECT
FEASIBILITY STUDY - VOLUME 1

6.0 MINING

6.1 GENERAL

Three mining areas are considered in this study:

(a) an open pit mine starting on the outcrop of the Kuliberget seam
(b) an open pit mine starting on the outcrop of the Gropa seam
(c) an underground mine developed by adit in the Kuliberget seam.

The areas are scheduled for mining in the order shown above. Open pit mining has the advantages of lower capital and operating costs initially and 95% recovery of the resource compared to 50% from underground. Annual production will be 1,360,000 tonnes of ore, at a grade of approximately 28% magnetite.

Kuliberget open pit is scheduled first, although it's operating life is only six months; this source of ore is close to the processing plant and the waste stripping is wanted for the industrial site preparation. Most of the stripping will be carried out by contractors while the plant is being constructed.

The Gropa open pit will provide 5.8 years plant feed at a low 0.574:1 average stripping ratio. Access to the Gropa pit will be provided from a road which is to be built to construct and service a dam at elevation 425 metres. This road will be too steep and narrow for ore haulage, so Gropa pit ore will be hauled to an ore pass driven from the Kuliberget underground mine.

The underground mine will be developed from a 5.5m x 4.0m decline collared in the wall of the Kuliberget pit. This decline, plus an orepass raise, will be driven early to provide a haulage route for the Gropa pit ore. Stope development will begin near the end of the Gropa pit life, and the ore pass will be converted to an exhaust airway. Kuliberget underground mining will be fully mechanized with virtually all the workings in ore. Thick seams (>13m) will be mined by longhole open stoping, thin seams (<7m) by room-and-pillar mining, and intermediate thicknesses by a combination of room-and-pillar followed by benching. The current underground mine plan has a life of almost 8 years.

The mine will work 3 shifts per day, seven days per week, in order to maintain a steady supply of plant feed without the need for storage and rehandling. Labour for mining operations will be recruited locally, and training will be necessary.

Mining equipment for the open pit will be maintained in a small shop on site for minor repairs (major repairs and overhauls will be carried out off site).

Table 6-1 below shows the annual ore production, average grades and sources.

Year of Production	Source	Tonnes	Grade Delivered
1	Kuliberget O.P. Gropa O.P.	700,000 660,000	27.7% M, 1.06%P 28.2% M, 1.03%P
2 to 6	Gropa O.P.	1,360,000	28.2% M, 1.03%P
7	Gropa O.P. Kuliberget U.G.	450,000 910,000	28.2% M, 1.03%P 28.1% M, 1.22%P
8 to 14	Kuliberget U.G.	1,360,000	28.1% M, 1.22%P
15	Kuliberget U.G.	220,000	28.1% M, 1.22%P
Total		19,260,000	28.1% M, 1.13%P

6.2 OPEN PIT DESIGN AND SCHEDULES

6.2.1 Kuliberget Open Pit

The part of the Kuliberget seam that will be mined by open pit methods, outcrops at the base of a steep hillside, near sea level. Drawings No. 50-05-F1 and F2 show the Kuliberget pit in plan and cross section respectively. Benches are nominally 5 meters high, but the top and bottom seam contacts will be mined by dozing down dip. The high wall has an overall slope of 45 deg.

The total volume in the Kuliberget pit is calculated as 352,643 cu.m. Table 3-3 in sub-section 3.5, Mineable Reserves, showed that 204,378 cu.m. contain 692,600 tonnes of ore. By difference, 148,265 cu.m. is waste which, at 2.8 SG, is about 415,150 tonnes.

Kuliberget pit will be developed in a single phase starting from the high point and working down. The pit floor will not be mined below sea level. Most of the waste will be removed by a contractor and used to build an industrial site. These excavations will be done during plant construction. For costing purposes it is assumed that 125,000 cu.m. (350,000 tonnes) of waste removal is to be paid for by others as part of the site preparation account.

The remaining 58,000 tonnes of waste will be carefully separated from the 700,000 tonnes of ore by the owner's forces when the mill is ready for production. It is assumed that this waste will be dumped into the fjord to expand the industrial site. The pit will be completely mined out in 6 months. The equipment and crews will then move up to the Gropa pit site.

6.2.2 Gropa Open Pit

The Gropa main (No.3) zone outcrops on a ridge located about 1.3 km west of, and 325m above, the Kuliberget portal. No suitable alignment could be found for a 3.5 km long, 15m wide, 8% gradient haul road down to the primary crusher at elevation 70m. A safe alternative is to drop the ore down a pass to the Kuliberget underground workings and truck haul from there to the crusher. This requires some capital expenditure underground but the main decline will be driven in ore, providing a 40,000 tonne stockpile at start-up, and the orepass will be useful later when converted to an exhaust airway.

The underground rehandle adds an estimated $0.61/t to the cost of Gropa pit ore. With underground mining averaging $3.83/t of ore and the Gropa pit at $1.78/t moved, the limiting strip ratio is just over 0.8:1. A large pit was designed with a life of 7.5 years with an average strip ratio of 1.0:1. This design was reworked to eliminate the high stripping ratio in the north east corner and to minimize footwall waste mining.

The final Gropa pit design is shown in plan on Dwg. No. 50-30-F1. Criteria were the same as the Kuliberget design with nominal 5m benches but with the footwall contact cleanly mined downdip. The highwall is at 45 deg. overall. These features are shown in section on Dwg. No. 50-05-F6.

The total volume in the Gropa pit is calculated as 3,983,000 cu.m. Table 3-4 in sub-section 3.5, Mineable Reserves, showed 2,350,000 cu.m. of ore equivalent to 7,910,000 tonnes, leaving 1,633,000 cu.m or 4,540,000 tonnes of waste for an overall stripping ratio of 0.574:1. This is believed to be close to the optimum pit design based on currently available data. An extension was designed which added 1,728,000 tonnes of ore but also 2,932,000 tonnes of waste for an incremental strip ratio of 1.70:1. The drawings illustrate why extensions to the east or north result in rapidly increasing strip ratios. The cross-sections also show a continuous anomaly over sections D,E,F,G, and H which may be fault related. East of the anomaly the seam is thinner and therefore less economic for mining. The drilling density is considered adequate for this level of feasibility study but not sufficient for definitive yearly mine design.

More drilling is needed to the northeast and south within the proposed final pit area. All intercepts should be analyzed for all relevant data. A geotechnical drilling program to define the probable fault and the pit slope angles possible in the waste and ore zones is necessary. This program would also supply data on ground water within the pit area.

For costing purposes it has been assumed that the annual stripping rate will be a constant 0.665:1 for the first 5 years then zero over the remaining 10 months. Since the ore outcrops on the west side of the pit, there will be a temptation to mine ore only during the first year or so. Stripping must be kept far enough ahead to avoid jeopardizing continuity of ore production.

6.3 OPEN PIT OPERATIONS, EQUIPMENT AND MANPOWER

It is planned to mine the two pits, consecutively, with the same basic crews and equipment, though some additions will be required for Gropa.

Conventional loader, truck mining has been used on five metre high benches. The 988B Caterpillar loader is matched to 40 tonne Mack Trucks. A complete equipment list is provided in Table 11.6. This study was initially based on an assumption of minimal open pit mining over a short life span and small equipment was selected to maintain continuity of ore supply and to minimise front end capital cost by mining three shifts per day. It is probable that the equipment can be sized larger, particularly if good used equipment is available. This would lower the labour cost per tonne of ore. Mining costs can be considered conservative and would probably be lower for a more definitive study.

Mining within ore and waste zones will be done on 5m high benches. This introduces two elements to be considered. The first is dilution. This will occur at the mining boundaries with the waste. In such a favourably thick seam this should be minimal on an overall tonnage basis. It is assumed to be equivalent to the tonnage of ore lost during mining. The overall effect is a 95% resource tonnage recovery balanced by a 5% dilution of gangue for the same overall tonnage but decreased grade. It is probable that dozing on the seam boundary will be necessary. Buffer blasting against the previously blasted material to prevent lateral movement of the muckpile may be necessary in the boundary areas.

The second consideration is the possibility of internal grade control within the overall mining. It is probable that some internal lower grade ore below the nominal 20% magnetite can be sorted out from the overall seam. This would decrease the total tonnage from the open pit but increase grade for the feed transported to the concentrator. Some close spaced drilling in conjunction with the needed infill drilling for mine planning would serve to give a guide on both geostatistical validity of the data and the possibility of grade control optimization during mining.

The ore transportation system was described in sub-section 6.2.2. Waste rock is assumed to be placed in the valley immediately northwest of the Gropa pit. On one of the data sets supplied to Kilborn, this area is outside the property boundary and has not been detailed.

The labour requirements for open pit mining, on a 3 shift 7 day basis, are detailed under operating costs in sub-sections 12.2.1 and 12.2.2 for Kuliberget and Gropa respectively. Both have 8 staff, basically 4 line supervision and 4 engineering/geology. The hourly force is 22 production plus 5 maintenance to mine 4200 t/d from Kuliberget, and 29 production plus 6 maintenance to mine 6470 t/d from Gropa during the first five years (excluding 8 truck operators on the underground rehandle). In partial year six, ore only from Gropa, the force is reduced to 25 production plus 4 maintenance to mine 3900 t/d.

6.4 UNDERGROUND MINING

6.4.1 Development

The underground Kuliberget Mine will be developed from an entrance adit drive on the footwall contact of the # 3 zone. A part of the # 3 zone will have been mined out by open pit methods, and the adit will be collared where the lower contact of the zone outcrops in the pit wall, as shown on Dwg. No. 50-05-F3.

The entrance adit will be driven cross pitch down-dip, in a straight line from the collar at elevation 25 meters to a point on the footwall of # 3 zone at elevation -40 meters. This adit is meant to accommodate a conveyor later, when the deeper part of the # 3 zone mineralization is to be recovered. The floor of the entrance adit will follow the footwall of # 3 zone, where possible, this will mean some variations in the grade, but the maximum grade will not be allowed to exceed 15%, since the entrance adit must be used also for truck haulage from the upper horizons of # 3 zone.

From the entrance adit, turn-offs are made to drift down into the different areas to be mined. The dip of the # 3 zone footwall varies from 15% to 45%, therefore the access drifts must be driven cross pitch so as not to exceed 15%. The variations in the dip of the footwall require changes in direction to keep a 15% drift on the foot wall.

The identified reserves were divided into mining blocks on the bases of grade, thickness and dip of the footwall. Two main mining methods will be used: long hole open stoping in the thicker areas (< 13m), and room and pillar in the thinner (3 m to 7 m) areas, with benching below the rooms in intermediate thicknesses.

6.4.2 Longhole Mining

Longhole open stopes are laid out as a series of 15 metre wide stopes separated by 15 metre pillars. The long axis of a stope is cross pitch so that the grade along the axis is restricted to 15% or less. Stopes are developed by driving central draw drifts on the foot wall contact and drill drifts on the hanging wall contact. Figure 6-1 shows the position of these drifts relative to each other.

The upper drift will be used to locate the hanging wall and to provide a location from which hanging wall support, e.g. cable bolts, can be installed, and from which rings of blast holes can be drilled. Remote controlled front-end-loader, operating in the lower drift, will pick up the blasted ore. Figure 6-2 shows these operations.

Stope mining will be started from a raise connecting lower drift with the hanging wall drift. This raise will be slashed to full (15 metre) stope width, to provide breaking space for the first ring of blast holes. The layout of stope mining will be planned so that a minimum number of connecting raises is needed. Dwg. No. 50-05-F4 shows how one slot raise will typically serve four stopes. Stope drifts are generally driven upgrade, and longhole mined retreating downgrade, in order to avoid pumping requirements at the working faces and abandoned stope ends.

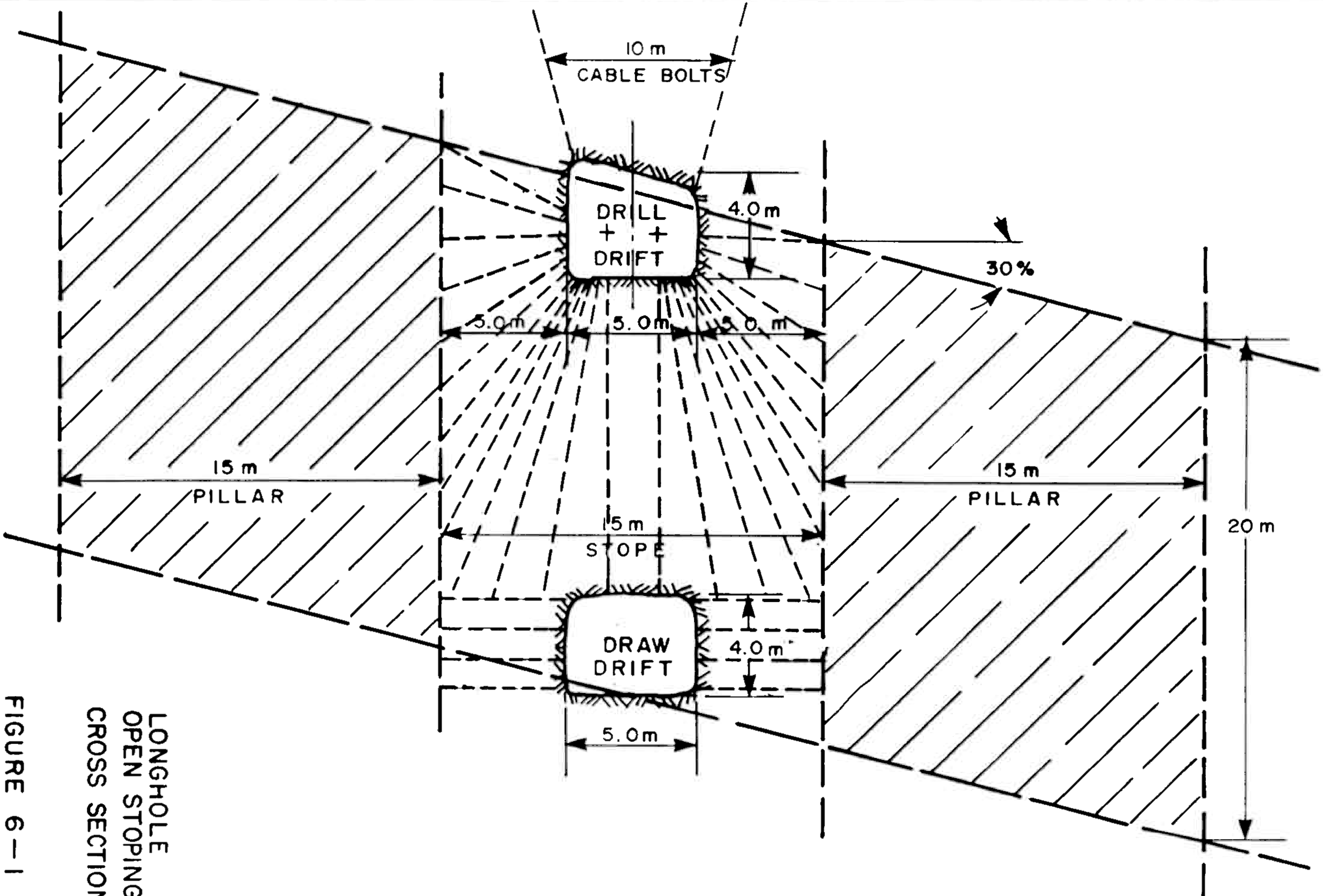
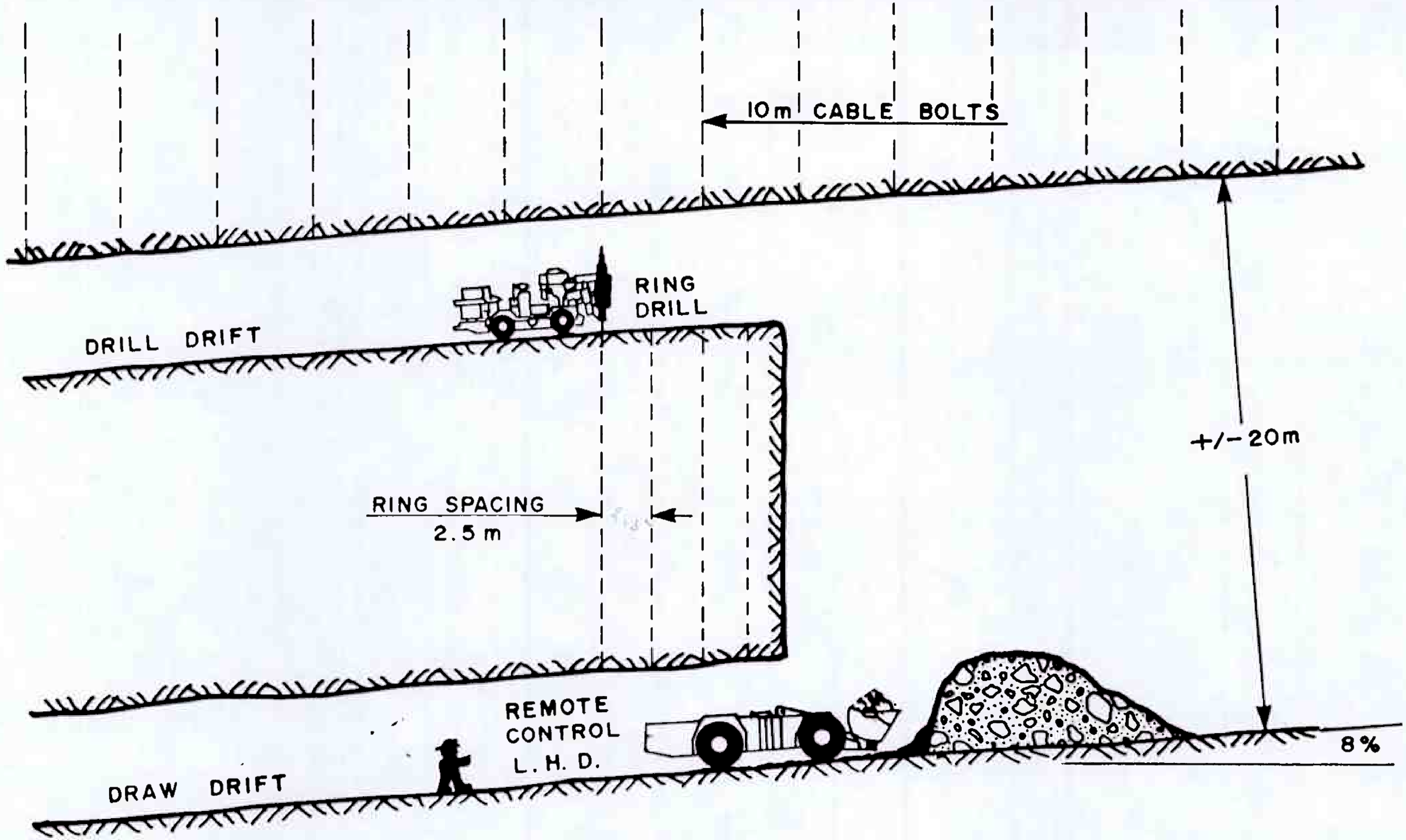


FIGURE 6-1
LONGHOLE
OPEN STOPING
CROSS SECTION



LONGHOLE OPEN STOPING
LONGITUDINAL SECTION

FIGURE 6-2

Stope lengths are limited to 60 to 90m but would still need to be completely mucked out 2 or 3 times because it is impractical to operate the LHD's by remote control at a range of much more than 30m. After the muck pile is drawn clear of the brow, the operator will remain in the draw drift with a remote control box, while filling the LHD bucket, then re-enter the cab to drive to the truck loading point. Another draw drift may be used as a remuck bay in order to minimize the truck loading time.

An overall recovery factor of 50% can be achieved in longhole areas only if the main haulage routes are stoped out in retreat and/or if it is found possible in practice to mine the stopes wider than the pillars.

6.4.3 Room and Pillar Mining

Rooms and pillars each 6m wide, are laid out in parallel with periodic breakthroughs leaving 6m by 8m pillars in plan. Dwg. No. 50-05-F4 shows the room and pillar areas to the west of the main adit and on the eastern edge of the Kuliberget deposit. Figure 6-3 shows these rooms in cross section plus benching in a zone of intermediate thickness.

The rooms will normally be driven cross pitch to limit the gradient to 15%. Development will be up dip where possible for natural drainage. Pillar breakthroughs will normally be mucked from the down dip side. Benching can proceed either up or down dip but must be carefully sequenced to maintain access and avoid trapping equipment.

It may be possible to achieve slightly more than 50% recovery from room and pillar areas provided that the routine breakthroughs on 14m centres remain practical and viable.

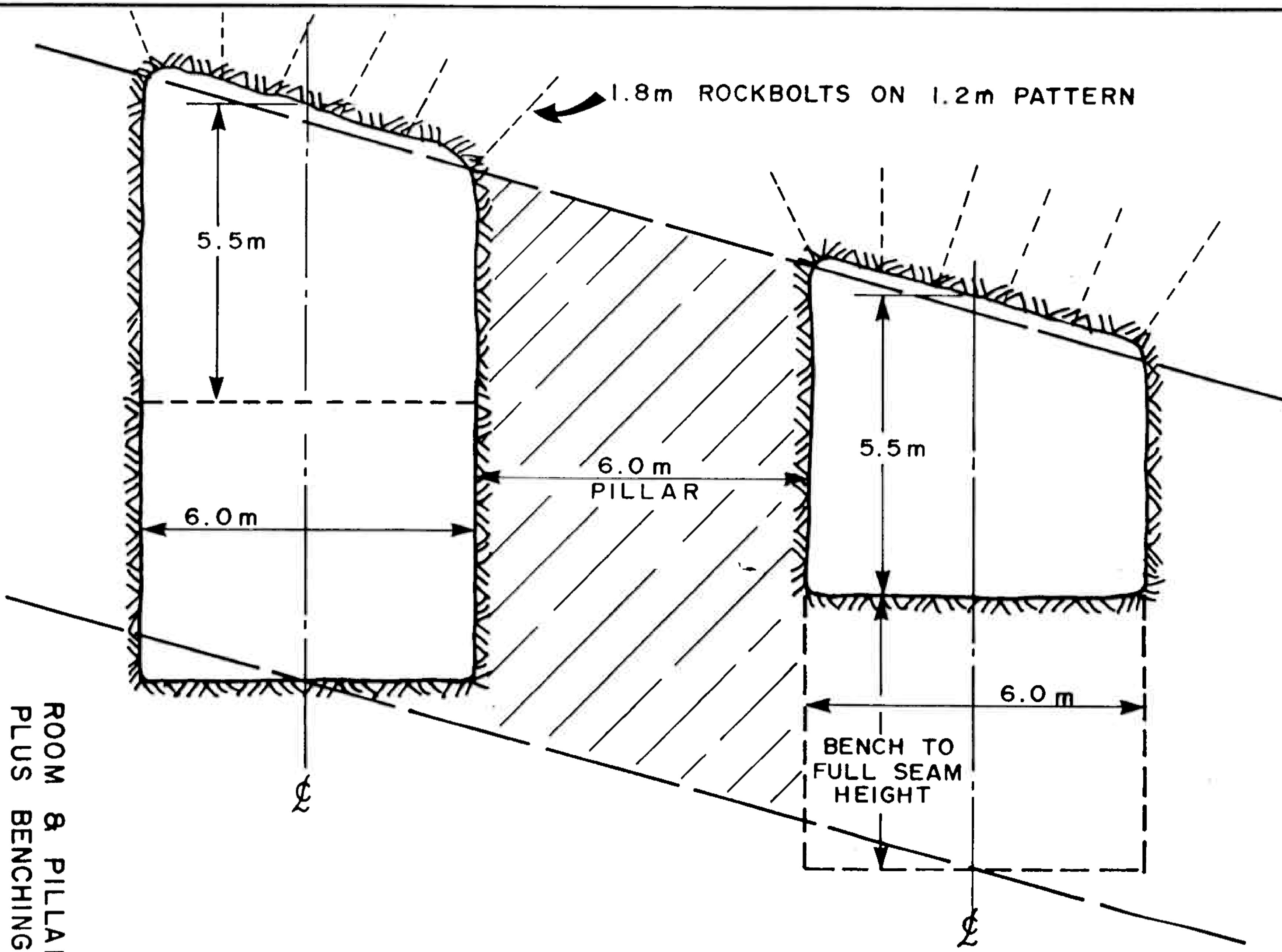


FIGURE 6-3
ROOM & PILLAR
PLUS BENCHING

6.4.4 Underground Services

The most important services in this highly mechanized mine will be power distribution and ventilation. Water will be piped to all work places for dust suppression, but not compressed air. All drills will be hydraulic. Equipment such as blasthole chargers will carry onboard compressors.

For initial Gropa ore transfer requirements, using two 300 hp Mack trucks, the original development ventilation system would be retained. For the production phase, the underground ventilation and mine air heating system is based on an average flow rate of 66 cu.m/s (140,000 cfm), derived from a factor of 100 cfm per operating diesel horsepower. Three 450 hp haul trucks are provided but one is a spare. With two trucks and all the service vehicles operating simultaneously, some 1200 hp would be in use. Fresh air will be drawn through the mine by exhaust fans on the two exhaust raises. Heated air will be ducted into the main portal in winter and mixed with the cold flow. The mining layout drawings (50-05-F4 & F5) show that each block of four longhole stopes is relatively isolated and can be easily sealed off when mining is completed. The room and pillar areas are isolated by barrier pillars through which the emergency exist will be sealed by doors. Ventilation of individual room headings, and longhole stope development headings, will require portable fans and ducting.

The sequence of extraction proceeds generally down dip, so the truck haulage distance tends to increase as the deposit is mined. In order to keep haulage distances relatively constant, an underground conveying system could be installed. An underground crusher would be installed to reduce the broken ore to a size suitable for conveying. A capital investment allowance has been provided in Year 10 for the underground conveyor and the crusher, and for a section of surface conveyor to discharge onto the belt feeding the crushed ore stockpile. It has not been planned in detail.

6.5 UNDERGROUND OPERATIONS, EQUIPMENT, PERSONNEL

6.5.1 Underground Operations

The underground mine will work three 8 hour shifts per day, 7 days per week, less statutory holidays and a partial shut down for vacations. Mine production is 1,360,000 t/y or approximately 1300 tonnes per shift calculated on the basis of 1050 shifts per year. Four crews will be used on a rotating schedule; the hourly paid employees will average a 42 hour work week.

Production from the mine must match the mill requirements very closely, since there is only a minimum of surge capacity in the plant crushed ore stockpile. It is intended to avoid re-handling of mined ore by dumping from the trucks directly into the crusher at the mill. An emergency stockpile will be built up, to be drawn on if there is some unusual hold up at the mine.

Underground mining methods will be room and pillar in the narrow areas (4m to 7m), room and pillar with benching (up to 13m), and longhole open stoping in rooms more than 13m high. All stope development will be in ore. In terms of equipment utilization, manning and costing, the sources of ore are more complex than two mining methods plus benching would imply. The diluted mineable reserve from stoping can be broken down as follows:

			Tonnes	%
1.	Room and Pillar			
	a)	Seam height rooms	223,380	2.2
	b)	5.5m rooms requiring benching	845,550	8.1
	c)	Benching below rooms	685,953	6.6
2.	Longhole Open			
	a)	Drifting within the stopes	1,086,287	10.5
	b)	Undercutting the stopes	1,086,287	10.5
	c)	L.H. Ring Blasting	6,448,754	62.1
	TOTAL FROM STOPING		10,376,211	100.0

The stoping quantities were derived from Table 3-5, subdivided in accordance with the proportions shown in Figures 6-1 and 6-3. However, the access drifts to reach these stopes are also driven in ore. It is estimated that some 50 metres of access drifting will be required on average each month. A life of mine allowance of 4000m was added to the mineable reserves, equivalent to 274,000 tonnes.

6.5.2 Underground Equipment

Mining equipment will be selected for optimum productivity and minimum operating costs.

Major items are listed in Table 11-8 in the Capital Cost Section and discussed below.

Electric powered LHDs are proposed for higher efficiency, lower operating cost, cleaner environment and ease of remote control. However, the equivalent diesel LHD would be cheaper to buy (probably matched by higher ventilation cost) and would have much greater mobility around the mine.

The listed dump trucks are 40 tonne capacity, filled in three passes by the proposed LHD.

These are the largest trucks commonly used underground. 50 tonne Caterpillar trucks were considered for the same capital cost, but they are underpowered at 450 hp and too wide for easy operation in 5m drifts (safety bays would be required under Ontario regulations). The 50t Kiruna truck is only two wheel drive. The selected 40t trucks are all-wheel drive for negotiating the steep sections of ramp, and the operator's cab is enclosed for operation outside in cold weather.

Three hydraulic drill jumbos are provided, all on rubber tired diesel carriers for high mobility:

- drift jumbo, 2 boom, with 4m feeds
- production jumbo, 2 feeds with rod change carousels
- bench jumbo, 1 boom with rod change carousel

Only one jumbo of each type is provided because theoretically none will operate more than 50% of the time. The bench jumbo uses extension steel to drill vertical (or near vertical) bench holes to depths of up to 8m and to drill horizontal undercut holes 5.5m long from a 5.0m wide draw drift. Theoretically the benching could be done with the drift jumbo, but a second rig would be required and the size of each blast would be limited by the steel length.

6.5.3 Underground Manning

The 8 staff and 37 hourly personnel are detailed in sub-section 12.3, Underground Mining Costs. As in the open pits, the staff comprise 4 line supervisors and 4 engineering personnel.

Development miners work in pairs and are expected to scale, rock bolt, drill, charge and blast all development drifts and rooms. Four crews will be expected to pull 21 rounds per week: more than 300t/manshift.

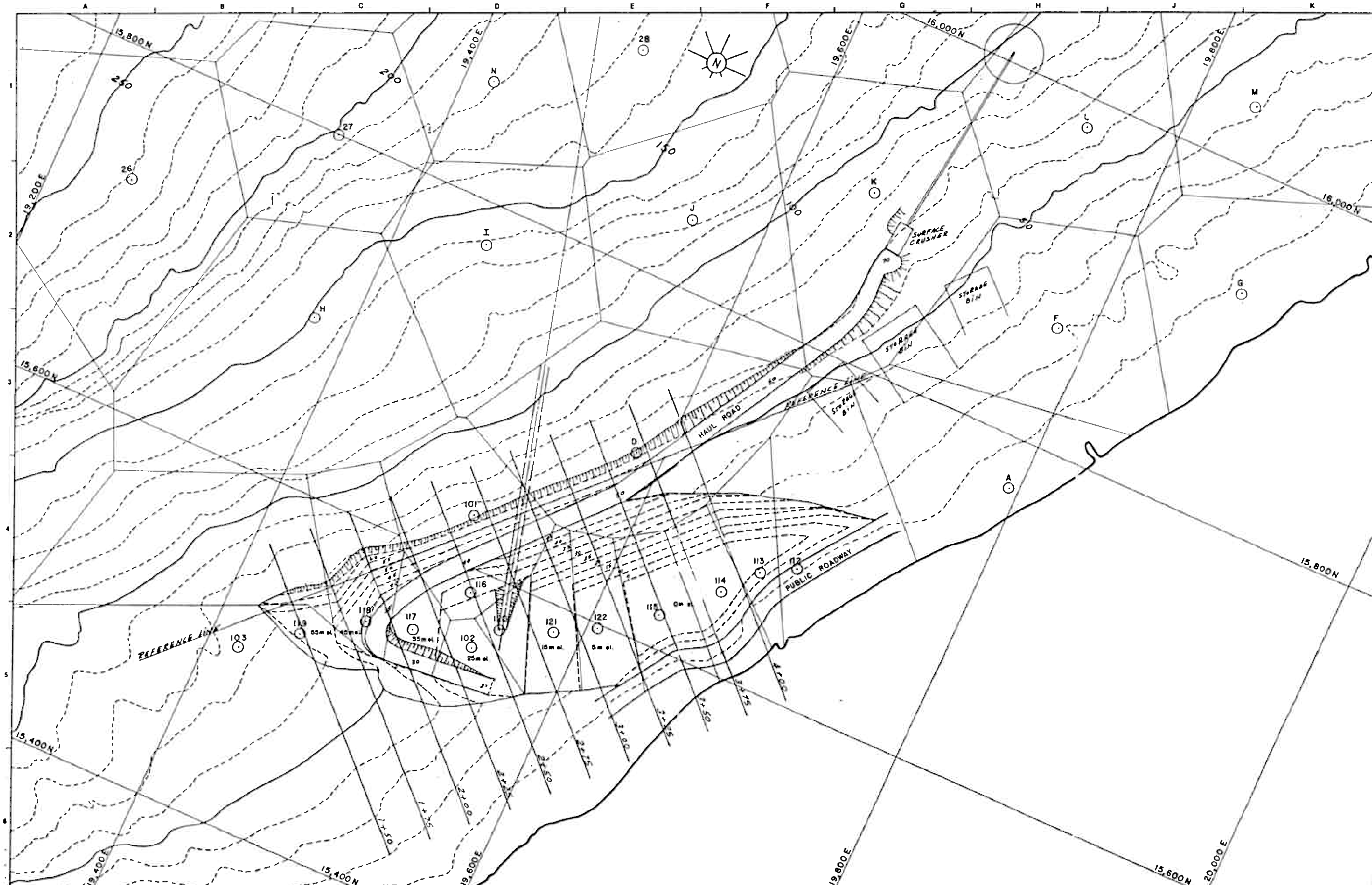
The four longhole stope miners would probably function as two individual drillers and a pair of men to install cable bolts, charge and blast.

Two bench and undercut miners should have plenty of time to drill, charge and blast the required 480t/manshift.

Two truck operators are required every shift to haul 1300 tonnes upgrade over the average 1100m haul distance from workplace to crusher. One spare truck is provided to assure availability. In theory, one LHD operator per shift can keep the trucks filled but two additional operators are provided for mucking development headings back to remuck bays and for secondary jobs which LHDs tend to get used for.

One utility operator per shift is expected to perform any other work required in the mine (grading ramps, fetching supplies, moving fans, tending pumps, etc.) as well as covering for absentees.

All on site equipment maintenance is performed by one mechanic per shift and one electrician on steady days. This covers routine preventive maintenance only. Repairs and rebuilds would be contracted to local businesses such as Ibestad Mechanical.



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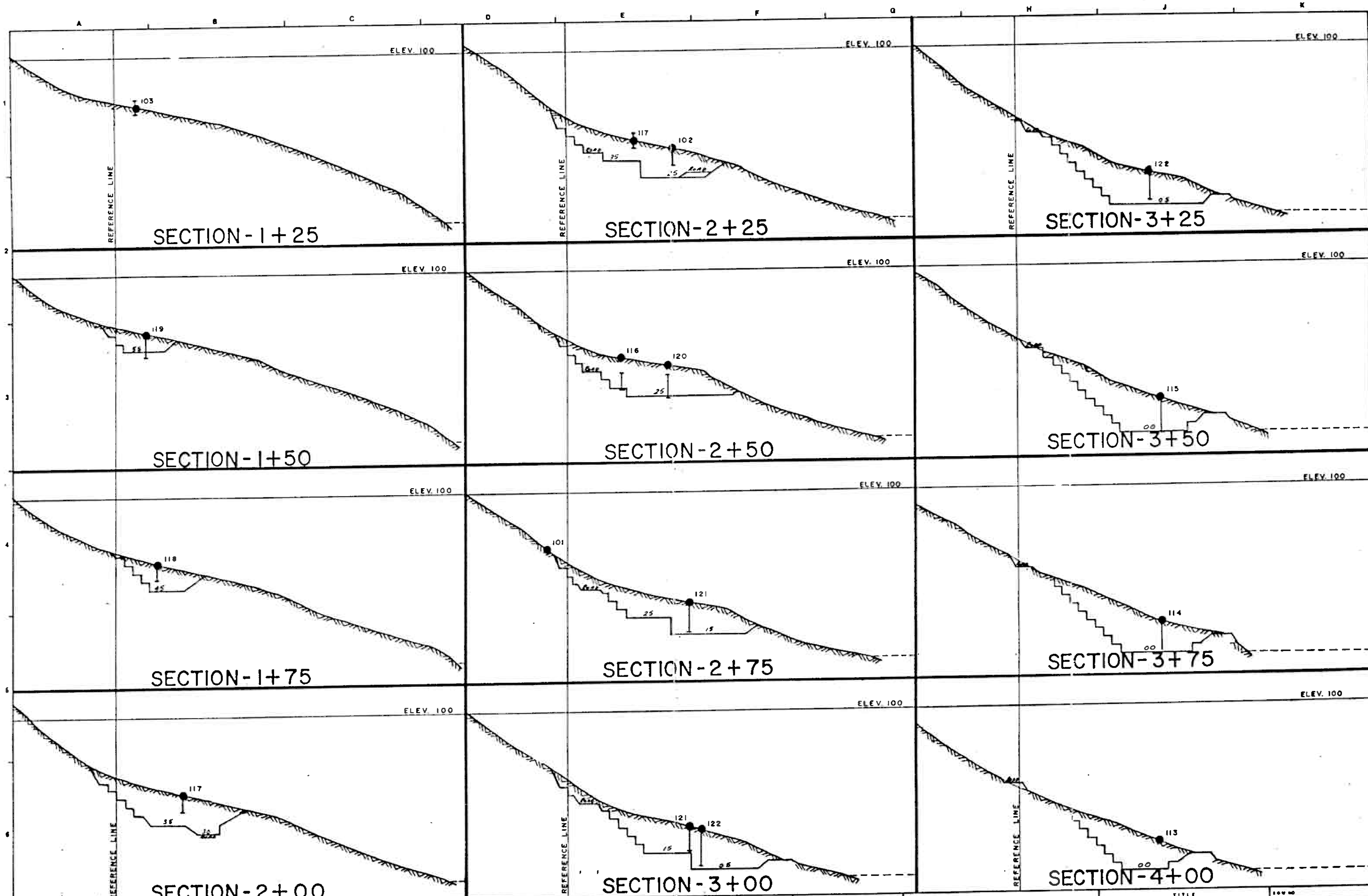
SCALE: 1 : 1000	DATE	LOCATION: ANDORJA ISLAND NORWAY	ANDORJA PROJECT 1360000 t/a MAGNETITE PLANT
DESIGNED: M. J. DAVIE	JUL. 81	KILBORN	KULIBERGET AREA OPEN PIT PLAN
DRAWN: R.W. LAROCQUE	JUL. 81		
CHECKED			
APPROVED			

PROJECT NO	DIVISION NO
3754	15

DRAWING NUMBER: 50-05-F1 REV A

REFERENCE DRAWINGS | REVISIONS | REVISIONS



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DRAWN	R.W. LAROCQUE — JUL. 91
CLIENT	FIMAS
LOCATION	ANDORJA ISLAND NORWAY
	KILBORN
TITLE	ANDORJA PROJECT 1360000 t/a MAGNETITE PLANT KULIBERGET AREA OPEN PIT CROSS-SECTIONS LOOKING NORTHEAST
PROJECT NO.	3754
DIVISION NO.	15
DRAWING NUMBER	50-05-F2
REV	A

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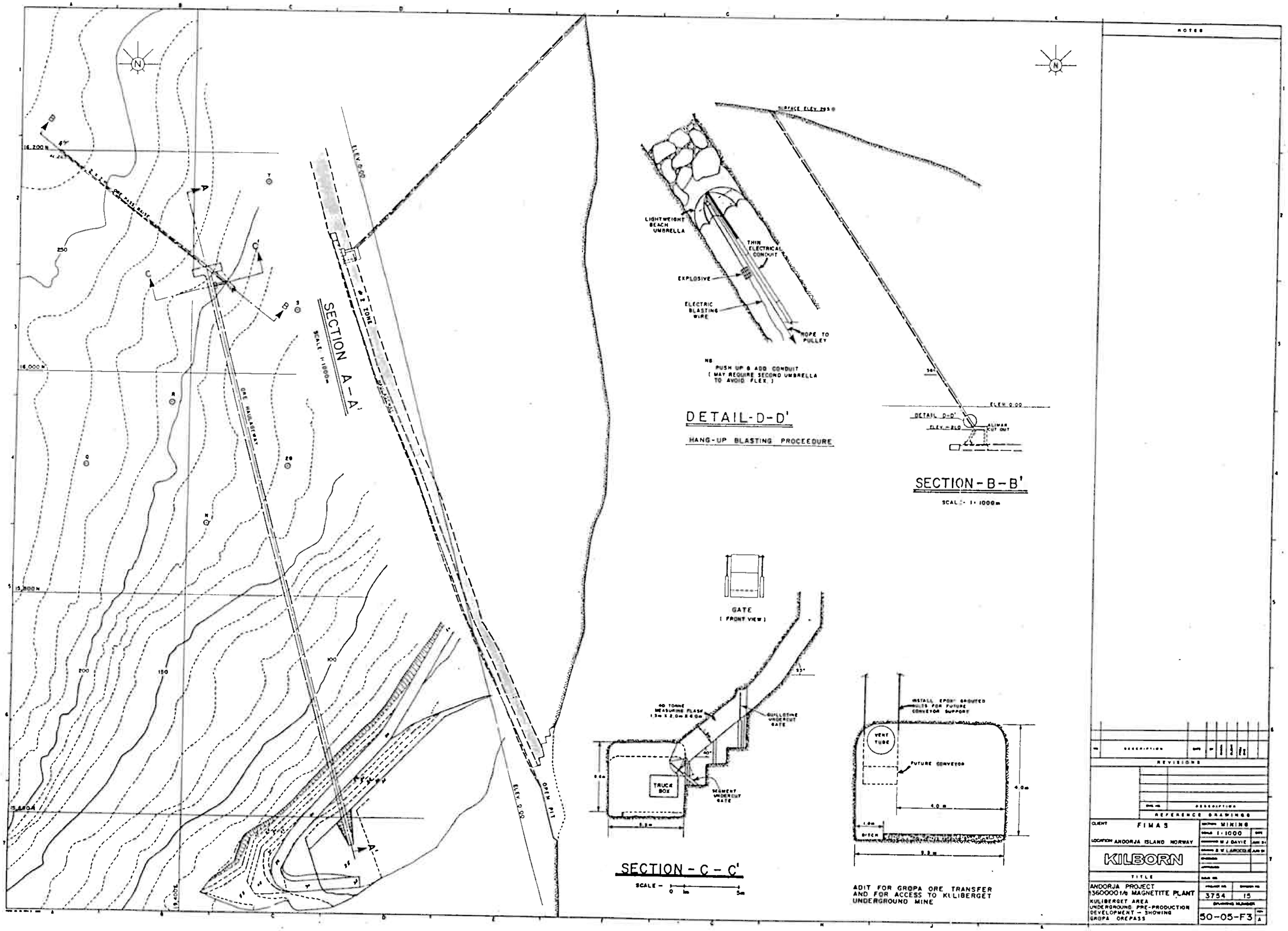
REVISIONS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ORE HAULAGEWAY
ELEV. 0.00
OPEN PIT
DETAIL-D-D'
HANG-UP BLASTING PROCEEDURE
LIGHTWEIGHT BEACH UMBRELLA
THIN ELECTRICAL CONDUIT
EXPLOSIVE
ELECTRIC BLASTING WIRE
ROPE TO PULLEY
NB
PUSH UP & ADD CONDUIT
(MAY REQUIRE SECOND UMBRELLA TO AVOID FLEX)
SECTION-B-B'
SCALE 1:1000m
GATE
(FRONT VIEW)
TRUCK BOX
SECTION - C - C'
ADIT FOR GROPA ORE TRANSFER AND FOR ACCESS TO KULIBERGET UNDERGROUND MINE
VENT TUBE
FUTURE CONVEYOR
REVISIONS
REFERENCE DRAWINGS
CLIENT FIMAS
LOCATION ANDORJA ISLAND NORWAY
MINING
1:1000
KILBORN
TITLE
ANDORJA PROJECT
1360000 t/a MAGNETITE PLANT
KULIBERGET AREA
UNDERGROUND PRE-PRODUCTION
DEVELOPMENT - SHOWING
GROPA OREPASS
3754
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50-05-F3
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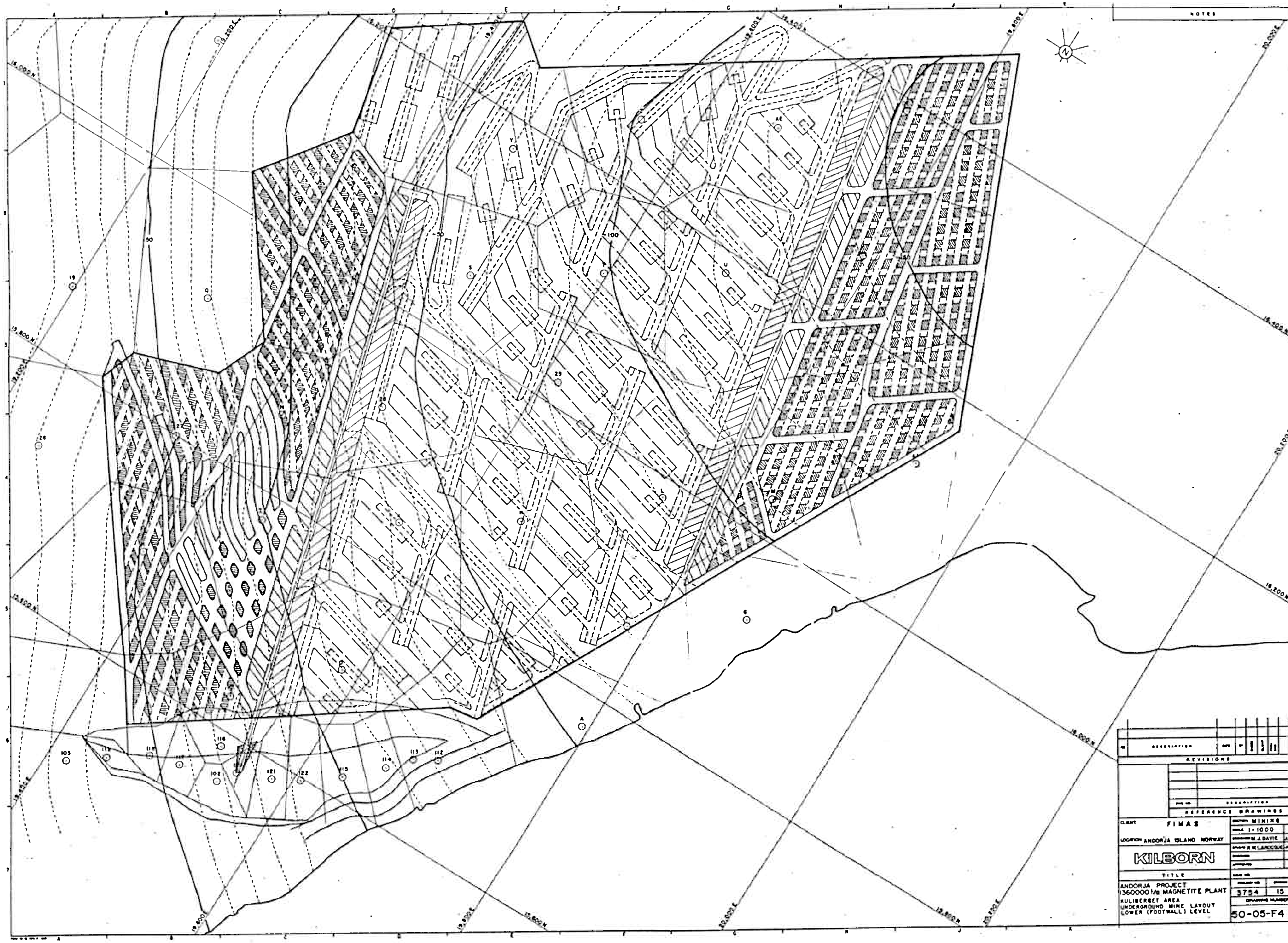
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REFERENCE DRAWINGS
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CLIENT FIMAS
LOCATION ANDORJA ISLAND NORWAY
KILBORN
TITLE
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KULIBERGET AREA
UNDERGROUND MINE LAYOUT
LOWER (FOOTWALL) LEVEL
MINING
1:1000
M. J. DAVIE
3754
15
DRAWING NUMBER
50-05-F4
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18,000 N
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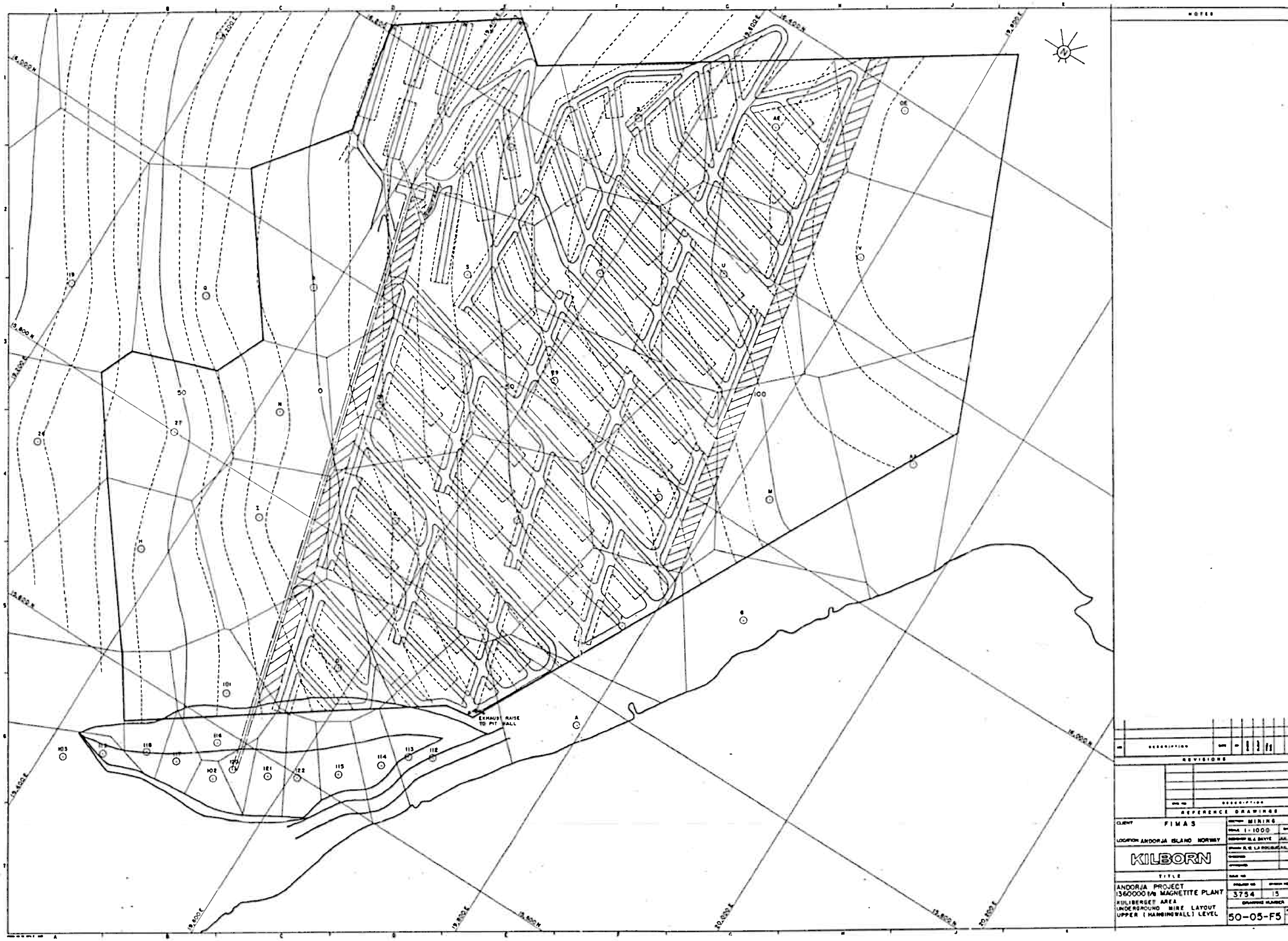
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EXHAUST RAISE TO PIT WALL
REVISIONS
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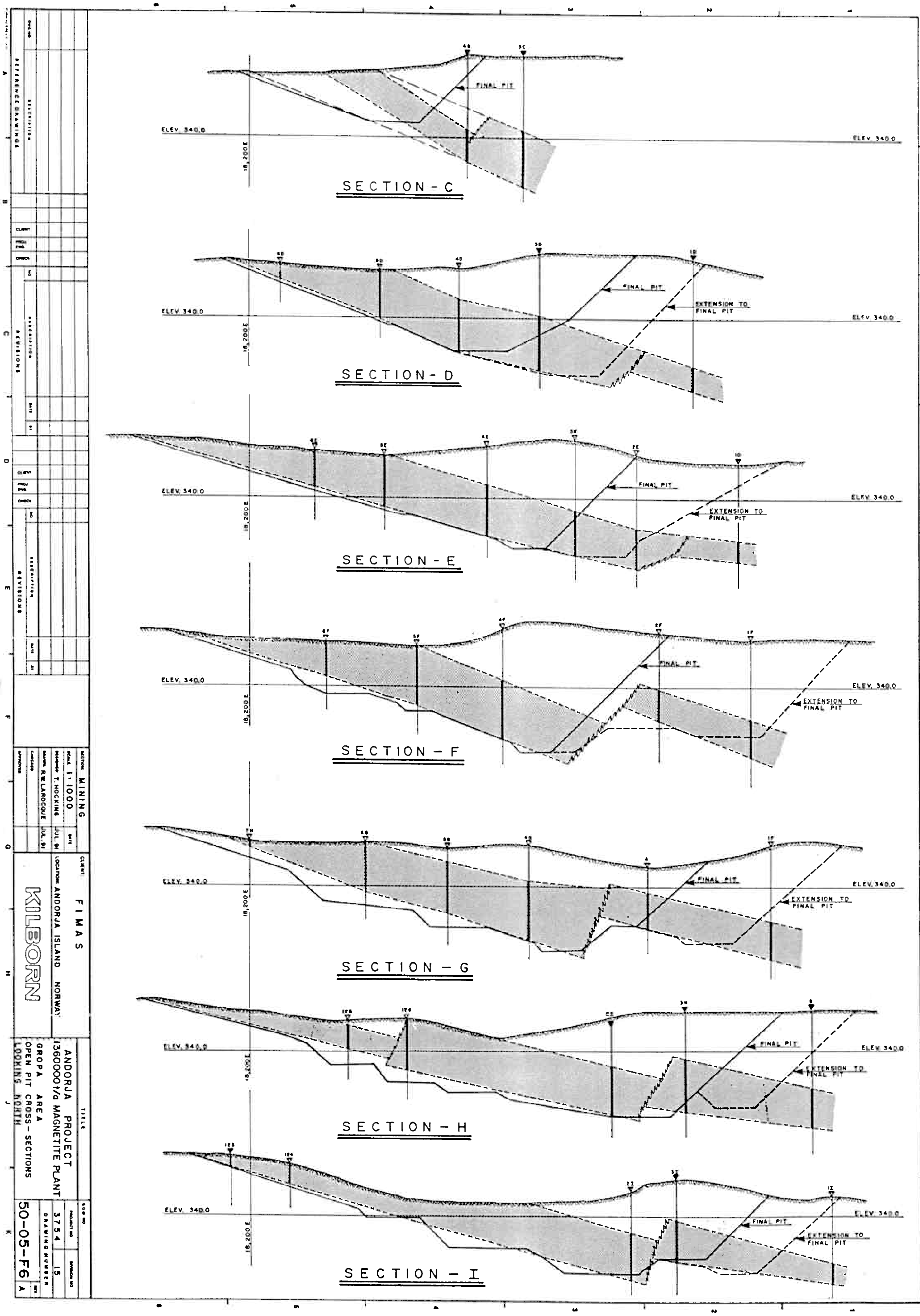
CLIENT FIMAS
LOCATION ANDORJA ISLAND NORWAY
KILBORN
TITLE
ANDORJA PROJECT
1360000 t/a MAGNETITE PLANT
KULIBERGET AREA
UNDERGROUND MINE LAYOUT
UPPER (HANGINGWALL) LEVEL
MINING
1:1000
3754
15
50-05-F5



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SECTION - D
SECTION - E
SECTION - F
SECTION - G
SECTION - H
SECTION - I
ELEV. 340.0
18,200 E
FINAL PIT
EXTENSION TO FINAL PIT
REFERENCE DRAWINGS
REVISIONS
MINING
1:1000
T. HOCKING JUL. 91
R.W. LAROCQUE JUL. 91
FIMAS
ANDORJA ISLAND NORWAY
KILBORN
ANDORJA PROJECT
1360000 t/a MAGNETITE PLANT
GROPA AREA
OPEN PIT CROSS-SECTIONS
LOOKING NORTH
3754
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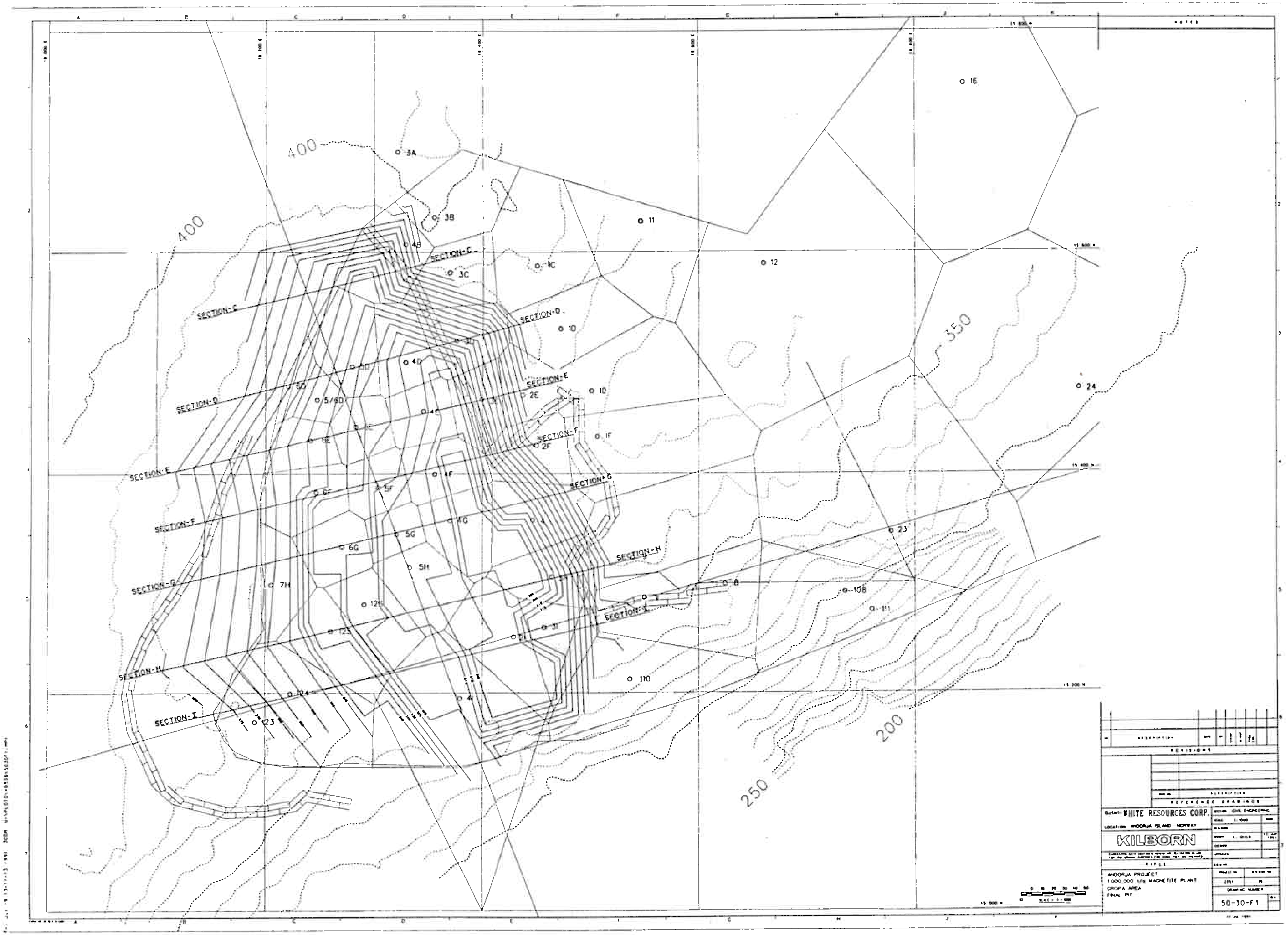
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o 3C
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o 10
o 24
o 1F
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o 5F
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o 6G
o 5H
o 7H
o 23
o 108
o 111
o 110
o 8
CLIENT: WHITE RESOURCES CORP.
LOCATION: ANDORJA ISLAND NORWAY
KILBORN
CIVIL ENGINEERING
1:1000
ANDORJA PROJECT
1 000 000 t/a MAGNETITE PLANT
CROPA AREA
FINAL PIT
50-30-F1

KONFIDENSIELT

SECTION 7.0

PROCESSING

3754_15

FALKHAMMER - IBESTAD MAGNETITE A.S.
ANDØRJA MAGNETITE PROJECT
FEASIBILITY STUDY - VOLUME 1

7.0 PROCESSING

7.1 GENERAL

Extensive test work has been carried out for the processing of the Andørja magnetite ore since its initial discovery. This work was originally undertaken by ~~Elkem~~ Chr sp.v during the 1960's. A laboratory scale pilot plant study was conducted at the Mineral Dressing Laboratory of the Norwegian Institute of Technology during the fall of 1988. A further full scale plant test (1990) was conducted by Swedish Mineral Processes A.B. (Minpro) at their plant at Strossa in central Sweden. This pilot plant testing was conducted on a 60 tonne bulk sample.

The results indicated that an acceptable heavy media magnetite, apatite and pigment toner grades could be produced. Samples of the finished products, as produced from the pilot plant testing, were forwarded to the respective purchasers. A proposed flowsheet was developed and is designated as Case 1 conforming to the original flowsheet as advised by Minpro.

During the course of this feasibility study, in an effort to simplify the flowsheet and reduce equipment costs, further testwork was requested from Hazen Research, Inc. in Golden, Colorado, U.S.A. The results of these tests are expected to confirm that changes to the flowsheet can offer substantial savings without impact on product recovery or quality. These changes have been incorporated into flowsheet Case 2.

7.2 DESIGN CRITERIA

The operation of the plant was based on two differing concepts. Case 1 being the original Minpro flowsheet with crushing and processing equipment being partially on land and the concentration plant and storage located on a specially designed self unloader ship. Due to the unavailability of a suitable size self unloader ship and the cost of installing on board the process equipment and ore storage needs, this alternate was discarded as being an uneconomical operation. Case 2 employs the revised Kilborn flowsheet, is land based and forms the basis of this feasibility study. Simplified flowsheets for both cases are included at the end summary Section 2.0.

In both cases 1 and 2 the operation was based on the same yearly production of products. Heavy media magnetite and apatite form the major products with superslig and pigment being produced in lesser quantities but with the ability to increase production as demand increases. With the more simplified flowsheet developed for Case 2, the separate production of aggregate and sulphide products are not included. It should be noted however, that revenue considerations for these products were not included in the project economics.

The design criteria used assumes a continuous operation, allowing for normal maintenance downtime, statutory holiday shutdowns and an allowance for unforseen circumstances such as winter storms and impassable roads.

As is customary for this type of crushing, grinding and concentrating operation, the mechanical availabilities for each section were different. The crushing section has been sized based on an availability of 80% The grinding section has been sized assuming an 87.5% availability while the concentrator has used a 94% factor.

All design criteria used for the design of the processing facilities is summarized for each product in Tables 7.1, 7.2 and 7.3 for Magnetite, Superslig and Apatite products respectively. Detailed design criteria for each intermediate process stage are contained in Appendix B entitled Design Criteria and Calculations.

TABLE 7.1

DESIGN CRITERIA - Magnetite	
Operating - Days per year	**350**
- Hours per day	**24**
- Plant availability - %	**92**
- Hours per year	**7728**
Feed Grade - Magnetite (total)	**28%[34% Max]**
Ore Moisture	**4%**
Ore Specific Gravity	**3.4**
Plant Recovery	**98.0%**
Product Grade	**67.1%** Fe.
Production Rate - tonnes/year	**325,000**
Milling Rate - tonnes/year	**1,360,000**
Plant Feed Rate - tonnes/day	**4,000**
Plant Feed Rate - tonnes/hour	**208.3**

TABLE 7.2	
DESIGN CRITERIA - Superslig	
Operating - Days per year	350
- Hours per day	24
- Plant Availability - %	92
- Hours per year	7728
Feed Grade - Magnetite (Total)	28%[34%Max]
Ore Moisture	4%
Ore Specific Gravity	3.4
Plant Recovery	98.0%
Product Grade	71.5% Fe
Production Rate - tonnes/year	75,000
Milling Rate - tonnes/year	1,360,000
Plant Feed Rate - tonnes/day	4,000
Plant Feed Rate - tonnes/hour	208.3

TABLE 7.3	
DESIGN CRITERIA - Apatite	
Operating - Days per year	350
- Hours per day	24
- Plant availability - %	92
- Hours per Year	7728
Feed Grade	1.29%P (+/-8.0% P_20_5)
Ore Moisture	4%
Ore Specific Gravity	3.4%
Plant Recovery	67.8%
Product Grade	17.2%P (39.7% P_20_5)
Production Rate - tonnes/year	81,600
Production Rate - tonnes/hour	10.6
Milling Rate - tonnes/year	1,360,000
Plant Feed Rate - tonnes/day	4,000
Plant Feed Rate - tonnes/hour	208.3

The sizing of all processing circuits closely conformed to the criteria developed by Minpro in their pilot plant work. Exceptions are noted in subsequent sections where significant cost savings are evident by changing the Minpro flowsheet.

The rate of production was based on information provided by FIMAS in the form of a memorandum dated March 8, 1991. In this memo, two production scenarios were presented together with the revenue information. Kilborn could not proceed on the basis of the product slate developed for the second case since this would require a larger mining operation than envisaged due to the increased volume of production. Additionally, the production of toner could represent a significant source of revenue with a production of only 40 tonnes per annum. However no testwork was available for the production of toner. Therefore the pigment circuit was oversized to be capable of producing 540 tonnes per annum, with the extra 40 tonnes available for further upgrading.

A further change was made in the area of superslig production. The second case based on the higher volumes had assumed a production level of 75,000 tonnes per annum of superslig. The case the study was proceeding on had assumed a level of 50,000 tonnes per annum. After reviewing the metallurgical testing, it was determined that a production level of 75,000 t/a could be achieved at the expense of magnetite/sinter feed production rate. Since the selling price of superslig is $40.00/tonne versus $23.00/tonne for magnetite/sinter feed, the production scenario was changed. Therefore a production level of 325,000 t/a was selected for magnetite/sinter feed.

The production of apatite had not been considered in the previously mentioned memorandum discussing the split between magnetite products. However, there is a market for this product with Norsk Hydro for up to 200,000 t/a of apatite. The Minpro Testwork had indicated a typical production rate of 6.0% of the mill feed. At a feed rate of 1,360,000 t/a, this would be equivalent an annual production level of 81,600 t/a. Table 7.4 summarizes the production levels assumed for the study.

TABLE 7.4
OVERALL PRODUCTION RATES

PRODUCT NAME	ANNUAL PRODUCTION
Mill Feed	1,360,000 t/a
Magnetite/Sinter Feed	325,000 t/a
Superslig	75,000 t/a
Pigment	500 t/a
Toner	40 t/a
Apatite	81,600 t/a
Tailings	877,860 t/a

It should be noted that the relative production of these various products is highly dependent upon grade. The sample sent to Minpro had a head grade of approximately 31.9% magnetite. The Kilborn flowsheet is designed to produce the above product mix with a feed rate of 1,360,000 t/a and an average head grade of 28.0% magnetite. However, the mine plan at present calls for a production of up to 34.0% magnetite. At this higher head grade, there will be the potential of producing up to 411,954 t/a of magnetite/sinter feed. Sufficient capacity has been designed to permit this enhanced level of production. Due to the relative high cost of concentrating tables, there has been no upgrading of the production capability for superslig.

In the case of apatite, the rate of production is again dependent on head grade. The Minpro pilot plant run typically achieved recoveries in the order of 75% at a finished grade of 39.7% P_2O_5.

7.3 PROCESS DESCRIPTION

Ore Receiving and Primary Crushing

(Reference Drawing 100-10-FB1)

The ore mined both from the underground and open pit mining operations will be delivered to a truck dump hopper. This hopper will be fitted with a grizzly, having 450 x 450 opening to protect the primary crusher from excessively large material. The run-of-mine ore contained in the 100t bin will be reclaimed by a hydra-stroke feeder. The feeder will discharge into a new double toggle jaw crusher, 1050 x 1200, having a closed side setting (CSS) of 200mm. This will reduce the run-of-mine ore to a top size of 225mm.

Crushed Ore Storage and Reclaim

(Reference Drawing 100-10-FB1)

The crusher discharge will gravitate onto a 900 mm wide conveyor for transfer to the 10,000 tonne (nominal) crushed ore stockpile. Reclaim from this stockpile will be via two (2) 1200 x 1500 variable speed vibratory feeders. These feeders will then discharge onto the 900 mm mill feed conveyor.

Grinding

(Reference Drawing 100-10-FB1)

The mill feed conveyor will discharge directly into the 8230 diameter x 5480 long SAG mill

with a blended feed of crushed ore and recycled SAG mill discharge oversize. Also feeding the SAG mill will be oversize from the SAG mill classification circuit. The SAG mill has been designed for a circulating load of 250%.
The SAG mill will discharge onto an inclined (20 degrees) 1830 x 3660 sizing screen. Pebble pockets in the grate discharge of the mill will allow for the removal of critical size material. This material will overflow this guard screen and be discharged onto a high angle 600 mm wide flex-wall conveyor. This material can either be discarded to the ground or returned to the mill feed conveyor. Sufficient space has been allowed for the installation of a 900 diameter cone crusher to crush these critical size rocks in the event that they tend to build-up in the grinding circuit.

The guard screen underflow will report to the SAG mill sump from where it will be pumped to a cyclo-pack of eight (8) 375 mm diameter classifying cyclones. The cyclones overflow will be further classified on a 1200 x 3050 sizing screen mounted in a horizontal configuration.

The grinding circuit is designed to produce a finished ground product of 90% minus 90 microns and 60% minus 45 microns. The Minpro test had reported an energy consumption of 18 kW-h/t for a fully autogenous grinding configuration. A SAG test, to determine Bond Work Index, had been commissioned during the course of this feasibility study, however the results of this test were unavailable at the time of preparation of this final report. The calculated mill power for the Minpro figure was 3730 kW (5000 HP).

In order to suitably address this risk, a used SAG mill from the taconite mining area near Hibbing, Minnesota, was located. This mill would be available for use at Andorja. It has twin 2611 kW (2500 HP) wound rotor drive motors. This would provide an adequate reserve of power should the SAG test demonstrate higher grinding power requirements. Also, sufficient funds have been allowed for the conversion of the wound rotor motors to variable speed service.

Primary Magnetic Separation

(Reference Drawing 100-10-FB1)

The primary separation between magnetic and non-magnetic products will occur as the SAG mill classifying screen underflow is passed through a five stage, 916 diameter x 3000 wide, wet drum magnetic separator. The magnetic concentrate, representing approximately 31.0% of the mass will overflow the magnetic separator at 30.0 - 33.0% solids by weight. This concentrate will be passed through a demagnetizing coil to prevent flocculation in downstream operations. The demagnetized magnetic concentrate will gravitate to a pumpbox and be pumped to storage in an agitated 9000 x 9000 surge tank. This surge tank will serve to provide a buffer between the grinding circuit at 87.5% availability and the concentrating circuit at 92% availability.

The remaining 69.0% of the mass will underflow the magnetic separator as a non-magnetic product and gravitate to a 1200 x 1200 pumpbox. This product will be further processed to recover the apatite values.

Superslig Concentration

(Reference Drawing 100-10-FB2)

This circuit is designed to upgrade the magnetic fraction to a superslig (or super concentrate) product which is high in iron content and low in sulphide, silicate and phosphorous. This will be achieved in a four stage gravity concentration circuit followed by two stage flotation. The magnetic fraction will be pumped from the surge tank to two (2) 375 mm diameter classifying cyclones. The cyclone underflow will be diluted with dressing water and be split; reporting to two (2) banks of eight (8) mineral concentration spirals (roughers). The lighter, lower density fraction, together with the classifying cyclone overflow will gravitate to the 2500 x 2500 spirals/tables tails pumpbox.

The rougher spirals concentrate will report to a pumpbox where it will be repulped with more dressing water and be pumped to a splitter feeding one (1) bank of seven (7) mineral concentrating spirals (cleaners). Again, the lighter fraction will report to the spirals/tables tails pumpbox. Similarly, the cleaner spirals concentrate will report to a pumpbox, repulped with more dressing water and pumped to a splitter feeding one (1) bank of five (5) mineral concentrating spirals (recleaners). The lighter fraction will report to the spirals/tables tails pumpbox while the concentrate reports to a pumpbox.

The recleaner concentrate will be diluted and pumped to a splitter feeding four (4) triple deck concentrating tables. The lighter fraction will gravitate to the spirals/tables tails pumpbox. The table concentrate will report to a pumpbox from where it will be pumped to a single 916 x 900 wet drum magnetic separator for thickening. The magnetic separator underflow will join the lighter fraction from the concentrating tables. The magnetic separator concentrate will report to the 1500 diameter x 3000 long superslig regrind mill.

The superslig regrind mill discharge will gravitate to a pumpbox from where it will be pumped to a single 254 mm diameter classifying cyclone. The Minpro flowsheet had produced a reground product having between 40 and 45% minus 45 microns. The energy consumption of 2.8-3.0 kW-h/t, as reported by Minpro was used in sizing the regrind mill. The cyclone underflow will be returned to the superslig regrind mill while the overflow will gravitate to a bank of six (6) 1.4 m^3 (50 ft^3) phosphate flotation cells. A fatty acid reagent, Berol ATRAC 387 will be added to promote the flotation of phosphate. The froth product will report to a pumpbox.

The phosphate flotation tails will report to a bank of six (6) 1.4 m^3 (50 ft^3) silicate flotation cells. An amine reagent will be added to these cells to promote the flotation of silicate. The froth product will report to the same pumpbox as the phosphate flotation froth product. From here it will be pumped to tailings. The tails product from the silicate flotation cells will report to a two stage 916 diameter x 900 wide wet drum magnetic separator for thickening. The non-magnetics and water will underflow this magnetic separator and gravitate to the magnetite thickener. The magnetic concentrate will then gravitate to the agitated 7500 diameter x 7500 high superslig surge tank.

The superslig concentration proposed does not precisely conform to the Minpro flowsheet in the following areas. Kilborn are recommending a three stage spiral circuit prior to tabling. This is due to the high cost and space requirements of tables and their low unit capacity. The recleaner spirals will reduce the number of tables required and make for a more compact plant. Also, the use of a sulphide flotation step for upgrading superslig was not adopted contrary to the Minpro report. This was again done for economy since the Minpro report indicated that a mass pull of only 0.2% of sulphide resulted. Since the Berol ATRAC 857 reagent for phosphate flotation will also promote sulphides, there should be a lowering of sulphur content in that flotation stage.

Pigment Production

(Reference Drawing 100-10-FB2)

A tee-off from the superslig surge tank feed line will be provided to divert a portion of superslig product to the pigment grinding circuit for further upgrading. This diverted product will report to an agitated 7000 diameter x 7500 high surge tank. This tank will be in closed circuit with a 75 kW tower grinding mill to produce an ultrafine pigment product having a size consist of 50% minus 2 microns.

Once the required fineness of grind is achieved, the charge will be pumped to a plate and frame filter press having ten (10) 250 x 250 plates. The filtrate will be pumped to the magnetite thickener. The dewatered cake will be thermally dried in a 600 diameter x 3660 long rotary kiln dryer.

Magnetite Production

(Reference Drawing 100-10-FB2)

The contents of the spirals/tables tails pumpbox together with the underflow from the ground superslig magnetic separators will report to the 17000 diameter magnetite thickener. Decanted water overflowing the thickener will be returned to the process. The thickener underflow will be pumped to the 2440 diameter x 2740 long magnetite regrind mill. The regrind mill discharge will then gravitate to a pumpbox and be pumped to a bank of four (4) 254 mm diameter classifying cyclones. The Minpro testwork had reported a grind of 80% minus 45 microns which corresponds to the required product specification. The grinding energy, as tested, 6.3 kW-h/t was used in the sizing of the regrind mill.

The classifying cyclone underflow will be returned to the regrind mill feed while the overflow will gravitate to a three stage 916 diameter x 1200 wide magnetic separator for thickening. The non-magnetics and water will report to tailings while the magnetic concentrate will report to the agitated 10500 x 11000 magnetite surge tank

Product Filtering

(Reference Drawing 100-10-FB2)

In order to minimize costs, a shared disk filter was selected for mechanical dewatering of both superslig and magnetite/sinter feed products. Calculations indicated that at 16 h/d for magnetite/sinter feed and 4 h/d for superslig, a single 2700 diameter x ten (10) disk unit could be used. There would remain 4 h/d for changeover and unplanned downtime.

The superslig and magnetite/sinter feed will be pumped from its respective surge tank depending on the mode of operation and delivered to the disk filter. The filtrate will be returned to the magnetite thickener while the dewatered cake will gravitate onto the 750 mm wide superslig/magnetite sinter feed transfer conveyor.

Apatite Production

(Reference Drawing 100-10-FB3)
The non-magnetic fraction underflowing the primary magnetic separation section will report to the apatite production circuit. A 6000 x 6000 conditioning tank will serve to provide the apatite circuit with surge between the 87.5% availability grinding circuit and the 92% availability concentrator. Frother (Dow 250 @ 10 g/t) and Potassium-Amyl-Xanthate (KAX @ 40 g/t) will also be added to this conditioning tank to promote the flotation of sulphides.

The conditioned feed will then be pumped to a bank of six (6) 14.2 m^3 (500 ft^3) flotation cells for removal of sulphides. This flotation operation will occur under natural conditions of 8.2 pH. The froth containing the sulphides overflowing the cells will report to tailings.

The tails will gravitate to a second 6000 x 6000 conditioning tank. There the pH will be raised using Sodium Hydroxide to 9.5 (NaOH @ 80 g/t). Concurrently with this pH modification stage, an apatite promoter (Berol ATRAC 387 @ 250 g/t) and an iron depressant (Dextrin @ 130 g/t) will be added to the conditioning tank.

The conditioned feed will then be pumped to a bank of six (6) 14.2 m^3 (500 ft^3) flotation cells for roughing (first 3 cells) and then scavenging (second 3 cells) of apatite. Tails from this bank of cells will report to tailings. Rougher froth will gravitate to a pumpbox from where it will be pumped to a bank of six (6) 8.5 m^3 (300 ft^3) cleaner flotation cells. Scavenger froth will also gravitate to a pumpbox from where it will be pumped back to the rougher feed.

First cleaner froth (first 3 cells) will gravitate to a pumpbox from where it will be pumped to the 10000 diameter apatite thickener. Second cleaner froth (second 3 cells) will gravitate to a pumpbox from where it will be returned to the cleaner cells feed. Tails from the cleaner cells will also gravitate to a pumpbox from where they will be pumped back to the rougher feed.

The apatite thickener overflow will be returned to the process while the underflow will be pumped to a 2000 wide x 8000 long horizontal belt filter for moisture reduction. Filtrate will be returned to the apatite thickener. The dewatered cake will be discharged onto the 750 mm wide apatite stockpile feed conveyor.

Product Packaging, Handling, Storage and Loadout

(Reference Drawing 100-10-FB5)

The pigment product will be packaged in 20 kg bags in a semi-automatic bagging unit. Packaged bags will then be loaded onto palettes and shrink wrapped. Loaded palettes will then be transferred to an indoor storage area by fork lift truck.

The superslig/magnetite/sinter feed conveyor will feed product onto either the 600 mm wide superslig stockpile feed conveyor feeding the 10,000 tonne covered superslig stockpile or the 600 mm wide magnetite/sinter feed stockpile feed conveyor feeding the covered 35,000 tonne magnetite/sinter feed stockpile. It is not planned to store magnetite and sinter feed separately since their specifications are similar.

As mentioned previously, apatite product will be transferred to the 10,000 tonne covered apatite stockpile by conveyor.

Each of the products from bulk storage will be reclaimed by wheel loader and fed into a reclaim hopper feeding onto the 900 mm wide product reclaim conveyor. This conveyor will then discharge onto the 900 mm wide shiploading conveyor. This conveyor will have luffing capabilities, however it is envisaged that the receiving vessel would require "warping" to fill all holds.

7.4 ANCILLARIES

(Reference Drawing 100-10-FB4)

Process Water

Decanted thickener overflow water together with required make-up water from the Lielvvatnet at elevation 418.5 m above sea level will be distributed from a central process water tank. This tank will provide water for two (2) 250 x 200 process water pumps feeding a ring main circuit. The gland water pumps will also be fed from this tank.

Vacuum System

Two (2) centrally located vacuum pumps will provide negative pressure to the apatite horizontal belt filter and the superslig/magnetite/sinter feed disk filter. Intake to these units will pass through a common barometric leg to prevent carryover of filtrate. These pumps will be located in an isolated room to attenuate their inherent high noise level.

Low Pressure Air

Two (2) low pressure blowers for aspiration of the flotation cells will also be located in the vacuum pump room due to noise considerations.

High Pressure Air

One (1) air compressor providing dry air at a pressure of 850 kPa (125 psi) will be provided for use as instrument air and other compressed air requirements. A twin tower regenerative air dryer will be included to remove water condensed during compression.

Ball Storage and Handling

Separate storage will be provided for both 100 mm diameter and 25 mm diameter grinding balls. Provision will be made for receipt by end dump trucks. As required, grinding balls will be reclaimed from the storage area and introduced into the SAG mill. At start-up a "seasoned charge" comprising a variation of grinding ball diameters would be used for the initial mill charge.

Flocculant

It is anticipated that powdered flocculant will be supplied in 20 kg bags. A feed hopper complete with integral bag splitter will receive the dry flocculant. As required, an automatic mixing system will periodically mix flocculant at a strength of 0.5% solids. A timer will initiate the auger feeder and simultaneously start a blower to transfer the flocculant to a water injected disperser. The mixture will then gravitate to an agitated 1000 x 1000 mixing/aging tank.

After sufficient aging time has elapsed the solution will be transferred by pump to a 1000 x 1000 dosing tank. From here it will be metered to the various processes as required.

Berol ATRAC 857

It has been assumed that this reagent will be delivered in liquid form in semi-bulk tanks (1000 kg). The reagent will then be transferred to its dosing tank via a barrel pump where it will be diluted with process water. A pump will deliver the prepared reagent to the various processes via a ring main loop.

Sodium Hydroxide

It has been assumed that sodium hydroxide or caustic will be delivered in drums at 50% solution. However, provision has been made to transfer from drums via barrel pump to a dosing tank. There will be dilution water available. A pump will deliver prepared caustic to the process via a ring main loop.

Xanthate

Same as for ATRAC.

Amine

It has been assumed that amine will be delivered in drums. It will then be transferred to a dosing tank via a barrel pump. Dilution water will be added at this point to make the required solution strength. A pump will deliver prepared solution to the process via a ring main loop.

Dextrin

Dextrin or starch will be delivered in bulk tank trucks and unloaded pneumatically into a 120 tonne capacity bin 500 diameter x 7500 high. The mixing system will consist of a 400 x 4000 tank complete with heating coils and agitators. Dextrin and water will be metered in automatically. Sodium hydroxide is also metered into the mixing tank. The solution will be distributed to the process via a ring main loop.

7.5 TAILINGS DISPOSAL

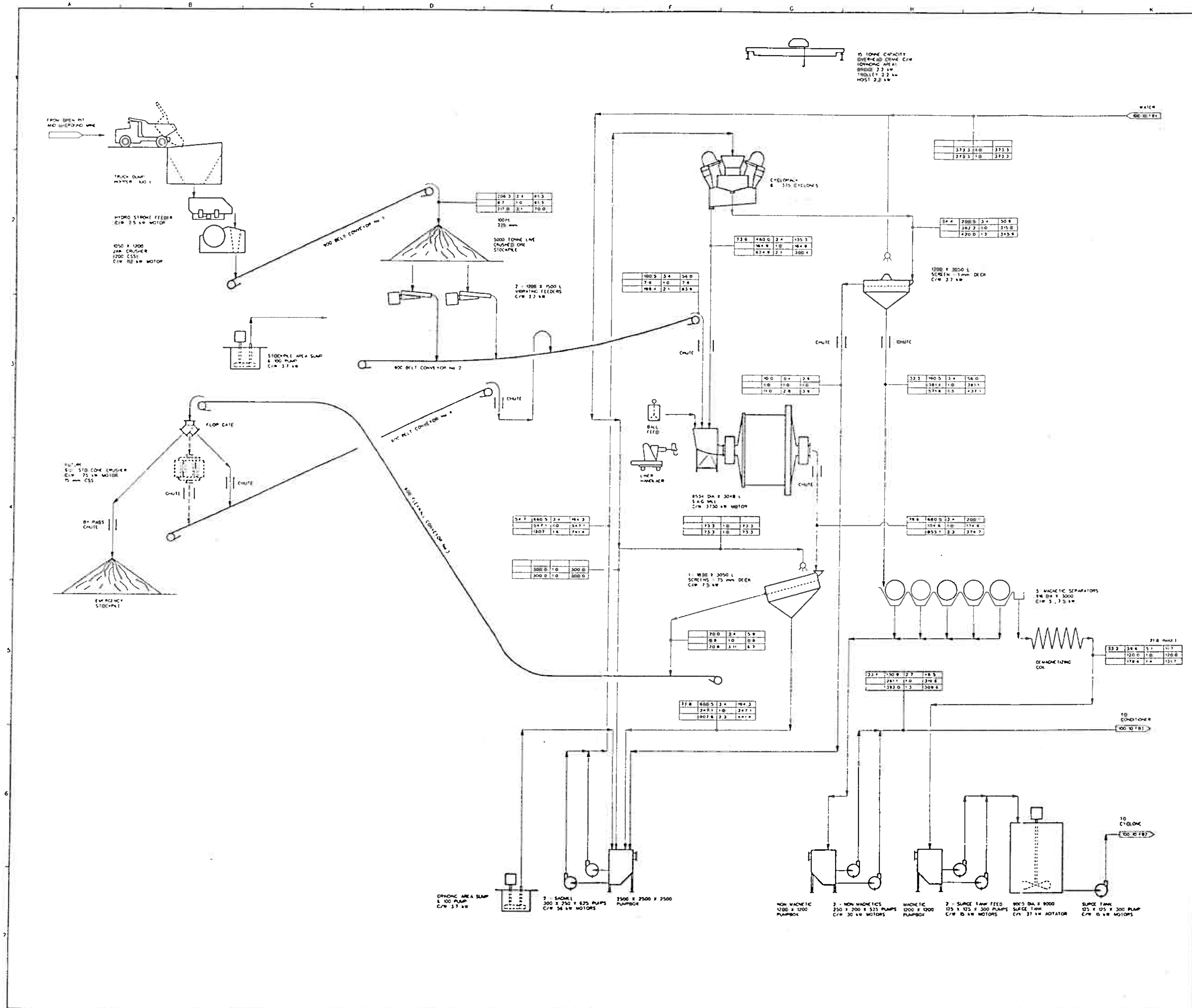
The topography of the Andorja site does not lend itself well to the use of open impoundments. This would be the preferred method of disposal since the water can be decanted and returned to the process thereby minimizing the make-up water requirements. These impoundments usually provide sufficient residence time so that reagents used in the process have time to naturally break down.

It is due to the presence of these reagents that a tailings thickener is not recommended. However, testwork should be done in this area to determine the effects of recycled reagents and its impact on the process efficiency. In an effort to reduce make-up water requirements, the decanted water from the thickeners and also filtrates are being recycled. Testwork should also be performed to confirm this decision.

There is no other option for tailings disposal other than discharging into the Fjord. The tailings will gravitate to a mixing chamber where they will be mixed in an approximate 50:50 ratio with sea water. The sea water will enter via a check valve arrangement and be induced into the chamber by a localized low pressure zone. This mixture will then have a density greater than sea water and will be introduced into the seabed at 50 meters minimum below sea level.

Make-up water to the process will gravitate from the high elevation lake known as Lielvvatnet located 418.5 m above sea level.

It is anticipated that tailings disposal into the sea will be temporary until mined out rooms are developed for tailings disposal.



B	RELEASED FOR REPORT								
A	RELEASED FOR INFORMATION								
No	DESCRIPTION								

REVISIONS

REFERENCE DRAWINGS

CLIENT: FIMAS

LOCATION: ANDØRJA ISLAND NORWAY

KILBORN

SECTION: GENERAL LAYOUT

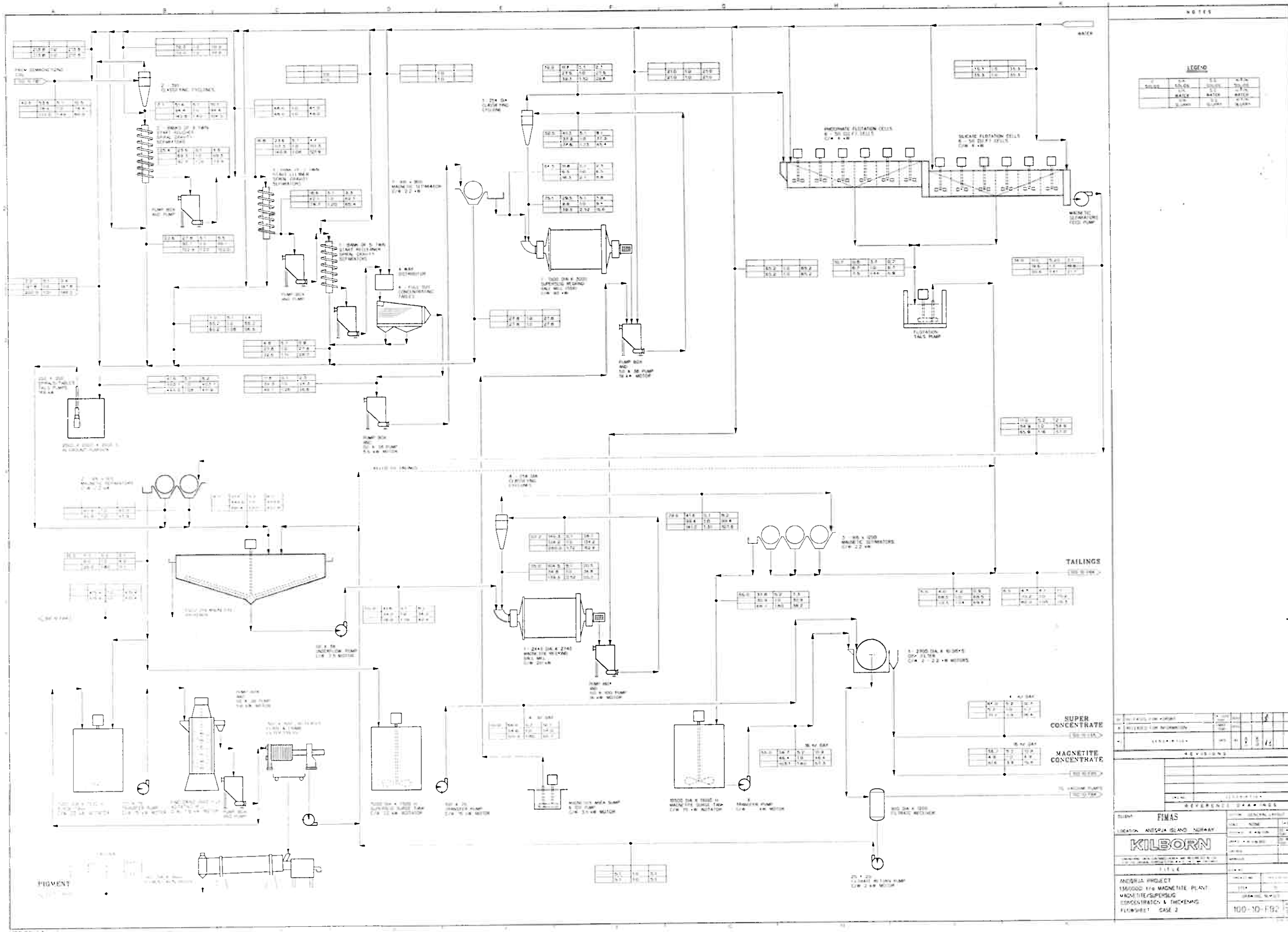
SCALE: NONE

TITLE

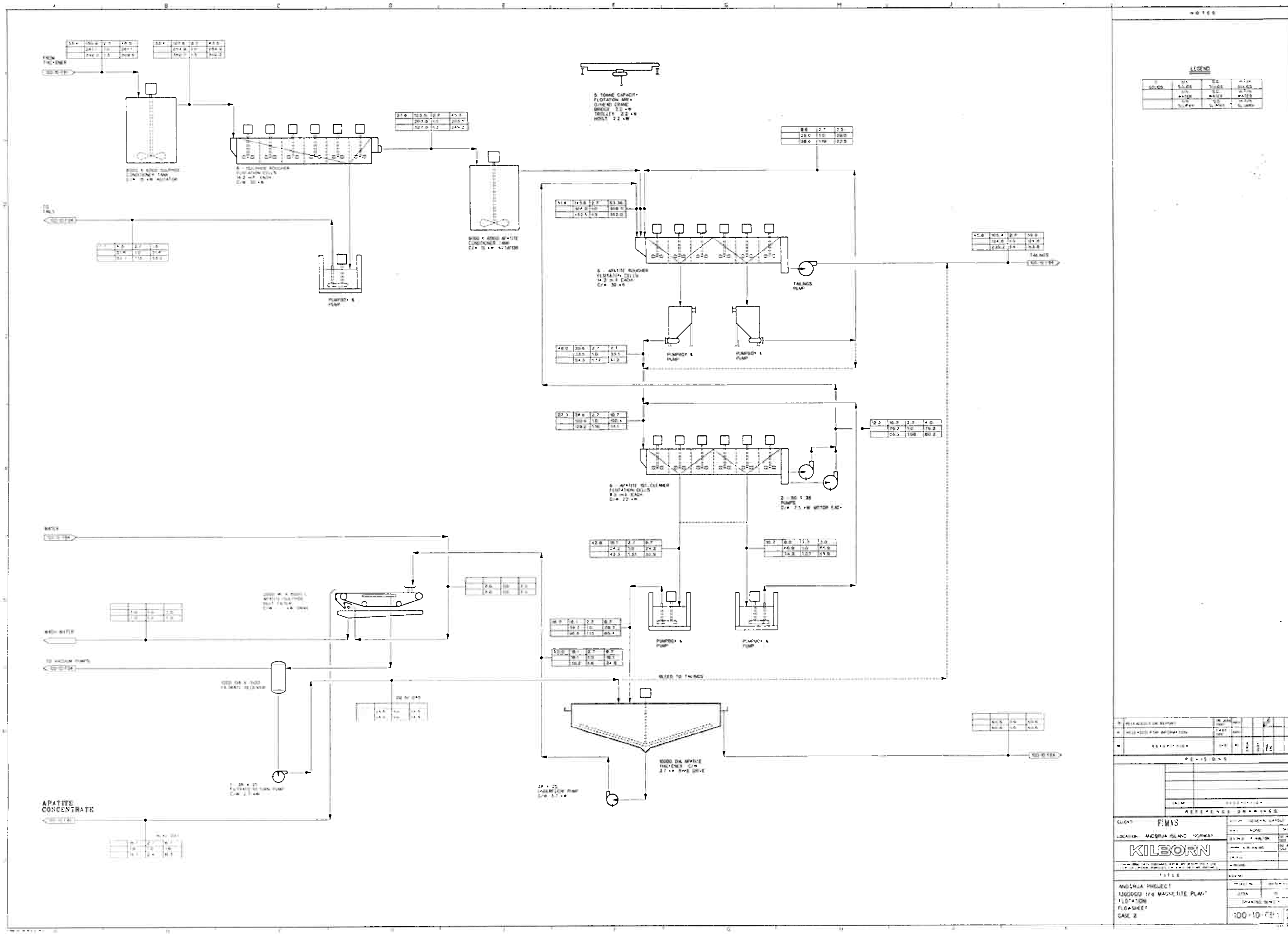
ANDØRJA PROJECT
1360000 t/a MAGNETITE PLANT
CRUSHING AND GRINDING
FLOWSHEET
CASE 2

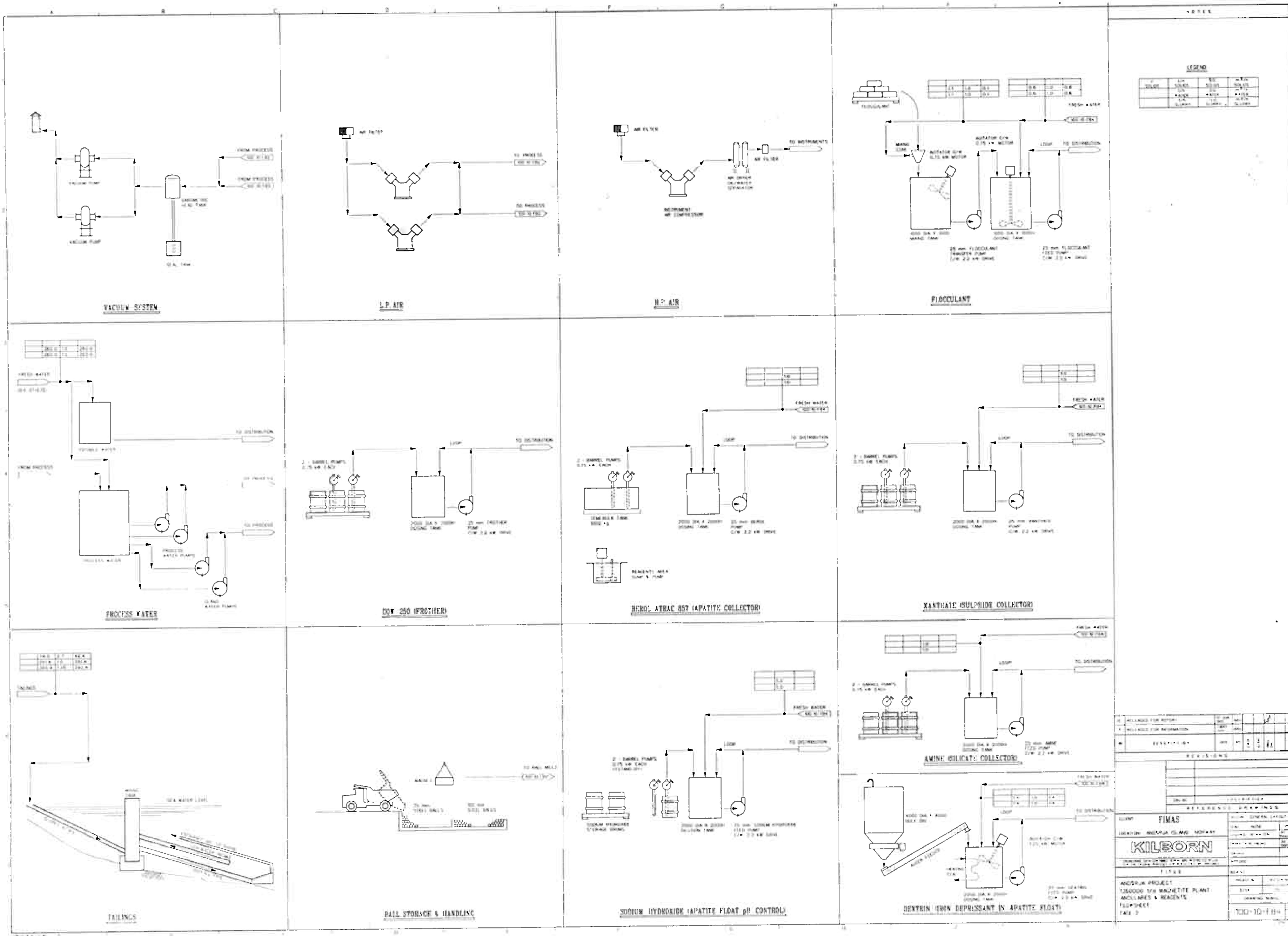
PROJECT No	DRAWING No
3734	15

DRAWING NUMBER: 100-10-FB1 REV B

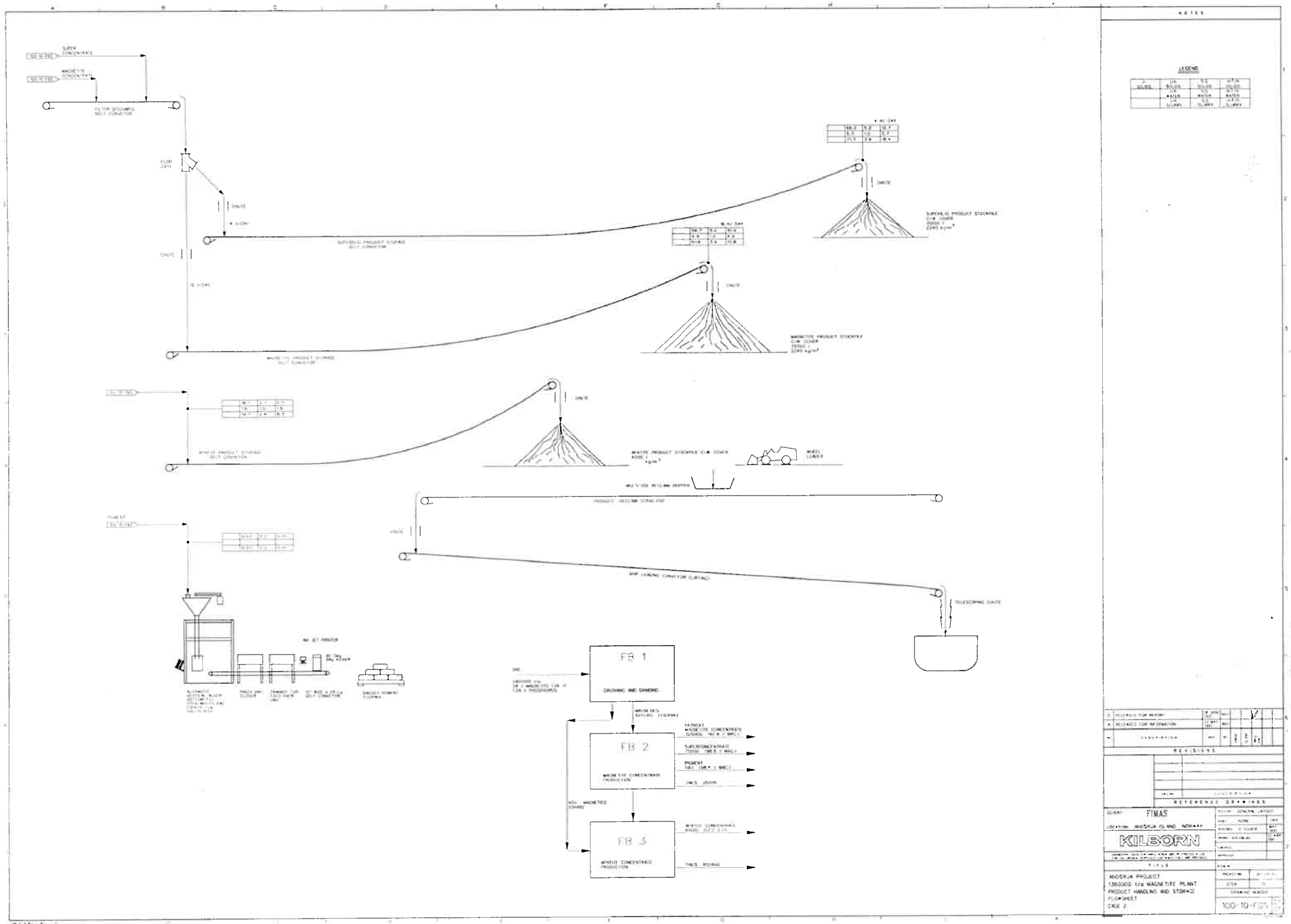


NOTES
LEGEND
WATER
TAILINGS
SUPER CONCENTRATE
MAGNETITE CONCENTRATE
PIGMENT
REVISIONS
REFERENCE DRAWINGS
CLIENT FIMAS
LOCATION ANDØRJA ISLAND NORWAY
KILBORN
TITLE
ANDØRJA PROJECT
1360000 t/a MAGNETITE PLANT
MAGNETITE/SUPERSLIG
CONCENTRATION & THICKENING
FLOWSHEET CASE 2
100-10-FB2


5 TONNE CAPACITY
FLOTATION AREA
6 - APATITE ROUGHER
FLOTATION CELLS
TAILINGS
PUMP
6 - APATITE 1ST CLEANER
FLOTATION CELLS
BLEED TO TAILINGS
APATITE
CONCENTRATE
CLIENT FIMAS
LOCATION ANDØRJA ISLAND NORWAY
KILBORN
TITLE
ANDØRJA PROJECT
1360000 t/a MAGNETITE PLANT
FLOTATION
FLOWSHEET
CASE 2
100-10-FS-1



VACUUM SYSTEM
L.P. AIR
H.P. AIR
FLOCCULANT
PROCESS WATER
DOW 250 (FROTHER)
BEROL ATRAC 857 (APATITE COLLECTOR)
XANTHATE (SULPHIDE COLLECTOR)
TAILINGS
BALL STORAGE & HANDLING
SODIUM HYDROXIDE (APATITE FLOAT pH CONTROL)
AMINE (SILICATE COLLECTOR)
DEXTRIN (IRON DEPRESSANT IN APATITE FLOAT)
LEGEND
NOTES
REVISIONS
REFERENCE DRAWINGS
FIMAS
KILBORN
ANDØRJA PROJECT
1360000 t/a MAGNETITE PLANT
ANCILLARIES & REAGENTS
FLOWSHEET
CASE 2
100-10-FB4



LEGEND
FB 1
CRUSHING AND GRINDING
FB 2
MAGNETITE CONCENTRATE PRODUCTION
FB 3
APATITE CONCENTRATE PRODUCTION
TELESCOPING CHUTE
WHEEL LOADER
REVISIONS
REFERENCE DRAWINGS
CLIENT FIMAS
KILBORN
ANDØRJA PROJECT
1360000 t/a MAGNETITE PLANT
PRODUCT HANDLING AND STORAGE
FLOWSHEET
CASE 2
100-10-F05

KONFIDENSIELT

FALKHAMMER - IBESTAD MAGNETITE A.S.

ANDØRJA MAGNETITE PROJECT

FEASIBILITY STUDY - VOLUME 1

SECTION 8.0 PLANT SITE AND SURFACE STRUCTURES

8.1 GENERAL

For the location of the site, two areas on the Andørja island were investigated. These consisted of a site on the point of Hamnhage which provided advantages for plant layout and process by utilizing the natural contours of the area in order to obtain a gravity flow of the material through the plant. However, this site presented difficulties in that the access road to the Gropa deposit encroached onto land which was not included in the Ibestad Kommune or FIMAS claims area. In addition, this location could involve the relocation of several existing households. The Kuliberget site lies alongside the fjord and requires the use of the mine stripping to build out into the fjord to the -15 meter depth sea contour in order to increase the useable land area for the industrial site and marine dock.

The building and equipment foundations in the study take full advantage of the prevailing ground rock conditions, by utilizing the rock average strength of 18,000 psi to provide support, thereby minimizing the concrete quantities.

The mill building will be set into the mountain side taking advantage of the natural contours and therefore minimize the cost of exterior building structure which would normally be required in a building of this size.

The product storage areas for magnetite, apatite and superslig prior to shiploading will be carved out of the mountain side and using the walls as support will be roofed over in order to keep the product dry for shipping.

The cost for ship loading facilities will be kept to the minimum by the use of a luffing conveyor located on the marine dock for loading of the ship. This will entail warping the ship when filling the holds. Space is allowed on the dock for the stacking of 20 ft containers.
Ref. Drawings Nos. 110-10-FA5, 240-10-FA1, 240-10-FA2

8.2 PRIMARY CRUSHING

Run of Mine (ROM) ore will be delivered to the crusher building by front end loader.

The ore will be dumped into the hopper located on top of crushing station. This structure will be set into the hillside, with the back wall, and side walls, being formed by vertical rock face. The building will be steel frame structure enclosed with metal roofing and siding to limit noise and dust problems.

Approximate plan area will be 6m x 15m with 14m overall height.

The height requirement is dictated by material flow: from dump hopper to reciprocating feeder to jaw crusher. Crushed ore will be conveyed to a stockpile.
Floors:

- Slab on grade will be mesh reinforced concrete poured directly on rock base and sloped to sump.
- Elevated platforms will be steel supported checker plate - under the feeder and around the crusher. All other walkways and platforms will be grating.

8.3 CRUSHED ORE STORAGE AND RECLAIM

The 225mm ore from the crusher will be conveyed to the crushed ore stockpile of 5000 tonne live capacity.

The stockpile will discharge to a concrete withdrawal chamber with roof openings for ore flow. Two vibrating feeders will in turn pass the material onto the mill feed conveyor. The concrete chamber, set in rock, will be sized to house the two feeders and conveyor tail end. The remainder of the conveyor will pass from under the stockpile through a corrugated metal tunnel.

8.4 CONCENTRATOR BUILDING

The concentrator building will set into the rock with an upper steel framed structure having a plan area of approximately 1750 sq.m, with grinding area average height of approximately 20m and the remainder of approximately 13m height. The bays of the grinding area will be serviced by a 15 tonne overhead crane.

The remainder of the building will house the reagent storage and mixing areas, compressor, control and electrical rooms, drying, pigment bagging and shipping.

The building will be constructed in a rock cut, with the grinding area set deep in the rock while the product loadout to stockpiles is located downhill at the other extreme of the building. The perimeter walls will consist of the rock face and profiled metal cladding above the rock.

- Interior partition walls will be of concrete block construction (control, electrical and compressor rooms).
- The ground floor will be a mesh reinforced concrete slab (on rock) sloped to sumps.

- Elevated floors will be reinforced concrete in service areas and remainder of the floors will be steel grating.
- Heating will be electric and located to suit the operator stations

8.5 SECONDARY CRUSHING - FUTURE

Provision has been made for Oversize material rejected from the SAG mill to be returned to the cone crusher building for further crushing. This crusher is housed in a steel frame building, 8m x 8m x 12m, with metal cladding and will be located between the concentrator and crushed ore stockpile. Ore from the cone crusher will be fed onto the reclaim conveyor from the bottom of the stockpile. The reclaim conveyor will discharge to the mill.

8.6 PRODUCT STORAGE AND RECLAIM

The three products will be conveyed to their individual storage areas close to the concentrator. All three storage structures will consist of pockets cut into the hillside rock and provided with roofing for the product protection against the elements. The downhill side of each containment area will be open for access by front end loaders on reclaim duty.

The reclaimed materials will be dumped into the loadout hopper and hence conveyed, via transfer house, to the luffing ship loading conveyor.

The individual storage capacity will be as follows:

- magnetite 35,000 t
- superslig 10,000 t
- apatite 10,000 t

8.7 CONVEYOR TRANSFER HOUSE

The product loadout conveyor to the ships will be located on the marine dock. The material will transfer to a luffing conveyor which will load the ships.

The transfer house will be unheated steel frame with metal cladding.

8.8 ANCILLARY FACILITIES

General

The proposed facilities include a completely equipped and furnished mill office, laboratory, mill dry and a warehouse. These will be housed in new or used pre-built modules which will be levelled, blocked, fully skirted and provided with entrance steps and platforms ready for connection of services.

Office and dry modules will be connected by a common entranceway passage which will be fitted with coat racks and storage space for boots. The proposed layouts of these facilities are shown on sketches included at the end of this section.

Heating to maintain design conditions will be provided by unit heaters.

Administration Offices

The proposed office layout is shown on sketch Page 1 of 4, where a larger office is allocated for the manager, with 2 smaller offices for the geologist and shift foremen. Another larger room will serve as a conference/lunch room. The room adjacent to manager's will serve as a general office. Also provided is a washroom which is located between shift foremen and reception/general office. This module will be approximately 3.6m wide by 18m long.

Laboratory

The proposed laboratory layout is shown on sketch page 2 of 4. Three separate laboratory areas are provided in a single module, as well as a security office.

- Sample Preparation
- Wet Laboratory
- AA Laboratory and Balance Room

These will be housed in a module approximately 3.6m wide by 18m long.

Mill Dry

The proposed mill dry, containing washroom and locker room, is shown on sketch Page 3 of 4. Two showers and toilet facilities are included in the washroom, while the locker room provides a convenient arrangement of change benches and 30 metal lockers. These will be housed in a module approximately 3.6m wide by 18m long, which will be connected to the office unit by a common entranceway passage.

Warehouse

A warehouse is shown on sketch Page 4 of 4 and consists of a large storage area with receiving, a small office and a waiting area. The warehouse module will be approximately 18m long by 3.6m wide.

8.9 SITE DEVELOPMENT

A major cut and fill operation will be undertaken by Ibestad Kommune for the development of the plant site. Waste rock will be excavated from the Kuliberget pit in the pre-development stages and dumped into the fjord as fill. The site development will commence at the -15 meter depth contour in the fjord and will be filled to a depth of 5 meters above the high water mark.

Miscellaneous rock excavation will be undertaken to provide space for tankage and other facilities. Excavated rock obtained will also be used in the fjord landfill in order to provide additional area for the Kommune's proposed commercial development.

This is a major cut and fill operation involving rock work quantities in the order of 2.6 million cubic meters (solid rock). The concept for filling assumes a rock slope of one and one half horizontal to one vertical. Detailed surveys of the fjord floor will be required to design the rock fill. The stability of and angle of repose of rock slopes will be governed by the bottom slope together with the nature and depth of the soil deposits overlying the fjord floor. Detailed geotechnical designs will be required to define the overall feasibility of this scheme.

Detailed studies will be required to define:-

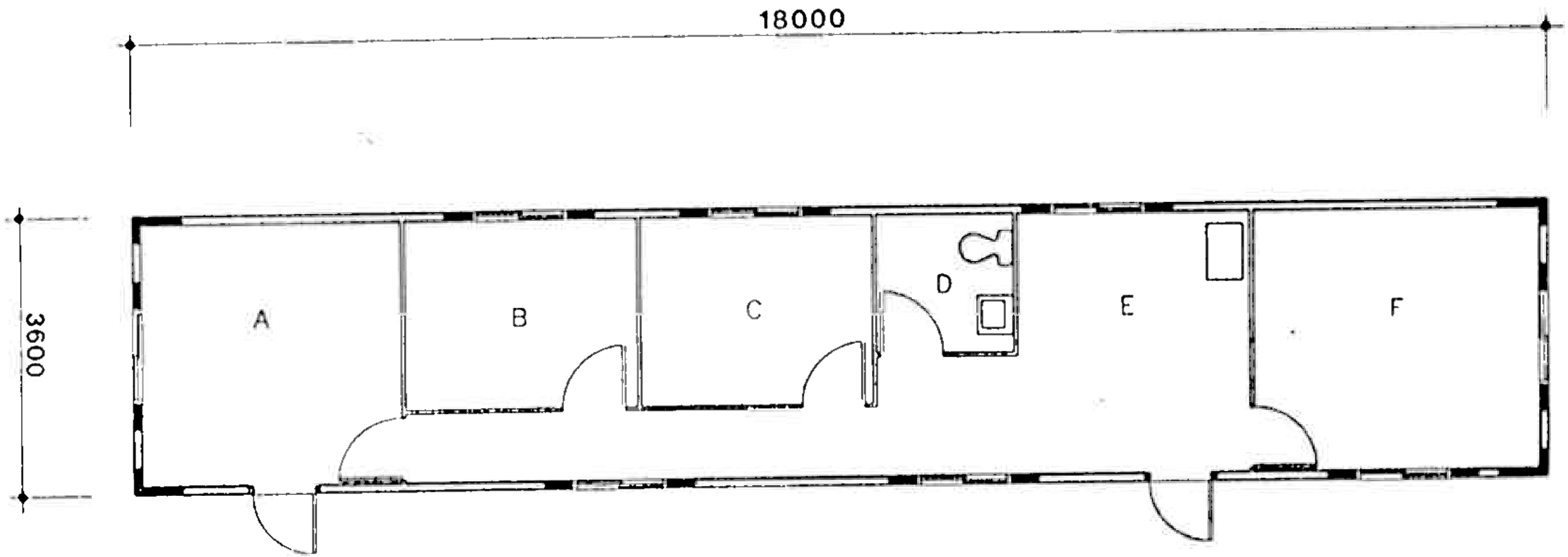
1. The nature and depth of fjord floor overburden materials throughout the proposed fill area.
2. The angle of repose of rockfill for the given bottom and seismic conditions.
3. Detailed topographical surveys of the shore and proposed open pit area including coordinate ties to the digital hydrographic surveys completed in 1991.
4. A definitive cost analysis for the proposed cut and fill work based on detailed geotechnical and terrain model data.

Design and permitting of the plant site development will be undertaken and funded by Ibestad Kommune.

8.10 DOCK SITE

The dock site will be designed and constructed by Ibestad Kommune. The design will be such as to provide sufficient space for the conveyor transfer structure for loading of magnetite and also to hold 20 ft containers, which it is expected will be required for both the mine's bagged products and the future occupants of the industrial site.

FORM KE-28-1



A - CONFERENCE & LUNCH ROOM

B - OFFICE - GEOLOGIST & SURVEY

C - OFFICE - SHIFT FOREMAN

D - WASHROOM

E - RECEPTION, XEROX, STORAGE - GENERAL OFFICER

F - OFFICE - MANAGER

KILBORN

OFFICE FACILITY

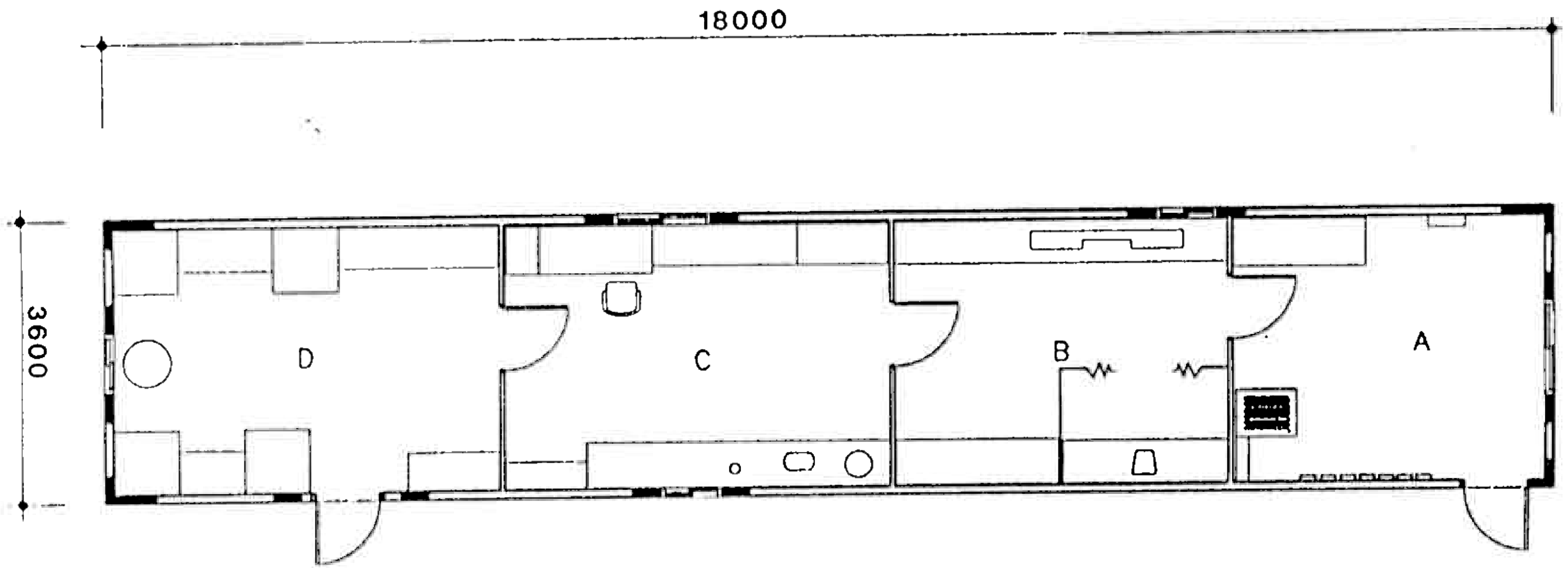
PAGE 1 OF 4

PROJ.No

DIV.No

REV

FORM KE-28-1 REV



A - OFFICE SECURITY

B - A-A LAB & BALANCE ROOM

C - WET LAB

D - SAMPLE PREPARATION

KILBORN

LABORATORY

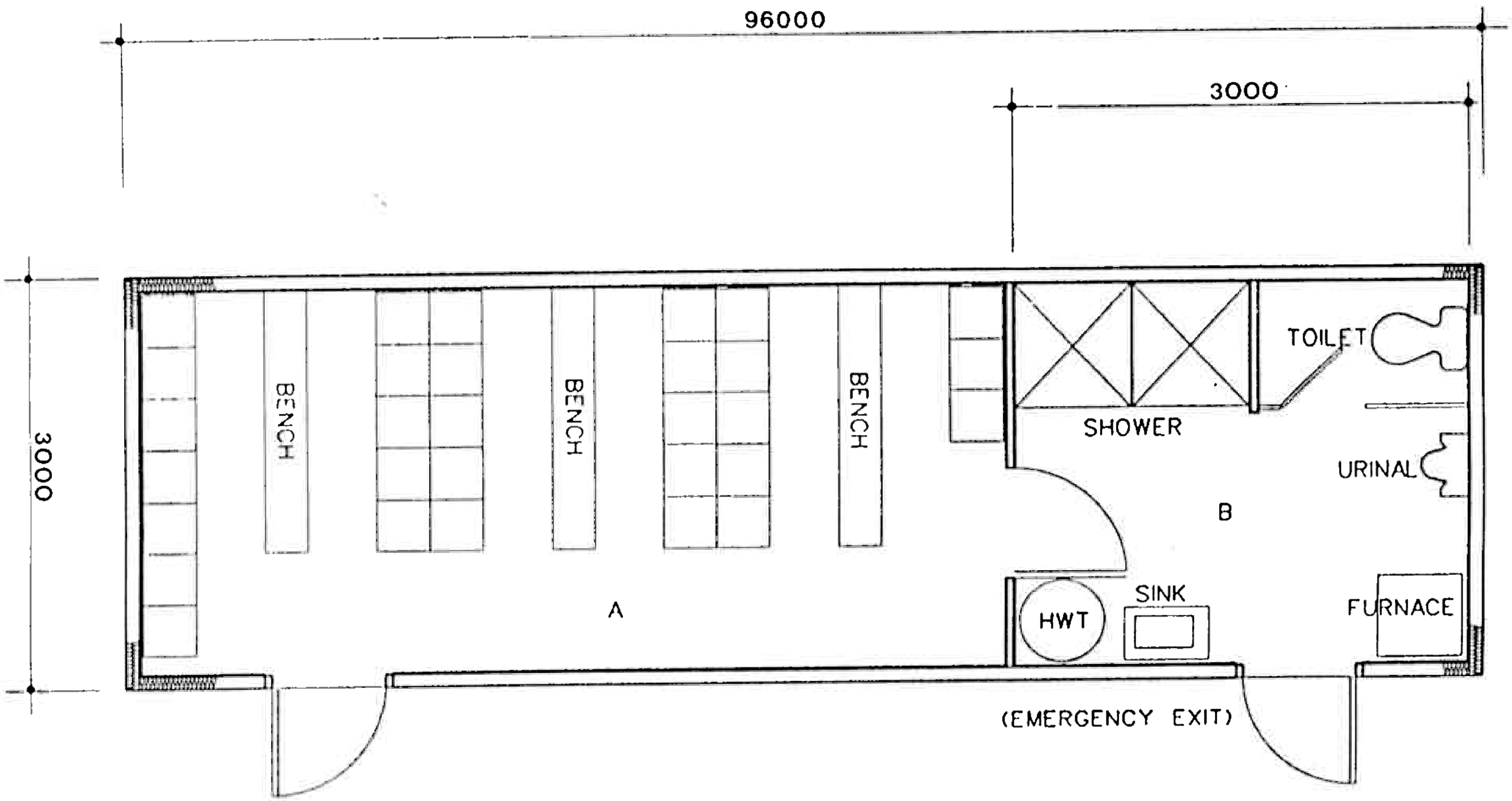
PAGE 2 OF 4

PROJ.No

DIV.No

REV

FORM KE-28-1 RE



A - LOCKER ROOM, 30 LOCKERS

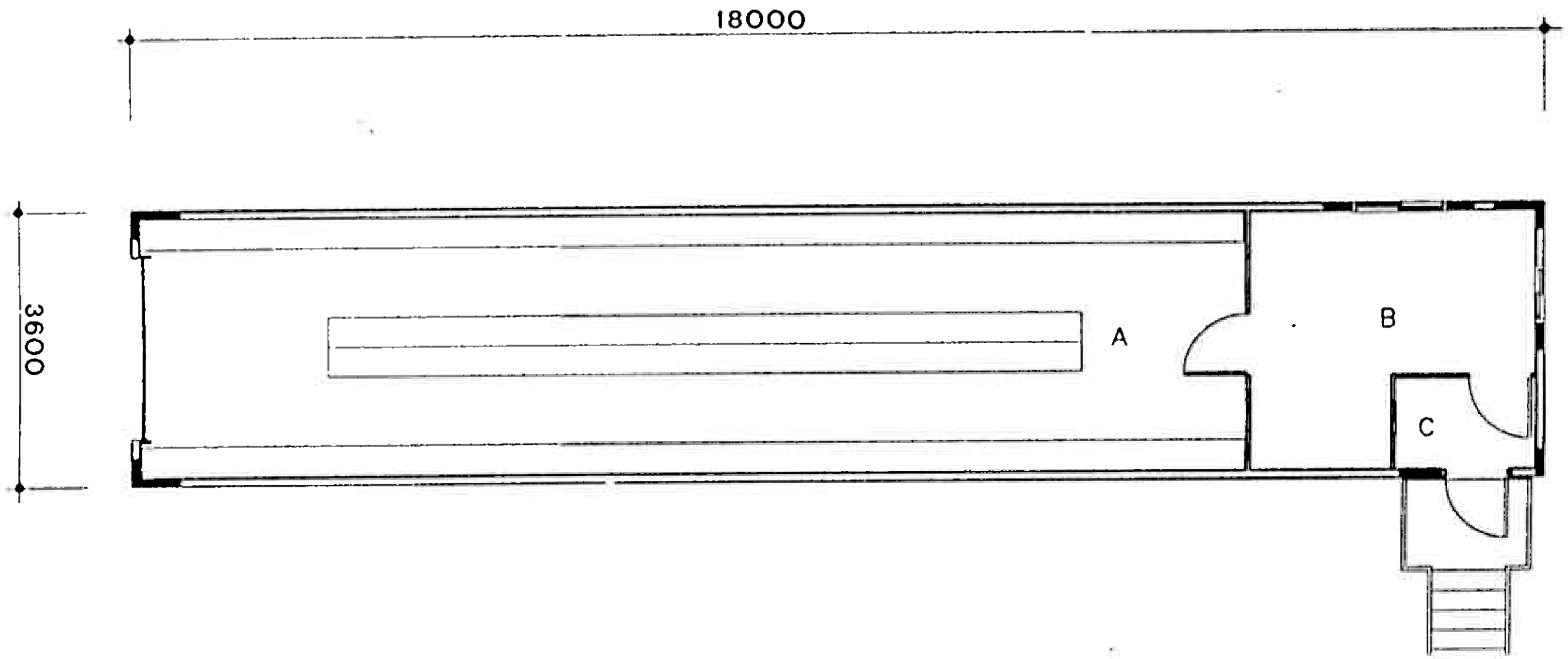
B - WASHROOM

KILBORN

MILL DRY

PAGE	3 OF 4
PROJ.No	
DIV.No	
REV	

FORM KE-28-1 REV.



A - STORAGE AREA WITH SHELVES

B - OFFICE

C - WAITING AREA

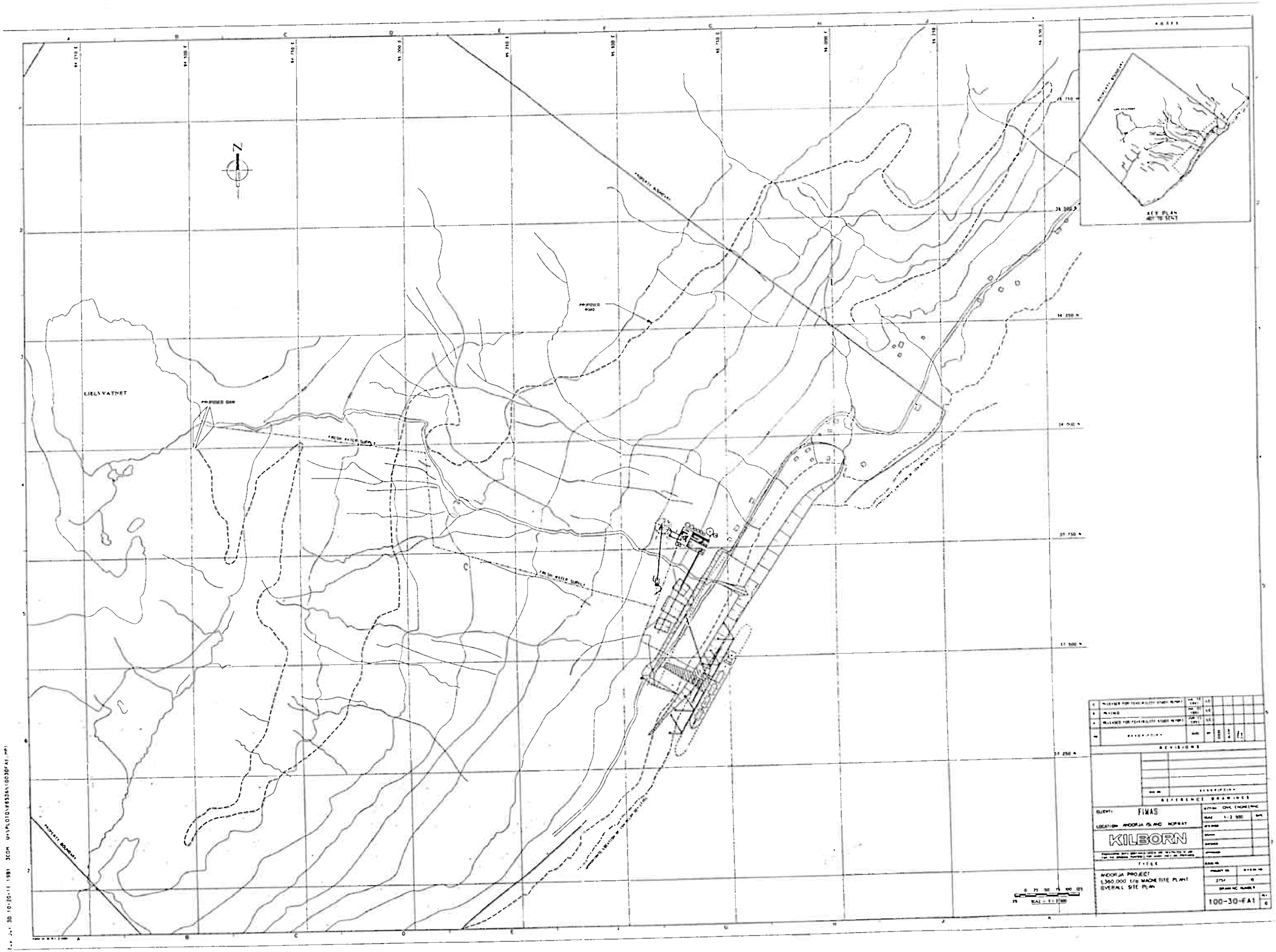
KILBORN

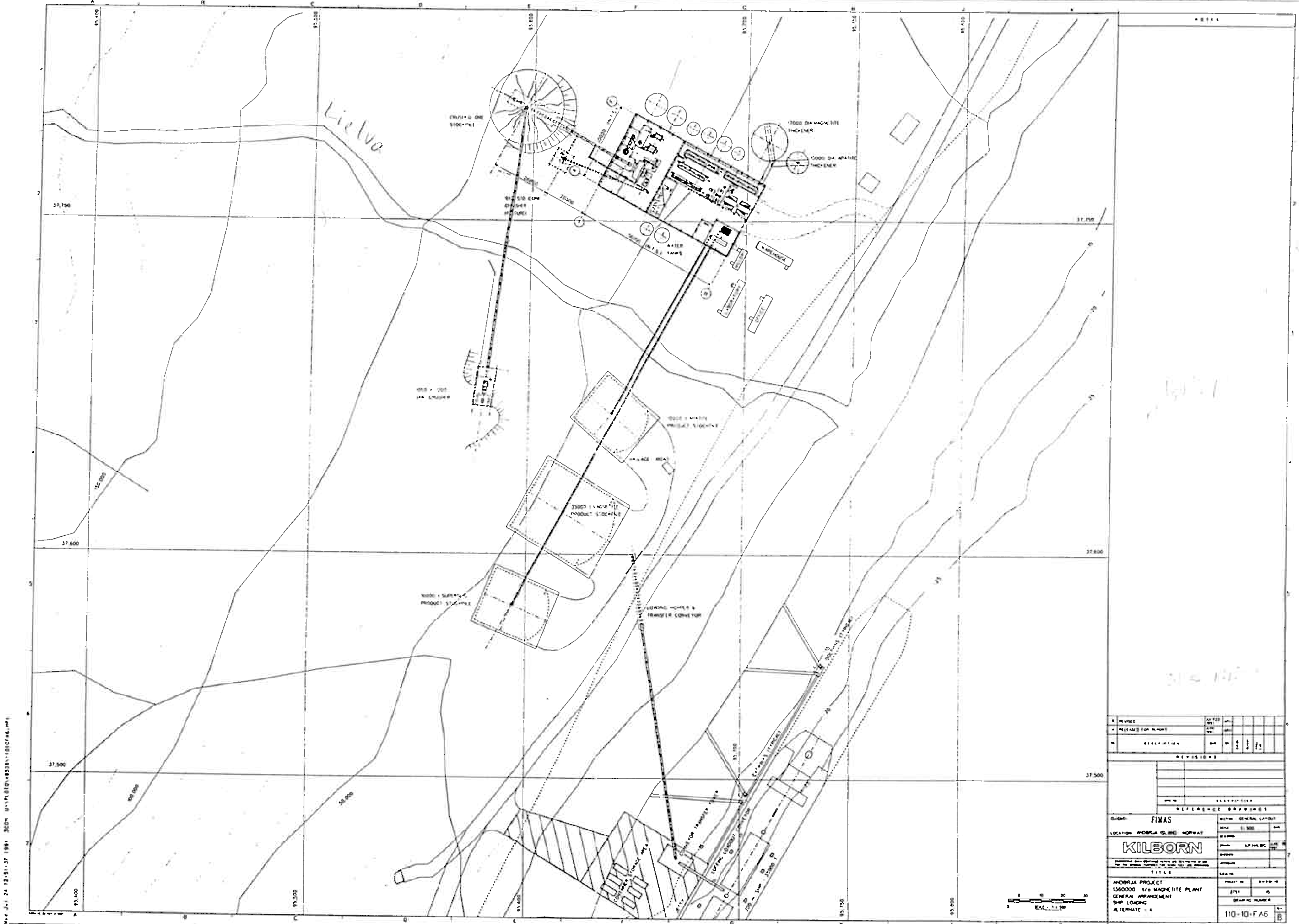
WAREHOUSE

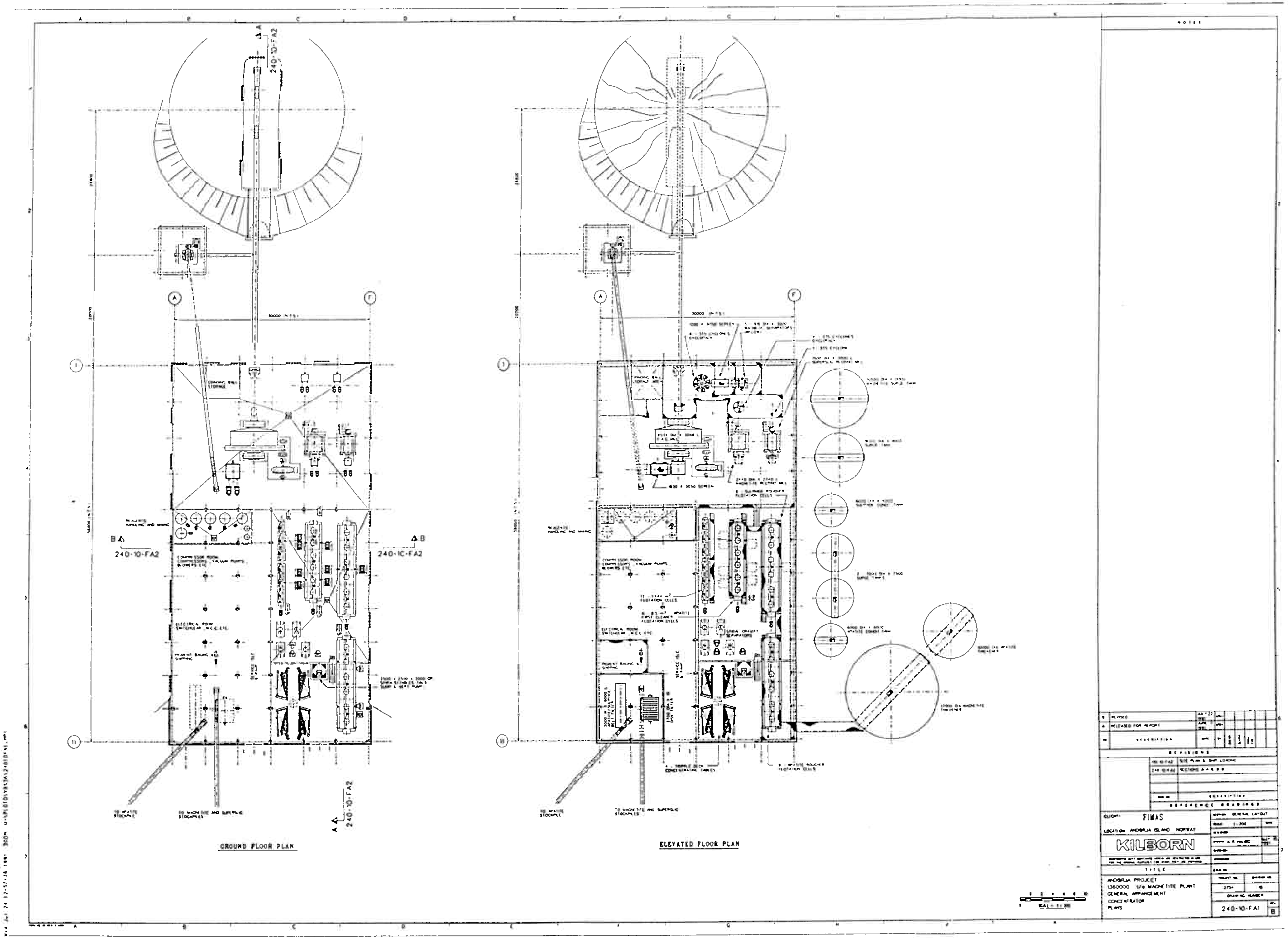
PROJ.No

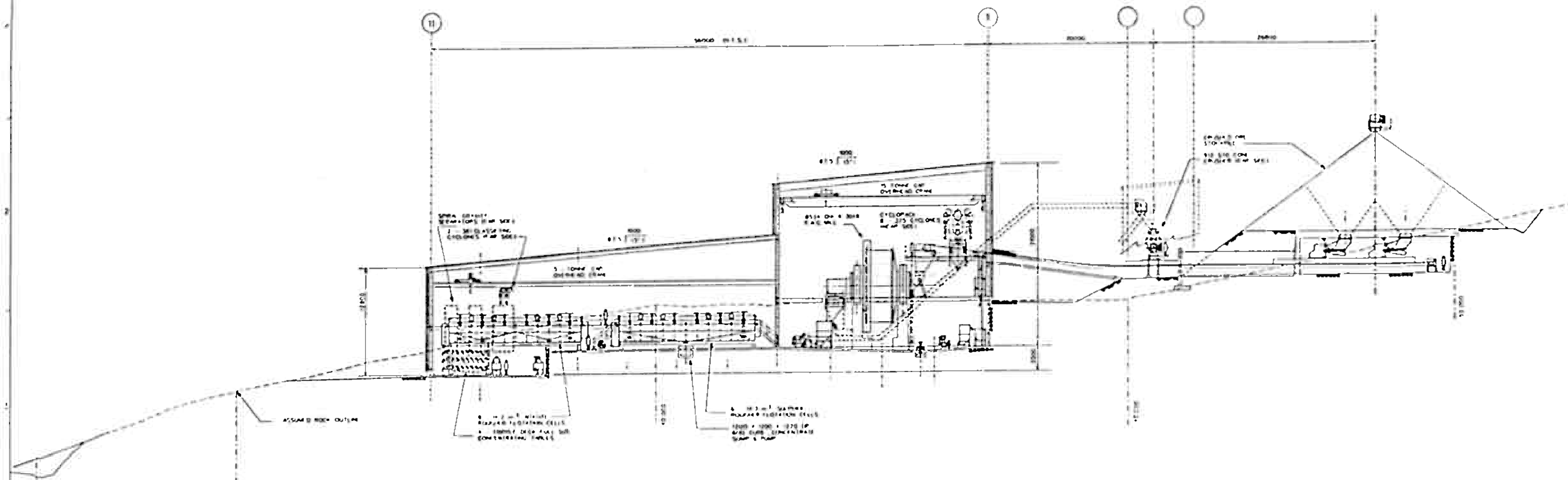
DIV.No

REV

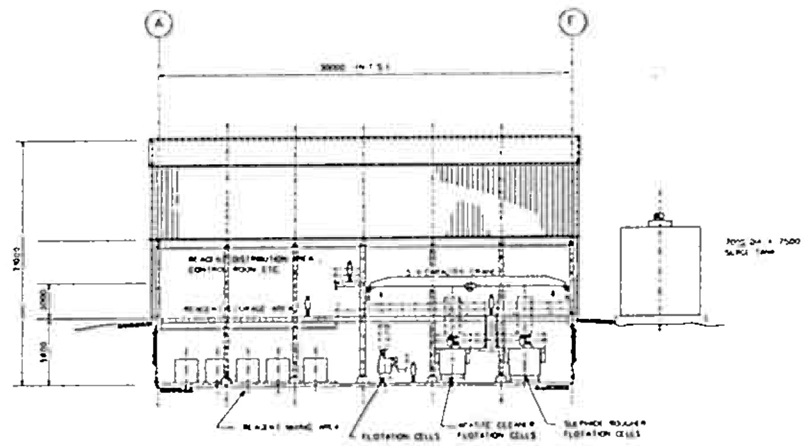

LIELVVATNET
PROPOSED DAM
FRESH WATER SUPPLY
PROPOSED ROAD
KEY PLAN
NOT TO SCALE
REVISIONS
REFERENCE DRAWINGS
CLIENT: FIMAS
LOCATION: ANDORJA ISLAND NORWAY
KILBORN
TITLE
ANDORJA PROJECT
1,360,000 t/a MAGNETITE PLANT
OVERALL SITE PLAN
CIVIL ENGINEERING
1:2 500
3754
100-30-FA1


Lielva
CRUSHED ORE STOCKPILE
17000 DIA MAGNETITE THICKENER
10000 DIA APATITE THICKENER
WATER TANKS
WAREHOUSE
35000 t MAGNETITE PRODUCT STOCKPILE
LOADING HOPPER & TRANSFER CONVEYOR
37.750
37.600
37.500
95.400
95.500
95.600
95.750
95.800
REVISIONS
REFERENCE DRAWINGS
CLIENT: FIMAS
LOCATION: ANDØRJA ISLAND NORWAY
GENERAL LAYOUT
KILBORN
TITLE
ANDØRJA PROJECT
1360000 t/a MAGNETITE PLANT
GENERAL ARRANGEMENT
SHIP LOADING
ALTERNATE - 4
DRAWING NUMBER
110-10-FA6
B


GROUND FLOOR PLAN
ELEVATED FLOOR PLAN
240-10-FA2
A
B
TO APATITE STOCKPILE
TO MAGNETITE AND SUPERSILIC STOCKPILES
REVISIONS
REFERENCE DRAWINGS
SITE PLAN & SHIP LOADING
SECTIONS A-A & B-B
DESCRIPTION
CLIENT: FIMAS
LOCATION: ANDØRJA ISLAND NORWAY
KILBORN
GENERAL LAYOUT
1:200
TITLE
ANDØRJA PROJECT
1360000 t/a MAGNETITE PLANT
GENERAL ARRANGEMENT
CONCENTRATOR
PLANS
DRAWING NUMBER
240-10-FA1
B



SECTION A-A



SECTION B-B

REVISIONS

REFERENCE DRAWINGS

CLIENT: FIMAS

LOCATION: ANDØRJA ISLAND NORWAY

KILBORN

TITLE

ANDØRJA PROJECT
1,360000 t/a MAGNETITE PLANT
GENERAL ARRANGEMENT
CONCENTRATOR
SECTION A-A AND B-B

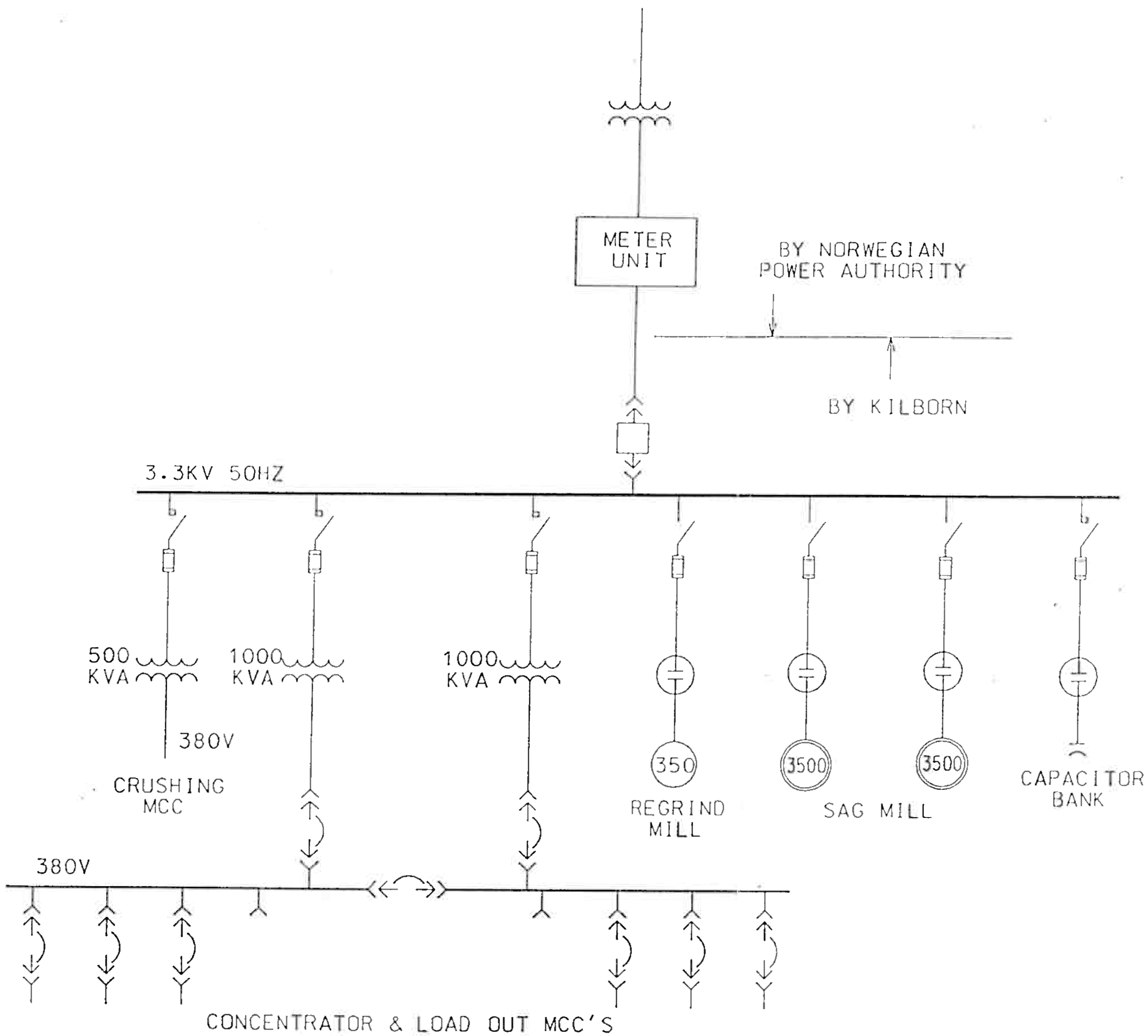
GENERAL LAYOUT

SCALE 1:200

2754

240-10-FA2

B



NOTES

NO	DESCRIPTION	DATE	BY	CHECK	CLIENT	PROJ. ENG.
A	RELEASED FOR INFORMATION	JUNE 1991	VGH			

REVISIONS

DWG. NO.	DESCRIPTION

REFERENCE DRAWINGS

CLIENT: FIMAS

LOCATION: ANDØRJA ISLAND NORWAY

KILBORN

ENGINEERING DATA CONTAINED HEREIN ARE RESTRICTED IN USE FOR THE ORIGINAL PURPOSES FOR WHICH THEY ARE PREPARED.

TITLE

ANDØRJA PROJECT
1360000 t/a MAGNETITE PLANT
MAIN SINGLE LINE

		DATE
SECTION	ELECTRICAL	
SCALE	NTS	
DESIGNED		
DRAWN	K.THIRAKUL	JUNE 7 1991
CHECKED		
APPROVED		
B.O.M. NO.		

PROJECT NO.	DIVISION NO.
3754	15

DRAWING NUMBER: 130-19-FA1 REV. A

FORM KE-36 REV. 3 (AO)

3754FLW.FM1

SECTION 9.0

SHIPBOARD ALTERNATIVE

FALKHAMMER - IBESTAD MAGNETITE A.S

ANDØRJA MAGNETITE PROJECT

FEASIBILITY STUDY - VOLUME I

9.0 SHIPBOARD ALTERNATIVE

The use of a ship to house the concentration equipment and to provide storage for the finished products was one of the initial study items for processing of the crushed ore.

A worldwide search was initiated using European, Asian and North American sources to investigate availability of a self unloading ship of sufficient capacity to handle the proposed throughput.

This search revealed that there was a worldwide shortage of self unloaders. Attention was then given to obtaining a ship of sufficient size which could be converted. One of the ships for which drawings and information was obtained was a barge with a pusher tug. This unit was lying in southern California and was available. Unfortunately the cost of the barge, its size, plus renovation to make her self unloading proved to be uneconomical and was dropped from consideration. Other ships that were available had similar cost problems.

During the investigation, some of the problems in utilizing a shipboard concept became very evident. These concerned the size of ship, which was required to have room to store the finished product and also provide the floor space needed for the large concentrating tables, regrind mills, flotation cells and the other space consuming equipment necessary for the process. Preliminary investigation revealed that a much larger vessel was required than the originally contemplated 35,000 tonne.

It had been suggested that additional capacity could be achieved from a given size of vessel by enclosing the ship inside a lagoon and pumping out the water. This would require that the ship now be supported on dry land with possibly a sand or granular backfill. Discussions with marine engineers indicated that this would destroy the structural integrity of the ship or in other words "break its back". This would render the vessel unseawothy should it ever become necessry to relocate the mill.

Other areas of concern was the material handling of the product for both storage and the subsequent loading of product onto ocean going bulk cargo freighters. At the rate of loading, which would be required to eliminate demurrage charges, this could cause concentrator ship trim problems as the ore was taken out. Also to be considered was the daily tides which also would have its effect on operations. The use of a dry dock or an enclosed lagoon which would correct this situation would also cause excessive cost penalties.

In all probability, the most serious drawback of a ship mounted concentrator and associated storage facility is the unsuitability of the saleable products for reclaim and loadout from a self-unloader. Self-unloaders were developed as bulk carriers for the Great Lakes/Saint Lawrence Seaway engaged in the transport of such commodities as grain, coal and iron ore pellets. These materials all share reasonable handleability and flowability characteristics. In the case of ground concentrates in micron sizes, handleability and flowability are two widely recognized problems. One way to overcome this problem would be to thermally dry the apatite and magnetite concentrates.

This would present a few new problems notwithstanding the high operating costs of thermal dryers both with fuel and maintenance. There would be a significant dust problem with dried concentrates which would add to costs. Dry magnetite behaves like a fluid and as such would have to be re-wetted prior to transfer onto the outgoing bulk carrier. Similarly, Norsk Hydro have indicated that they do not have dust collection or dust suppression facilities at their unloading destinations and would require a moisture content in the 7-8% range already achievable with mechanical dewatering (filters). Again this would necessitate the product be rewetted prior to loading.

Based on the above, it was agreed that a shipboard concentrator and storage facility would, under the present existing conditions, not be viable for the tonnes processed and therefore efforts would be transferred to investigation of a land based facility.

KONFIDENSIELT

10.0

ROAD AND SEAWAY FACILITIES

3754_15

FALKHAMMER-IBESTAD MAGNETITE

ANDØRJA MAGNETITE PROJECT

FEASIBILITY STUDY - VOLUME I

10.0 ROAD AND SEAWAY FACILITIES

10.1 MAIN ACCESS ROADS

The Chopa and Kuliberget magnetite ore deposits are located on the island of Andørja in the southern Troms region of northern Norway. Its position at 68.8°N latitude and 17.4°E Longitude places it approximately 320 kilometres north of the Arctic Circle.

The nearest port and city is Harstaad. To access Harstaad requires a short drive from the site at Krakrohamm on Andørja to the ferry stop at Sorvik, across to Ibestad on the island of Rozla driving across the island on county road 848 to SOR-Rollnes and taking another ferry from there to Harstaad. The trip dependent upon making the necessary ferry connections takes approximately 2- 3 hours.

The city and port of Harstaad has a population of about 20,000 and has available, two shipyards and the port facilities to handle ships up to 50,000 ton capacity. Unfortunately it does not have bulk handling capability.

Another highway route is by using the highway E6 from either the provincial capital of Tromsoe 200 km to the north, or Narvik, approximately 100 km to the south, cutting off at Fosbakken onto county roads 848 and 825 leading to Myrlandshaug, then taking the ferry across to Sorvik. The nearest airport is at Evenes, approximately 50 Km to the southwest. This airfield is all weather equipped, capable of handling the largest aircraft with daily service to Tramso, Bodo and Oslo.

The above routes to access the mill site are shown on the following vicinity map. The county roads, while adequate for passenger cars, would require caution when moving heavy equipment of the type that would be required during the construction of the mine and plant.

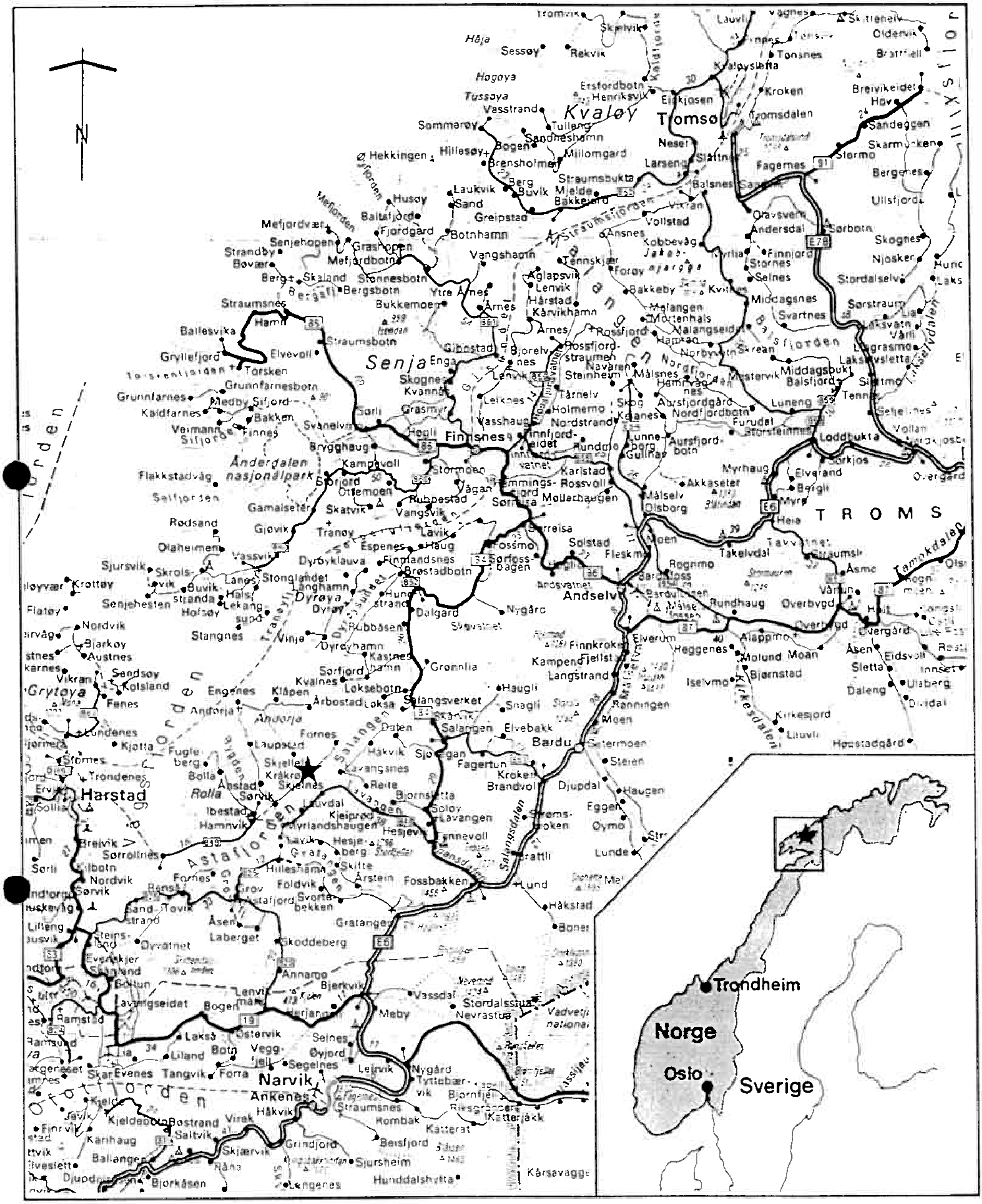
It should be noted that there has been considerable discussion concerning the construction of new road and bridge between Gratland on the mainland and between Jektevika and Fornes on Andørja. In conjunction with this would be the construction of a tunnel between Sorvik and Ibestad on the island of Rolla which would further open up the area for increased development.

The dock will be developed to provide facilities for the ship loading of the mines bulk production and also the bagged pigment and toners. In conjunction with this is the provision for the loading and unloading of containerized products for both the mine and the future industrial development.

10.2 SEAWAY

The seaway route from North America and Europe into Andørja offers no real problems other than the normal care that is exercised on navigation when travelling within the Norwegian Fjords. The marine dock and its facilities will be one of the first items to be constructed. This will then allow shipping in of all the major construction and mining equipment to be unloaded onto the dock utilizing, in some instances, the ships own unloading equipment.

For other equipment it is intended that the car ferry which presently plies between Ibestad and Sorvik could be utilized to bring in the construction crews and any equipment that would need to be supplied locally.



FIMAS
Andorja Magnetite Project
Vicinity Map

KONFIDENSIELT

11.0

CAPITAL COSTS

FALKHAMMER - IBESTAD MAGNETITE A.S.
ANDØRJA MAGNETITE PROJECT
FEASIBILITY STUDY - VOLUME 1

11.0 CAPITAL COST

A summary of the capital costs by areas for the Andørja Magnetite project is included in Tables 11-1 to 11-7 in this section.

A detailed breakdown of the capital cost is provided in Appendix D.

11.1 BASIS OF ESTIMATE

The estimate of capital costs to bring the project into operation was established on the following basis.

- equipment pricing was developed from supplier quotations, and material costs from in-house data and excludes all applicable federal taxes.
- quantities were established from flowsheets, site plans and general arrangement drawings for the process plant, and associated infrastructure.
- preproduction stripping quantities for the open pit development were established as the minimum which would allow for initial operation of the mine and the establishment of the industrial area utilizing the stripped rock with consequent initial relief in cost and are based on a 6 month period for the stripping operation.
- mine capital labour costs are predicated on the owner supplying labour using purchased equipment.
- The labour rates for the construction work force are based on skilled labour in the Andørja area working a 37½ hour week.

Two composite wage rates for construction labour have been used, namely:

- Unskilled @ $27.00 per hour
- Skilled @ $34.00 per hour

The labour rates include the following:

- Basic pay, benefits
- Supervision and administration
- Contractors' overhead and profit
- Cost of small tools and consumables

It should be noted that the labour rates indicated above are an "all up" cost to the project and are not just the costs paid by contractors.

The capital cost estimate is based on 2nd quarter 1991 US dollars. Where source information was quoted in Norwegian currency, these amounts are connected at rates of 6.7 NOK to $1.00 U.S.

The following cost considerations are excluded from the estimate:

a) escalation
b) owners all-risk insurance, permits and licences
c) financing charges
d) interest during construction
e) power to substation and plant
f) site development and stripping of mine site.
g) water supply to the battery limits.
h) dam
i) sewage
j) roads to dam site

k) marine dock

The following allowances contained in the capital cost estimate are based on in-house historical experience:

a) plumbing and drainage systems
b) heating and ventilation
c) fire protection systems
d) lighting and miscellaneous electrical
e) process piping
f) process electrical
g) instrumentation

Based on information obtained during the study concerning the availability of used mining equipment within the Scandinavian area and to take advantage of the situation we have used as a measure of the economic value of using such equipment, a factor of 60% of the new equipment cost. This percentage cost, based on experience, covers the cost of the used equipment and any refurbishing that is required to bring the item back to a fully operational state.

<u>Estimate Structure</u>

The detail estimate is built up on work classification account codes within each area. The three digit area codes and the four digit work classification codes are listed in Appendix "D". An estimate for each specific item of work is indicated by a two digit sequence number which follows the area and classification main codes eg,

```
245.4103.01
 |   |  |__ Sequence
 |   |_____ Work Classification
 |_________ Area
```

Each line item is identified with a description, quantity and unit of measure. Estimated labour, material, equipment and sub-contract unit rates are extended by the quantity to derive the labour hours, labour costs, material cost and subcontract cost.

Sub-totals are indicated for each project area. These subtotals are carried forward to the "Area Summary Report" to give the project totals.

11.2 482140 TONNE/YEAR PRODUCT

Summary

A summary of capital costs for the mining and processing of 482 140 tonnes/year of product is given in Table 11.1 followed by cost by area described below:

Mining - Table 11-2
Capital costs are based on cost of equipment and initial equipment servicing facilities.

Surface Facilities and Processing - Table 11-3
Capital costs are based on cost of equipment and initial equipment servicing facilities.

Infrastructure - Table 11-4
This portion of the project is to be carried out by the Ibestad Kommune and pricing for such work has been provided by the Ibestad Kommune.

Kuliberget Open Pit - Table 11-5
Capital costs are based on cost of equipment and initial equipment servicing facilities.

Gropa Open Pit - Table 11-6
Capital costs are based on cost of equipment and initial equipment servicing facilities.

Kuliberget Underground Mine - Table 11-7

Capital costs are based on cost of equipment and initial equipment servicing equipment.

Tailings Disposal

The capital costs for tailings disposal is based on utilising a submarine line to dispose of the tailings for the initial period until such times as they can be returned to the underground mine.

TABLE 11-1
SUMMARY - CAPITAL COST ESTIMATE
482 140t/YR PRODUCT

	Cost $ (x 1000)
***Infrastructure, provided by Ibestad Kommune**	* $5193
Mining	3110
Surface Facilities-Processing	16847
Direct Costs	19957
Construction Indirects	1996
Engineering, Procurement and Construction Management (11% surface)(5% Mining)	2193
Contingency 10%	2414
MINING PREPRODUCTION & SURFACE FACILITIES	**26,560**
Startup	100
Initial Inventory	250
Working Capital (3 months operating capital)	2211
TOTAL CAPITAL COST (EXCLUDING INFRASTRUCTURE)	**29,121**
TOTAL CAPITAL COST (INCLUDING INFRASTRUCTURE)	**34,314**

21953
674
22627

* Infrastructure costs provided by Barlindhaug. Indirect Costs, EPCM and Contingency Costs are assumed to be included.

TABLE 11-2
CAPITAL COST ESTIMATE - MINING

	Cost $ (x 1000)
PRE-PRODUCTION	
Pit Equipment	2,530
Kuliberget Portal and Decline	580
Total Pre-Production	$3,110
POST-PRODUCTION	
Ore Pass System	300
Gropa Pit Facilities	520
Additional Haul Trucks	390
Year 1 Sub-Total	$1,210
Year 4 Equipment Replacement	$ 930
Underground Equipment	5,190
Underground Services	660
Year 7 Sub-Total	$5,850
Replace Small Vehicles	175
Crushing Plant	600
Underground Conveyor, 600m	660
Surface Conveyor, 300m	540
Year 10 Sub-Total	$1,975
Year 13 Equipment Replacement	$ 175
Total Post-Production	$10,140
TOTAL MINING CAPITAL	$13,250

Note: Each Sub-total indicates direct costs. No allowance is included for construction indirects, EPCM and contingency.

TABLE 11-3

CAPITAL COST ESTIMATE - SURFACE FACILITIES AND PROCESSING

482140 t/yr Product

		Cost $ (x 1000)
Permanent Access Road	Ibestad Kommune	940
Site Development and Roads	Ibestad Kommune	1,090
Water & Sewage Systems	Ibestad Kommune	1,223
Marine Dock	Ibestad Kommune	1,940
Infrastructure Total		5,193
Dump Hopper & Conveyor System		2,470
Concentration Plant & Process Equipment		13,424
Office Complex & Communications System		220
Front-End Loader & Fuel Storage		639
Tailings Disposal		94
Direct Costs		16,8467
Construction Indirects		1,685
Engineering, Procurement and Construction		
Management		2,038
Contingency		2,057
TOTAL SURFACE FACILITIES (EXCLUDING INFRASTRUCTURE)		**22,627**

Note: Items provided by Ibestad Kommune assumed to include Indirects, EPCM and Contingency

CAPITAL COST ESTIMATE - INFRASTRUCTURE

Thousands of Dollars

		Cost $ (x 1000)
Access Road	Ibestad Kommune	940
Dam	Ibestad Kommune	597
Site Development	Ibestad Kommune	1716
Marine Dock	Ibestad Kommune	1940
TOTAL		5193

TABLE 11-5
CAPITAL COST ESTIMATE
KULIBERGET OPEN PIT EQUIPMENT

Units	Description	Cost
1	Cat 988B Front End Loader	$433,000
1	Cat # 12 Grader c/w Snow Plow	225,000
3	Mack DMM688SX (or equiv. @ $130,000)	390,000
1	Drill (Diesel)(DTH)(101mm)	400,000
1	Bulldozer D8L or equivalent	515,000
1	Lube and Fuel Vehicle	150,000
1	Service Vehicle	100,000
1	Set Lights & Pumps	50,000
2	Supervisor Vehicles	50,000
1	Explosive Storage	100,000
	Sub-Total	$2,413,000
	Initial Spares	117,000
	Total	$2,530,000

TABLE 11-6
CAPITAL COST ESTIMATE
GROPA OPEN PIT

A.	PRE-PRODUCTION CAPITAL	
	(Kuliberget underground development in preparation for handling Gropa ore)	
	Portal Excavation by the stripping contractor	
	4,400 cu.m. @ $7.00	31,000
	Decline Excavation by a tunnel contractor	
	Mobilization and Set-up	26,000
	532m of 5.5 x 4.0 m @ $982	523,000
	Sub-Total Pre-Production	**$580,000**
B.	POST-PRODUCTION CAPITAL	
	Ore pass by the tunnel contractor	
	Alimak Chamber Excavation, 220 cu.m.	11,000
	Alimak Installation	7,000
	Orepass, 340m of 2 x 2 m @ $660	225,000
	Truck loading chute	57,000
	Sub-Total Ore pass	300,000
	Additional Mack Trucks, 3 @ $130,000	390,000
	Haul Road, pit to dump, 1.1 km @ $200,000	220,000
	Office and First Aid Trailers	100,000
	Pre-Fab Repair Shop with Tools	150,000
	Gen. Set & Electrical Distribution	50,000
	Sub-Total Year 1	$1,210,000
	Replace Mack Trucks, 6 @ $130,000	780,000
	Replace Service and Supervisor Vehicles	150,000
	Sub-Total Year 4	$930,000
	TOTAL GROPA PIT CAPITAL	**$2,720,000**

TABLE 11-7
CAPITAL COST ESTIMATE
KULIBERGET UNDERGROUND EQUIPMENT

Required in Year 7

(a)	Load-Haul-Dump, electric powered Toro T500E 13.5t capacity (or equivalent) Cost $590,000, required 2	$1,180,000
(b)	Articulated Dump Truck Toro T40D 40 t capacity (or equivalent) Cost $390,000, required 3	$1,170,000
(c)	Drifting Drill Jumbo Atlas Copco H145S c/w 2 hydraulic drills (or equivalent)	$ 750,000
(d)	Long Hole Drill Jumbo Atlas Copco SIMBA H-450 (or equivalent)	$ 795,000
(e)	Bench Drill Jumbo Tamrock Solo 606RA (or equivalent)	$ 370,000
(f)	Rock bolter	$ 320,000
(g)	Cable bolter (allowance)	$ 380,000
(h)	Lube & Fuel Vehicle	$ 150,000
(i)	Personnel & Supply Vehicles	$ 175,000
	Sub Total Mobile Equipment	$5,190,000
	Repair facility and tools	$ 175,000
	Ventilation fans, controls, heater	$ 100,000
	Pumps and pipelines	$ 50,000
	Electrical distribution	$ 260,000
	Refuge station equipment	$ 75,000
	TOTAL COST, Year 7	$5,850,000

Required in Year 10	
Replace small vehicles	$ 175,000
Crusher & Bin	$ 310,000
Feeder to belt	$ 90,000
Installation (@ 50%)	$ 200,000
Belt, underground (600m at $1100)	$ 660,000
Belt, surface (300m at $1800)	$ 540,000
TOTAL COST, Year 10	$ 1,975,000
Required in Year 13	
Replace small vehicles	$ 175,000
TOTAL UNDERGROUND CAPITAL	$ 8,000,000

KILBORN MANAGEMENT SYSTEMS ASRF　　　　AREA SUMMARY REPORT　　　　PAGE NO. : 1

FIMAS
ANDORJA PROJECT
PROJECT NUMBER: 3754-15

RUN DATE : 18JUL71
DATA DATE:
RUN TIME : 14:06:58

AREA	DESCRIPTION	100 SITE WORK	200 BUILDING STRUCTURE	300 BLDG. SERVICE	400 PROCESS MECH.	500 PIPING	600 ELECTRICAL	700 INSTRUMENTATION	900 INDIRECT	TOTAL
110	SITE DEVELOPMENT	0	0	0	0	0	0	0	0	0
121	POTABLE WATER SYSTEMS	31000	0	0	0	0	0	0	0	31000
123	PROCESS WATER SYSTEMS	33500	0	0	0	0	0	0	0	33500
130	SITE ELECTRICAL	0	0	0	0	0	373400	0	0	373400
160	SURFACE MOBILE EQUIPMENT	0	0	0	639000	0	0	0	0	639000
220	INTERBUILDING CONVEYORS	38520	1053396	0	752400	0	0	0	0	1844316
230	CRUSHING PLANT	32625	530573	0	438988	0	0	0	0	1002186
235	RECLAIM STRUCTURE	0	129150	0	0	0	0	0	0	129150
240	CONCENTRATOR	105750	3146389	263200	0	450000	1320000	342390	0	5627729
241	GRINDING	0	104400	0	1776670	0	0	0	0	1881070
242	SUPERSLIG PIGMENT & TONER	0	90180	0	1148676	0	0	0	0	1238856

KILBORN MANAGEMENT SYSTEMS ASRF — AREA SUMMARY REPORT

RUN DATE : 18JUL91
DATA DATE:
RUN TIME : 14:06:58

FIMAS
ANDORJA PROJECT
PROJECT NUMBER: 3754-15

AREA	DESCRIPTION		100 SITE WORK	200 BUILDING STRUCTURE	300 BLDG. SERVICE	400 PROCESS MECH.	500 PIPING	600 ELECTRICAL	700 INSTRUMENTATION	900 INDIRECT	TOTAL
243	MAGNETITE		0	123040	0	803836	0	0	0	0	926876
244	APATITE		0	45788	0	1091088	0	0	0	0	1136876
246	REAGENTS		0	0	0	330536	0	0	0	0	330536
270	PRODUCT STORAGE & LOADOUT/SHIPPING		2520	1120586	0	215790	0	0	0	0	1338896
310	SERVICE COMPLEX		0	220000	0	0	0	0	0	0	220000
400	TAILINGS MANAGEMENT		0	51250	0	0	42140	0	0	0	93390
520	MAIN ACCESS ROAD		0	0	0	0	0	0	0	0	0
540	MARINE DOCK		0	0	0	0	0	0	0	0	0
580	WATER SUPPLY DAM		0	0	0	0	0	0	0	0	0
COST TYPE		D TOTAL	243915	6614752	263200	7176984	492140	1673400	342390	0	16846781
660	CONSTR. INDIRECTS		0	0	0	0	0	0	0	1684678	1684678

KILBORN MANAGEMENT SYSTEMS AGRF

AREA SUMMARY REPORT

RUN DATE : 18JUL91
DATA DATE:
RUN TIME : 14:06:58

FIMAS
ANDORJA PROJECT
PROJECT NUMBER: 3754-15

AREA	DESCRIPTION		100 SITE WORK	200 BUILDING STRUCTURE	300 BLDG. SERVICS	400 PROCESS MECH.	500 PIPING	600 ELECTRICAL	700 INSTRUMEN TATION	900 INDIRECT	TOTAL
670	E.P.C.M.		0	0	0	0	0	0	0	2038460	2038460
680	CONTINGENCY		0	0	0	0	0	0	0	2057081	2057081
COST TYPE		I TOTAL	0	0	0	0	0	0	0	5780219	5780219
PROJECT TOTAL			243915	6614752	263200	7196984	492140	1693400	342390	5780219	22627000

KONFIDENSIELT

12.0

OPERATING COSTS

FALKHAMMER - IBESTAD MAGNETITE A.S.
ANDØRJA MAGNETITE PROJECT
FEASIBILITY STUDY - VOLUME 1

12.0 OPERATING COSTS

12.1 SUMMARY

The following summarizes the operating costs for the FIMAS Andørja Magnetite project.

The case considers the operating costs for locating the plant alongside the Kuliberget ore deposit, proceeding with open pit mining of that deposit for a period of 6 months and then open pit mining from the Gropa deposit for 5.8 years and finally going underground at Kuliberget by a decline to mine the remaining ore seams.

OPERATING COST SUMMARY

Mining		
-	Kuliberget Pit, 6 months	$2.12 $/tonne Ore
-	Gropa Pit	
	- 5 years @ 0.665:1 strip ratio	$3.56 $/tonne Ore
	- 0.8 years @ zero strip ratio	$2.75 $/tonne Ore
-	Kuliberget Underground	
	average over 7.8 years	$3.83 $/tonne Ore
Mill		$3.61 $/tonne Ore
Management and Administration Costs		$300,000 $/year
Site Rental		$231,000 $/year
WRC Consultancy Fee		$100,000 $/year

12.2 OPEN PIT MINING COSTS

12.2.1 Kuliberget Pit Cost Details

The Kuliberget open pit operating costs are based on Owner operation with all new equipment after 125,000 cu.m (350,000 tonnes) of waste have been stripped by others. The remaining quantities are:

Ore	700,000 tonnes
Waste	58,000
Total	758,000 tonnes

The ore will provide mill feed for 180 days at the rate of 1,360,000 tpy, and the average total mining rate will be 4,208 t/d.

LABOUR COSTS

Staff	Salary or Wage Rate	No.	Annual Cost
Mine Engineer/Geologist	40,000	1	40,000
General Foreman	40,000	1	40,000
Shift Foremen	36,000	3	108,000
Surveyor	30,000	1	30,000
Rodman	20,000	1	20,000
Sampler	20,000	1	20,000
Sub-Total Staff		8	258,000
Hourly Paid Staff			
Hourly (paid 2250 hr/yr)			
Drillers	13	2	58,500
Loader Oper	13	4	117,000
Truck Oper.	12	8	216,000

Dozer Oper.	13	4	117,000
Grader/Relief Oper.	13	2	58,500
Blaster/Utilities	12	2	54,000
Mechanic	14	5	157,500
Sub-Total Hourly		27	778,500
Total Base			**1,036,500**
Payroll Burden @ 18%			186,500
Total Annual Payroll Cost (for 350 days)			1,223,000
Kuliberget Cost for 180 days			629,000
UNIT LABOUR COSTS			
- per tonne mined			$0.83
- per tonne of ore			$0.90

SUPPLIES COSTS		$/t Mined
Drilling (from Gropa pit details)		0.130
Blasting (from Gropa pit details)		0.168
Loading (from Gropa pit details)		0.227

Hauling	Ore	Waste
Cycle Time : Load	3 min.	3 min.
Dump	3	2
In pit Travel	5	5
Out of pit loaded	4.5 (600m, + 8%)	0.7 (300 m, - 5%)
Out of pit empty	1.4	1.2
Totals	17 min	13 min
Loads per 50 min. hour	2.94	3.85
Tonnes per hour (40t cap)	117.6	153.8
Trucks required per shift	1.63 +	0.10 = 1.73
Truck hours per day	33.06	2.09

Cost/day @ $54.78/hr.	1,810.78	114.73	0.458
Ancillary Operations, 15% of above			0.148
Unit Supplies Costs - per tonne mined			$1.131
- per tonne of ore			$1.224
Total Unit Costs - per tonne mined		$1.96	
- per tonne of ore			$2.12

12.2.2 Gropa Pit Cost Details

The Gropa open pit operating costs are based on Owner operation of the equipment which was purchased 6 months earlier for Kuliberget, haulage of ore 1.1 km to an orepass driven from underground, and haulage from an underground loading box to the mill crusher. Production quantities are:

Ore	7,910,000 tonnes
Waste	4,540,000 tonnes
Total	12,450,000 tonnes
Strip Ratio	0.574 : 1 average, 0.665:1 over 5 years

The ore will provide mill feed for 5.8 years at the rate of 1,360,000 tpy and the average total rate over the five whole years will be 2,264,000 t/y or 6,470 t/d.

LABOUR COSTS

Staff	Salary or Wage Rate	No.	Annual Cost
Mine Engineer/Geologist	40,000	1	40,000
General Foreman	40,000	1	40,000
Shift Foremen	36,000	3	108,000
Surveyor	30,000	1	30,000
Rodman	20,000	1	20,000
Sampler	20,000	1	20,000
Sub-Total Staff		8	258,000

Hourly (paid 2250 hr/yr)			
Drillers	13	3	88,000
Loader Oper.	13	4	117,000
Truck Oper.	12	12	324,000
Dozer Oper.	13	4	117,000
Grader/Relief Oper.	13	4	117,000
Blaster/Utilities	12	2	54,000
Mechanic	14	6	189,000
Sub-Total Hourly		35	1,006,000
Total Base			1,264,000
Payroll Burden @ 18%			228,000
Total Annual Payroll Cost			$1,492,000
UNIT LABOUR COSTS - per tonne mined			$0.659
- per tonne of ore			$1.097

SUPPLIES COSTS $/t Mined

Drilling

Drill pattern 4 x 4 x 5.5m (0.5m below 5m bench)

Tonnes/Hole = Ore 4x4x5x3.38 SG = 270.4

= Waste 4x4x5x2.80 SG = 224.0

Holes/year =(1,360,000/270.4)+(904,000/224) = 9,065

Unit Drilling Cost = $1.80/ft - $5.90/m

Cost./Year = 9,065 x 5.5 x $5.906

= $294,434 : 2,264,000 = $0.130

Blasting

Powder factors: 0.18 kg/t ore, 0.15 kg/t waste

Blasting Cost: $1.00/kg for Anfo, including ancillary items

Anfo/year = (1,360,000x0.18)+(904,000x0.15)

Cost/year = 380,400 kg x $1.00 : 2,264,000 $0.168

Loading

Operating hours/year = 350 days x 3 shifts x 7 hours

x 85% Availability x 90% utilization

= 5,623 hours/year

Unit cost for Cat 988B = $91.46/hr

Cost/year = 5,623 x 91.46 = $514,257 0.227

Hauling

Cycle Time:	Ore	Waste	
Load	3 min	3 min	
Dump	3	2	
In pit Travel	5	5	
Out of Pit loaded	2.5 (1100m-8%)	2	
Out of Pit Empty	4.25	2	
Totals	17.75	14	
Loads per 50 min. hour	2.817	3.57	
Tonnes per hour(40t cap)	112.7	142.9	
Trucks required per shift	1.64 +	0.86 =	2.5
Truck hours/year	12,067	6,326	
Cost/year @ $54.78./hr	661,054	346,544	0.445
Ancillary Operations, 15% of above			0.146
Unit Supplies Costs - per tonne mined			$1.116
- per tonne of ore			$1.857
Total Unit Costs - per tonne mined			$1.775
- per tonne of ore			$2.954

During the final year, with zero stripping ratio, the total unit cost is reduced to $2.139 per tonne of ore.

The cost of underground truck loading from the ore pass and haulage to the mill is estimated at $0.606/t as detailed in the next sub-section.

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12.3 UNDERGROUND MINING COSTS

The underground mine labour costs assume that the high productivities which are being attained in the Kiruna iron ore mine can be quickly achieved at Kuliberget. The supplies costs are estimated by combining the unit costs of the many component operations in the average proportions which are anticipated over the life of the reserves. Those proportions are set out in Section 6.6 and are used in the following summary.

UNDERGROUND COST SUMMARY

Cost Centre	Applicable Tonnage (t x 1,000)	Unit Cost ($/t)	Total Op. Cost ($ x 1,000)
SUPPLIES			
L.H.Stope Drifting	1,086	4.497	4.884
L.H. Stope Undercutting	1,086	1.904	2,068
L.H. Stope Mining	6,449	1.684	10,860
Room Mining	1,069	3.862	4,128
Room Benching	686	1.774	1,217
Sub-Total	10,376		23,157
Access Drifting	274	4.497	1,232
LABOUR	10,650	1.185	12,620
Total by Method		3.475	37,009
GENERAL			
Vent. Supplies & Heating ($130,000/yr)		0.096	1,018
Service Vehicle Costs ($200,000/yr)		0.147	1,556
Roadbed & Gen. Mine Maint. ($150,000/yr)		0.110	1,175
TOTAL U/G MINING COST		$3.83	40,768

UNDERGROUND COST DETAILS

LABOUR COSTS

	Salary or Wage Rate	No.	Annual Cost
Staff			
General Foreman	40,000	1	40,000
Mine Eng./Geologist	40,000	1	40,000
Shift Foremen	36,000	3	108,000
Surveyor	30,000	1	30,000
Rodman/Draftsperson	20,000	1	20,000
Sampler/Technologist	30,000	1	30,000
Sub-Total Staff		8	268,000
Hourly (paid 2250 hr/year)			
Development Miners	14	8	252,000
L.H. Stope Miners	14	4	126,000
Bench & Undercut Miners	14	2	63,000
LHD Operators	13	6	175,500
Truck Operators	12	8	216,000
Utility/Relief Operators	12	4	108,000
Mechanics	14	4	126,000
Electrician	14	1	31,500
Sub-Total Hourly		37	1,098,000
Total Base			1,366,000
Payroll Burden @ 18%			246,000
Total Annual Payroll Cost			1,612,000
Labour Cost/Tonne			$1.185

SUPPLIES COSTS

Drift, 5x4x3.8m advance, 76 cu.m, 258t

Drilling			Can $	US $/t
46 holes x 4.0 m = 184m/round				
- bits & steel	@	$ 1.35/m	248.40	

- small tools & hoses @	$ 0.13/m		23.92	
- lube & miscellaneous @	$ 0.16/m		29.44	
	$ 1.64/m		301.76	
Jumbo, 1.9 op.hours @	$95.00/hr		180.50	
			482.26	1.625
Blasting				
Anfo, 76m^3 x 1.5 = 114 kg @ $1.00			114.00	
Nonel, 46 @ $3.80			174.80	
B-Line, Cap. etc.			11.58	
			300.38	1.012
Ground Support				
Rock bolts, 20m^2/1.44 = 13 @ $5.00			65.00	
Drilling, 13x1.8 = 24m @ $1.64			39.36	
Bolting rig, 0.9 hours @ $43			38.70	
			143.06	0.482
Haulage				
258t/40 = 7 truck trips				
Cycle time 16.55 min/50 = 0.33 hours				
x 7 trips = 2.32 hours @ $63 =		146.16	0.493	
Elapsed time (2 trucks) = 4x0.33 = 1.32 hr				
Mucking				
1.32 hours (elapsed) @ $93 =		122.76	0.414	
Services				
600V Electric Cable	$10.00/m			
2" Pipe	$ 6.50/m			
36" Vent. Duct		18.40/m		
4m @	$34.90/m	139.60	0.471	
SUB-TOTAL DRIFTING		1,334.22	$4.497	

Room Mining, 6x5.5x3.8m Advance, 125 cu.m, 426 t		
Drilling		
67 holes x 4m = 268m/round	Can. $	
bits & steel, etc. $1.64/m	439.52	
Jumbo, 2.8 op.hours @ $95	266.00	
	705.52	1.440
Blasting		
125 cu.m x 1.5 = 188 kg Anfo @ $1.00	187.50	
Nonel, 67 x $3.80	254.60	
B-line, Cap. etc.	14.50	
	456.60	0.932
Ground Support		
Rockbolts, $23m^2/1.44$ = 16 @ $5.00	80.00	
Drilling, 16x1.8m = 29m @ $1.64	47.56	
Bolting rig, 1.1 hours @ $43	47.30	
	174.86	0.357
Haulage		
426t/40 = 11 truck trips x 0.33 hr		
= 3.64 truck hours @ $63 =	229.38	0.468
Elapsed time (2 trucks) 2.0 hr.		
Mucking		
2.0 hours @ $93	186.00	0.380
Services		
As above, 4m @ $34.90	139.60	0.285
SUB-TOTAL ROOM MINING		$3.862

Room Benching, 6m x 5m av.depth x 4m advance

= 120 cu.m = 408 tonnes/blast

Drilling	Can $	US $/t
Burden 1.3m, spacing 1.9m, dia 64 mm		
Drill 12 holes, 5.5 m deep = 66m @ $1.74	=118.14	

Jumbo, 1.83 op.hours @ $75 =	137.25	
	252.09	0.537
Blasting		
120 cu.m x 1.35 - 162 kg Anfo @ $1.00	162.00	
Nonel, 12 x 3.80	45.60	
B-Line, Caps, etc.	9.84	
	217.44	0.463
Haulage		
408t/40 = 10 truck trips x 0.33 hours		
= 3.31 truck hours @ $63 =	208.53	0.444
Elapsed time (2 trucks) 1.66 hours		
Mucking		
1.66 hours @ $93 =	154.38	0.329
SUB-TOTAL BENCHING	832.44	1.774

Long-hole Stoping

Consider one ring with 2.5m burden

Drill 220m in 23 holes, 2m toe spacing

Volume of 20m high x 15m wide slice

= 750cu.m, less two 5x4 drifts and two

5x4 undercuts (200 cu.m) = 550 cu.m = 1,900t

Drilling		
220m of 76mm dia @ $1.94 =	426.80	
Simba Rig, 4.4 hours @ $101 =	444.40	
	871.20	0.400
Blasting		
550 cu.m x 1.2 = 660 kg @ $1.00 =	660.00	
Nonels, 23 @ $3.80 =	87.40	
B-line, Cap. etc.	28.30	
	775.70	0.355

Ground support		
Cable bolts, 2x10m, grouted @ $11.00	220.00	
Drilling, 20m @ $1.94	38.80	
Bolting rig, 0.6 hours @ $49	29.40	
	288.20	0.132
Haulage		
1900t/40 = 48 truck trips x 0.33 hours		
= 15.9 truck hours @ $63 =	1,000.94	0.458
Elapsed time (2 trucks) 8.0 hours		
Mucking 8.0 hours @ $93	744.00	0.341
SUB-TOTAL LONGHOLE STOPING	3,680.04	1.684

Longhole Undercutting

Consider undercutting two rings

i.e. 5m advance x 4m high x 5m each side

of drift = 220 m^3 = 680t

Drilling		
Burden 1.65m, spacing 1.3m		
Drill 24 holes, 5.5m deep (angled forward)		
132m, 64 mm dia @ $1.74	229.68	
Jumbo, 3.38 hours @ $75	253.50	
	483.18	0.618
Blasting		
200 cu.m x 1.35 - 270 kg Anfo @ $1.00 =	270.00	
Nonels, 24 x $3.80	91.20	
B-line, Cap, etc.	12.92	
	374.12	0.478
Haulage		
680t/40 = 17 truck trips @ 0.33 hrs.		
= 5.63 hours @ $63	354.50	0.453

Elapsed time (2 trucks) 2.98 hour	
Mucking	
2.98 hours @ $93	277.14 0.354
SUB-TOTAL UNDERCUTTING	1,488.94 1.904
REHANDLE OF GROPA ORE	
TRUCK CYCLE	Mack DMM 688 SX
U/G Haulage, 500 m @ 12%	3.8 min @ 8 kph
Surf Haul. 600 m @ 8%	3.6 min @ 10
Turn and Dump	2.0
Return to portal, 600 m @ -8%	1.8 min @ 20
Return U/g, 500 m @ -12%	2.5 min @ 12
Turn and Load	2.0
Cycle Time	15.7 min
Trips per 50 min. hour	3.2
Tonnes per Oper. Hour (40t cap.)	128
Oper. Hours for 3900 t/day	30.5
Truck shifts per 6.5 hr. day	4.7

REHANDLE COST ESTIMATE

Labour - Operators 5 x 8 x $12 x 1.18 =	$ 566.40
Supplies - Truck cost @ $54.78 (C$63/hr) =	1,671.60
- Chute & Road Maint.	125.00
Cost/Day	$2,363.00
Cost/Tonne	$ 0.606

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12.4 PROCESSING

12.4.1 Cost Summary 1,360,000 Tonne/Year Feed

The operating costs for the mill and ancillaries, processing 1,360,000 t/a are estimated at $3.61 per tonne of ore processed. The operating costs are based on the operation of receiving run-of-mine ore at the truck dump, primary crushing by jaw crusher, open crushed ore storage and reclaim, SAG milling, primary magnetic separation, separate processing of magnetic and non-magnetic products, filtration, stockpiling, reclaim and shiploading.

The operating costs are summarized as follows:

1,360,000 TONNE/YEAR PROCESSED
OPERATING COST SUMMARY

	Annual Cost $	Cost/tonne Processed $
Mill Supervision	202,193	0.15
Mill Operating Labour	691,397	0.50
Mill Maintenance Labour	302,083	0.22
General Services Cost	292,000	0.21
Mill Operating Supplies	700,000	.51
Reagents	1,259,220	.92
Maintenance Supplies	280,000	0.22
Electrical Power	1,198,263	0.88
TOTAL	$ **4,814,233** kr 33,[illegible],-	**3.61**

= for all : 12.3[illegible] / 21,131000 [illegible]

[illegible]

1,360,000 TONNE/YEAR PROCESSED
PERSONNEL SUMMARY

The total personnel requirements for the operating phase of the processing plant and the ancillaries are as follows:

	Employees
Mill Supervision	5
Mill Operating Labour	20
Mill Maintenance Labour	8
Warehouse/Security	3
TOTAL	36

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Mill Operating Labour

	Number	Rate $	Hrs/Year
Crusher Operator	3	14.04	2,190
Mill Operators	8	14.04	2,190
Labourer	6	12.00	2,190
Warehouseman/Security	3	13.70	2,190
Sub-Total	25		
Payroll Burden	18%		
TOTAL			
TONNES PROCESSED/YEAR			
COST PER TONNE PROCESSED			

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Mill Maintenance Labour

	Number	Rate	Hrs/Year $	Annual Cost $
Mechanics	4	14.61	2,190	128,000
Electricians	4	14.61	2,190	128,000
Sub-Total	8			256,000
Payroll Burden	18%			46,080
TOTAL				**302,080**
TONNES PROCESSED/YEAR				1,360,000
COST PER TONNE PROCESSED				$ 0.22

Mill Operating Supplies

	Consumption	Cost/Year $
Grinding media	0.25kg/t 412,500kg/y @ $0.80/kg	330,000
SAG Mill Liners	1 set per year x 1	250,000
Ball Mill Liners	1 set per year x 2	100,000
Jaw Crusher Liners	1 set per year x 1	20,000
TOTAL - MILL OPERATING SUPPLIES		**700,000**

TONNES PROCESSED/YEAR	1,360,000
COST PER TONNE PROCESSED	$ 0.57

Electrical Power

The power consumption is based on the calculated load developed with the flowsheets and equipment sizing. A breakdown of the installed motor list and running factors is located in Appendix B. Peak demand and usage factors are applied to the connected load.

The following table summarizes the connected horsepower load for the 1,360,000 tonne per year facility:

* total connected load	8,756 hp
* demand factor	0.61
* consumption factor	0.6
* cost per KWH	\$.030

DEMAND - kVA/month	-	5,337
ENERGY - kW	-	3,202
YEARLY DEMAND CHARGE	-	\$356,725
YEARLY ENERGY CHARGE	-	\$841,538
TOTAL ELECTRICAL COST	-	\$1,198,263 per year
TONNES PROCESSED	-	1,360,000
COST PER TONNE PROCESSED	-	\$0.88

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Maintenance Allowance

	Cost per year $
Buildings	30,000
Equipment	250,000
TOTAL	**280,000**
TONNES PROCESSED/YEAR	**1,360,000**
COST PER TONNE PROCESSED	**$0.20**

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Reagent Costs

	Addition kg/tonne	Consumption kg/year	Cost $/kg	$/year
Dextrin	0.20	186,970	0.61	114,052
Berol ATRAC 857	0.30	280,455	2.40	
73,092				
Dow 250	0.03	23,371	2.20	51,417
Liloflot D814 (Amine)	0.20	16,091	3.00	48,273
NaOH(50%)	0.10	93,485	1.00	93,485
Xanthate	0.06	56,091	1.81	101,525
Flocculant	0.05	4,080	3.00	12,240
Freight Allowance		660,543	0.25	165,136

TOTAL REAGENT COSTS	**$1,259,220**
TONNES PROCESSED/YEAR	1,360,000
COST PER TONNE PROCESSED	$ 0.92

General Services Costs

	Annual Cost $
Consultants	16,000
Travel Expenses	40,000
Communication	80,000
Laboratory Supplies	56,000
Office Supplies	16,000
Surface Vehicle Operation	16,000
Company Accommodation	16,000
Legal and Audit	32,000
Road Maintenance	20,000
TOTAL	**292,000**
TONNES PROCESSED/YEAR	1,360,000
COST PER TONNE PROCESSED	$ 0.21

Operating Cost Details 1,360,000 Tonne/Year Product

Administration

	Number	Annual Salary $	Annual Cost $
Manager	1		75,000
Chief Accountant	1	50,000	50,000
Payroll Clerk	1	30,000	30,000
Clerk/Typists	2	24,000	48,000
Janitors	1	23,000	23,000
Sub-Total	6		226,000
Payroll Burden	18%		40,680
Total Cost			266,680
Administration Supplies			33,320
TOTAL ADMINISTRATION			300,000
TONNES PROCESSED/YEAR			1,360,000
COST PER TONNE OF PRODUCT			$0.22

KONFIDENSIELT

13.0

PROJECT SUMMARY SCHEDULE

FALKHAMMER - IBESTAD MAGNETITE A.S.

ANDØRJA MAGNETITE PROJECT

FEASIBILITY STUDY - VOLUME 1

13.0 PROJECT SUMMARY SCHEDULE

The Project Summary Schedule shows a 21 month period from decision to proceed to plant start-up. The schedule was prepared on an integrated computer database in a level of detail sufficient to establish proper activity relationships and constraints required to execute the project in an orderly and cost efficient manner.

Depending on the time a decision to proceed with the project is made, the events shown on the schedule may require revision in order to obtain the maximum economical construction time periods.

Development of the mine and construction of the plant facilities at the Andørja Minesite is dependent to some extent on weather windows. This dependency on seasonal weather conditions may have impact on the construction start dates for the marine dock, dam site, mine development and the plant site and buildings.

Stripping of the site which has received prior governmental approval can commence immediately the decision to proceed is given and is expected to take 6 to 7months. The Kuliberget open pit must be stripped before the erection of the plant structure commences, due to the possibility of blast damage which could occur during this phase of operations. Foundation work can be started before all blasting is complete, however, precautions such as prior warning and removal of personnel during blasting operations must be observed.

It is recognized that the marine dock will need to be constructed in the early phase of the site operation, but it is not anticipated that, other than occasional small scatter material, this structure will be affected during the blasting phase.

Engineering

Engineering will also commence on the decision to proceed and will occur essentially over the first 10 - 12 months of the project. The Environmental Impact Statement will need to be started at the same time in order to complete all studies necessary for submission to the appropriate permitting authorities. The marine dock will have to be given priority in both engineering and construction phases to ensure availability during the construction of the plant buildings.

Procurement

Activities for the procurement of the equipment which have long delivery or are to be purchased used must commence immediately after finalization of flowsheet. Refurbished used equipment must be inspected and a firm commitment made for availability in order to meet the schedule.

Construction

The site stripping phase will allow sufficient lead time for all the construction bid documents to be drawn up, issued and analyzed, thus ensuring the maximum economic advantage for the project. The marine dock, as noted previously, will be the first item to be constructed in order to be able to off-load the plant equipment and building supplies.

Construction of the processing facilities is scheduled essentially over a 12 month period to encompass prime work seasons and assure optimum resource utilization. The final month of the schedule is reserved for pre-operational check-out and testing (commissioning).

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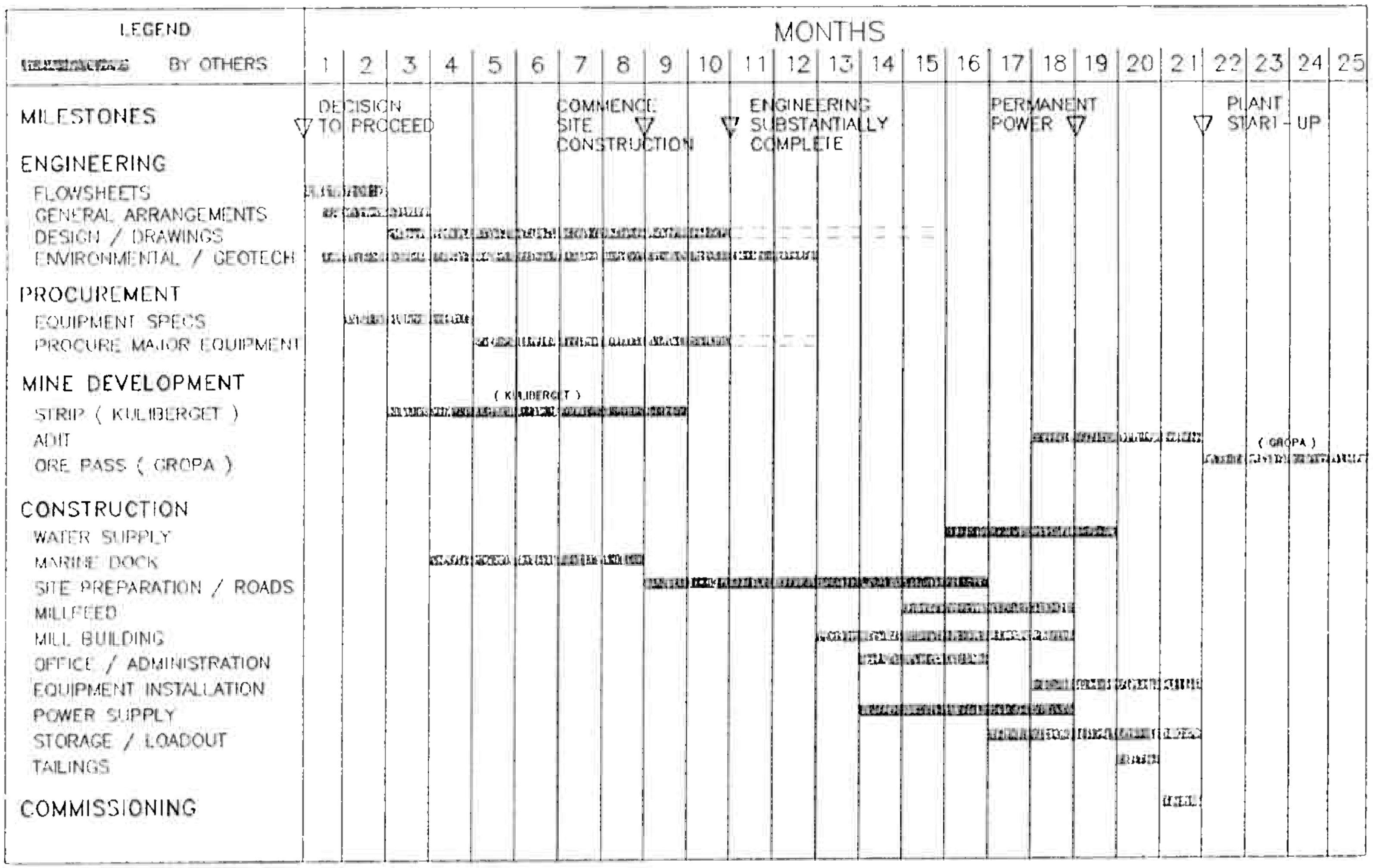
FIMAS

ANDORJA MAGNETITE PROJECT

SUMMARY SCHEDULE



KONFIDENSIELT

14.0

MARKETING

FALKHAMMER - IBESTAD MAGNETITE A.S.

ANDØRJA MAGNETITE PROJECT

FEASIBILITY STUDY - VOLUME 1

14.0 MARKETING

14.1 GENERAL

The Andørja magnetite deposit has been known for over 80 years as a potential source of a commercial grade magnetite suitable for the steel making industry. Over the ensuing years diamond drilling and other investigatory testing has been carried out to confirm the quality and quantity of magnetite and other minerals which could be usefully mined and processed on an economical basis.

The Andørja Magnetite project covers two separate deposit areas, Gropa and Kuliberget with the Gropa deposit which is located higher up the side of the mountain, having the higher grade magnetite when compared to Kuliberget.

The location of the Andørja magnetite deposits versus the accessibility of other more readily available deposits has, until now, combined to hold back the development of the property.

During the last decade, some of the major magnetite producing mines both in Northern Europe and the U.S.A. have been closing down, or are about to close which has helped improve the viability of the Andørja project which is to be developed in order to service the industrial mineral market.

This situation has been further advanced by FIMAS who have been negotiating with two prospective clients to take sufficient yearly quantities of heavy media magnetite and apatite product that will provide the economic basis for the project. Copies of the actual contracts

Refractory Block Concentrate

Magnetite has a relatively high specific heat and specific gravity which makes it valuable to the producers of electric heaters. The magnetite is made into briquettes which is used to store heat energy during periods of lesser power demand and therefore cheaper power rates. By warming the briquettes in this manner, they store sufficient heat to warm homes during the day time periods of higher electrical costs.

The magnetite grain size distribution is 0 to 6.3mm (magnetite gravel) and the bulk density must be +4.

The primary market for this material is in the UK and Europe and is approximately 200,000 tonnes/year.

Ballast

This is a coarse magnetite gravel of 0 - 10mm with a bulk density of +4 which is used mainly in the larger offshore concrete oil platforms.

Pigments and Toners

Magnetite is used for its colour and magnetism. The magnetite has to be finely ground (micronized) and is subject to stringent quality requirements. The prime use is for paints and in toners for copying machines.

Superslig

This material is used for the production of powder steel in the foundry industry. The process which is patented reduces the magnetite to steel without smelting and thereby retaining its granular form. It is used to forge fine steel machine parts that require a minimum of tooling.

when finally agreed upon will be provided to interested parties upon written request to FIMAS.

14.2 PRODUCTS

The total industrial market for magnetite is in the order of 2-3 million tonnes/year. The major consumers being the oil, coal, electrical, pigments, toners and the magnetic tape industries. The major products are:

Heavy Media

The magnetite's high specific gravity and its magnetic properties are used in the coal washing industry and separating ore from gangue materials. It is used to make a dense slurry which is added to the coal or ore to effect cleaning and removal of undesirable products. The magnetite is then recovered by utilizing its magnetic properties for return to the circuit.

Heavy media is divided into several grades of varying grains sizes with the coarse products commanding the higher prices. The grain size distribution of the various grades are:

Coarse heavy media	85% - 0.2mm + 0.06mm
Semi coarse media	75% - 0.2mm + 0.06mm
Fine heavy media	50% - 0.06mm
Very fine media	85% - 0.06mm

For all grades the specific gravity must be between 4.8 and 5.0 and the magnetic value 95% or better.

The demand for this grade is in the order of 300,000 to 500,000 tonnes/year in the USA and 150,000 to 250,000 tonnes/year in Europe.

Superslig requires a very fine magnetite that can be taken off by further processing during normal magnetite production based on using a high grade initial ore.

Apatite

Apatite is a major component in the manufacture of phosphate based fertilizer and can be separated from the magnetite by means of flotation. The main concern with the apatite is the cadmium and chlorine content to meet with environmental and operating requirements. This has been tested and proven to be within the parameters of environment and process requirements.

KONFIDENSIELT

15.0

ECONOMIC EVALUATION

FALKHAMMER - IBESTAD MAGNETITE A.S.
ANDØRJA MAGNETITE PROJECT
FEASIBILITY STUDY - VOLUME 1
15.0 ECONOMIC EVALUATION

15.1 INTRODUCTION

The FIMAS, Andørja Magnetite Project Study examines the viability of mining Magnetite from the Kuliberget and Gropa deposits in northern Norway. The evaluation is based on cash flow projections which have been developed to reflect the development plans for the project. Additional evaluations provide an analysis of the impact on the project of changes in price, operating costs and capital costs.

The evaluation is based on an annual production rate of 1,360,000 tones of ore mined and 482,000 tonnes of product (28% ore). The diluted mineable reserves considered for the current plan are 19,260,000 tonnes. It is anticipated that additional reserves will be established from the known larger mineral reserve. Production is assumed to be at 90% of full capacity in the first year of operation and at full production will be operating at 88% of rated capacity.

15.2 SUMMARY

The Base Case cash flow is calculated on a stand-alone basis with no debt and no inflation. The tax basis is provided by Coopers and Lybrand and incorporates the latest Norwegian tax legislation for this type of mining project. The results indicate a project which generates an after-tax cash flow of US$29,347,000 over a 14.2 year mine life. The Net Prevent Value

(NPV) of the cash flow at 10% is US$4,730,000. The Discounted Cash Flow Rate of Return (DCF ROR) is 14.1% with a Payout Period of 5.4 years.

This project has the advantage of loans and loan guarantess as well as non-repayable grants provided by the Norwegian Government. The results of the effect of the strong financial participation by Norwegian Government and debt financing is reflected in a parallel financial analyses showing a DCF ROR of 35.9%. The results of this case and the base case are summarized in Table 15.1

Variance Analysis

The Base Case was evaluated under a number of conditions of price, capital and operating costs. The results are summarized graphically in the following figures:

Figure 15.1	Cash Flow by Year
Figure 15.2	Sensitivity Analysis
Figure 15.3	Comparison of Product Revenues
Figure 15.4	DCF ROR vs Mine Life
Figure 15.5	DCF ROR vs Mine Reserves

The curves in Figures 15.6 and 15.7 are based on approximations of capital and operating costs using an exponential relationship between tonnage rates and an exponent of .6.

Figure 15.6	DCF ROR vs Daily Production Rate
Figure 15.7	DCF ROR vs Annual Production Rate

TABLE 15.1

Total Cash Flow Summary

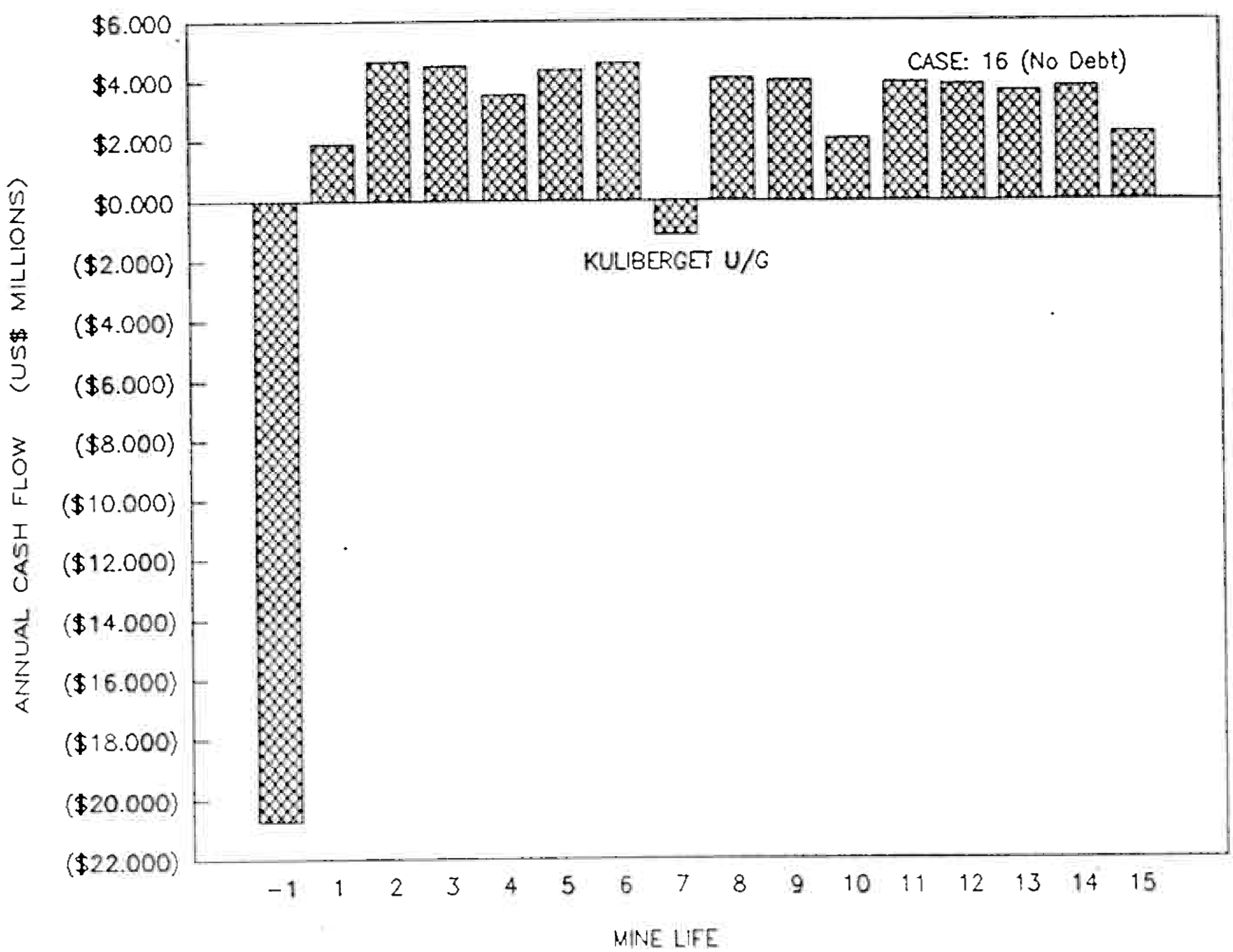
(US$ 1000)

	Base Case	67% Debt
+ Gross Revenue	$221,888	$221,888
- Operating Costs	$148,493	$148,493
- Interest Payments	-	$ 22,785
- Norway & Local Taxes	$ 12,892	$ 6,497
- Capital Costs	$ 39,234	$ 39,234
+ Salvage	$ 600	$ 600
+ Recaptured Cash Items	$ 2,434	$ 2,434
- Decommissioning	$ 1,926	$ 1,926
+ Government Grant	$ 6,970	$ 7,219
= Cash Flow Before Debt	$ 29,347	$ 13,116
+ Principal Received	-	$ 20,304
+ Accrued Interest	-	$ 1,082
- Principal Repayments	-	$ 21,386
= Cash Flow Before Legal Reserve Fund	$ 29,347	$ 13,116
+ Legal reserve Fund Interest Earned	-	$ 1,455
= Total Cash Flow	$ 29,347	$ 14,571
DCF ROR	14.1%	35.9%
Payout Period	5.4 years	2.8 years
Net Present Value at 10%	$ 4,730	$ 5,168

Criteria: No inflation. Stand-alone basis. No debt in Base Case. Debt case includes 67% at 12% interest over 12 years.

FIGURE 15.1

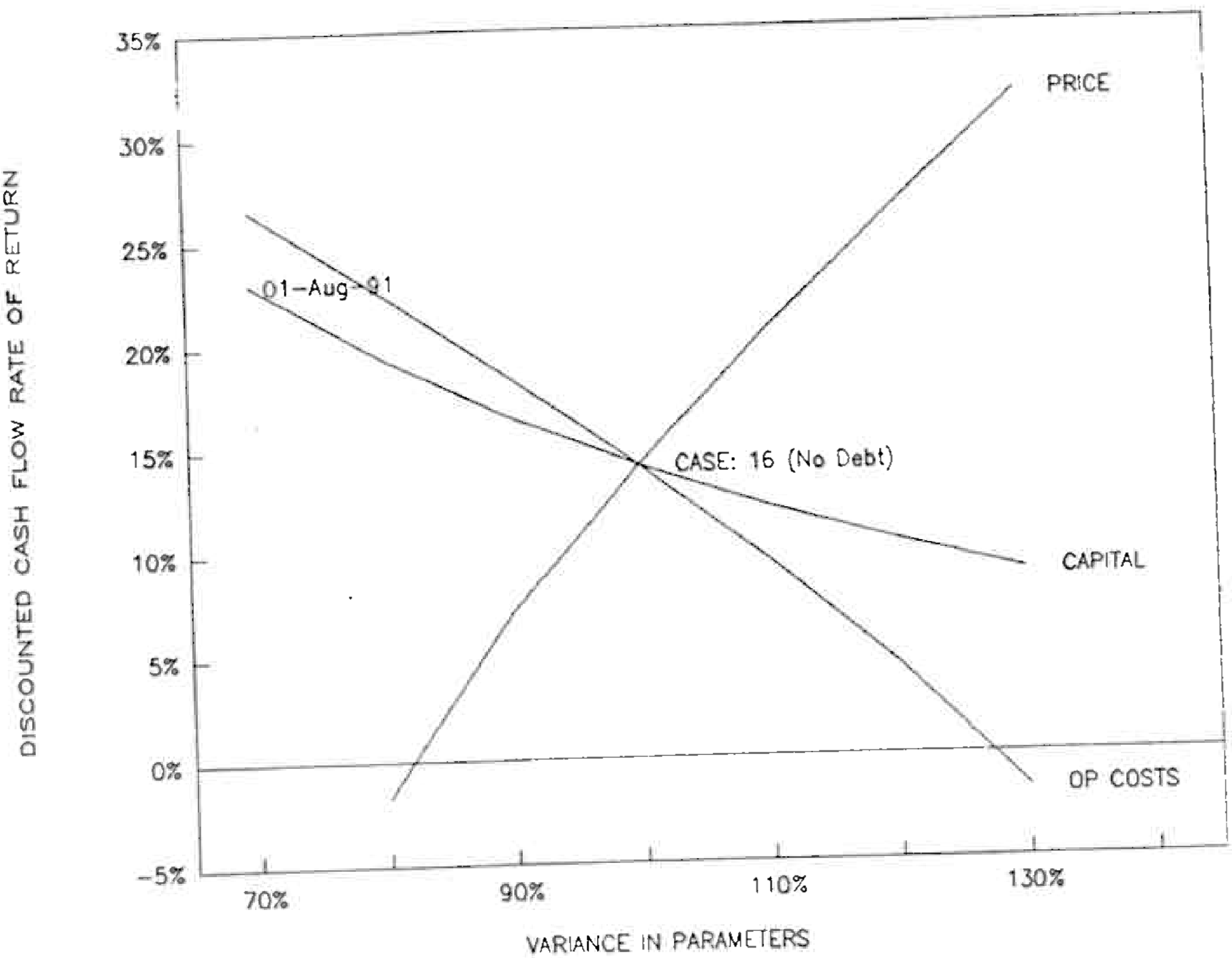
CASH FLOW BY YEAR



Criteria: No inflation. No debt. Stand-alone lone basis.

FIGURE 15.2

SENSITIVITY ANALYSIS

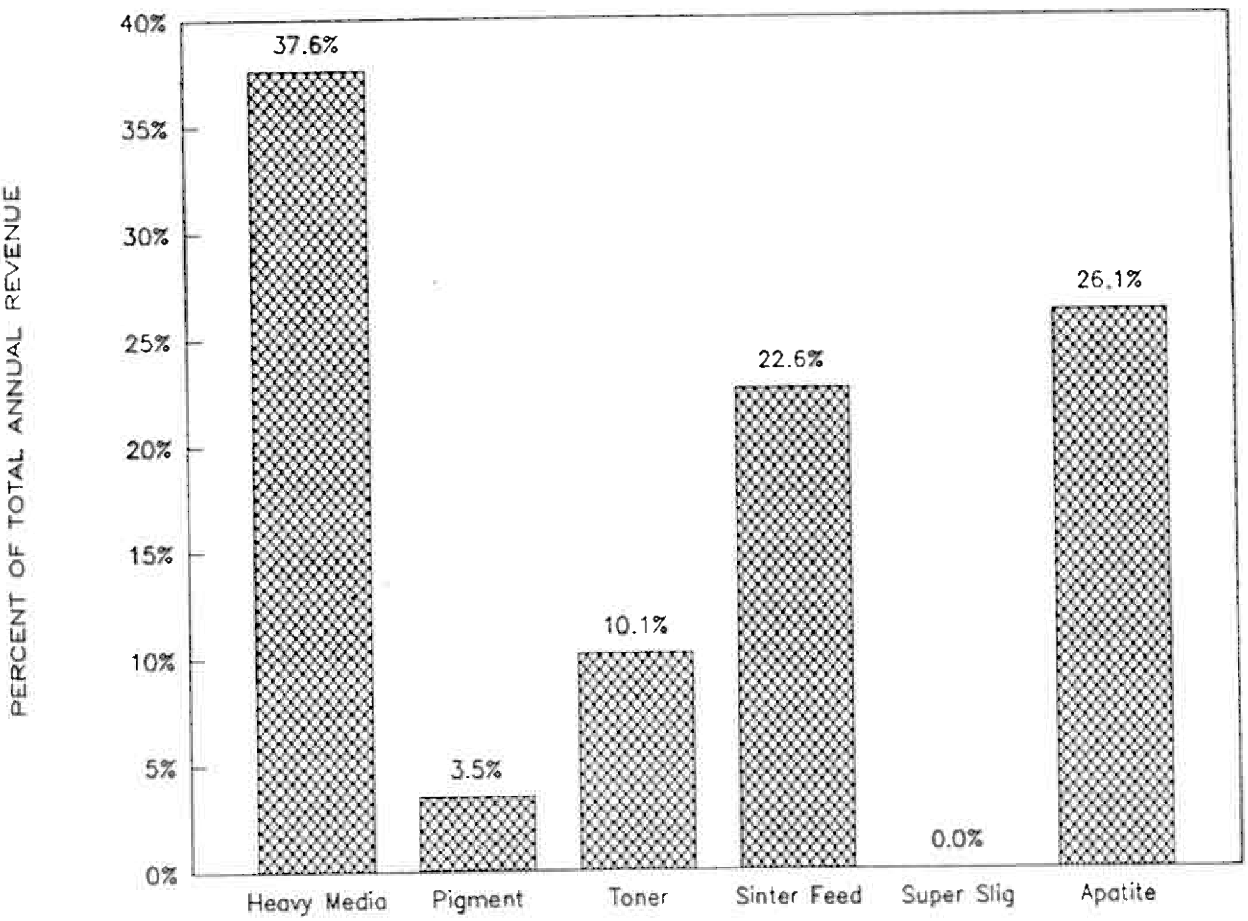


Criteria: No inflation. No debt. Stand-alone basis.

3754_15

FIGURE 15.3

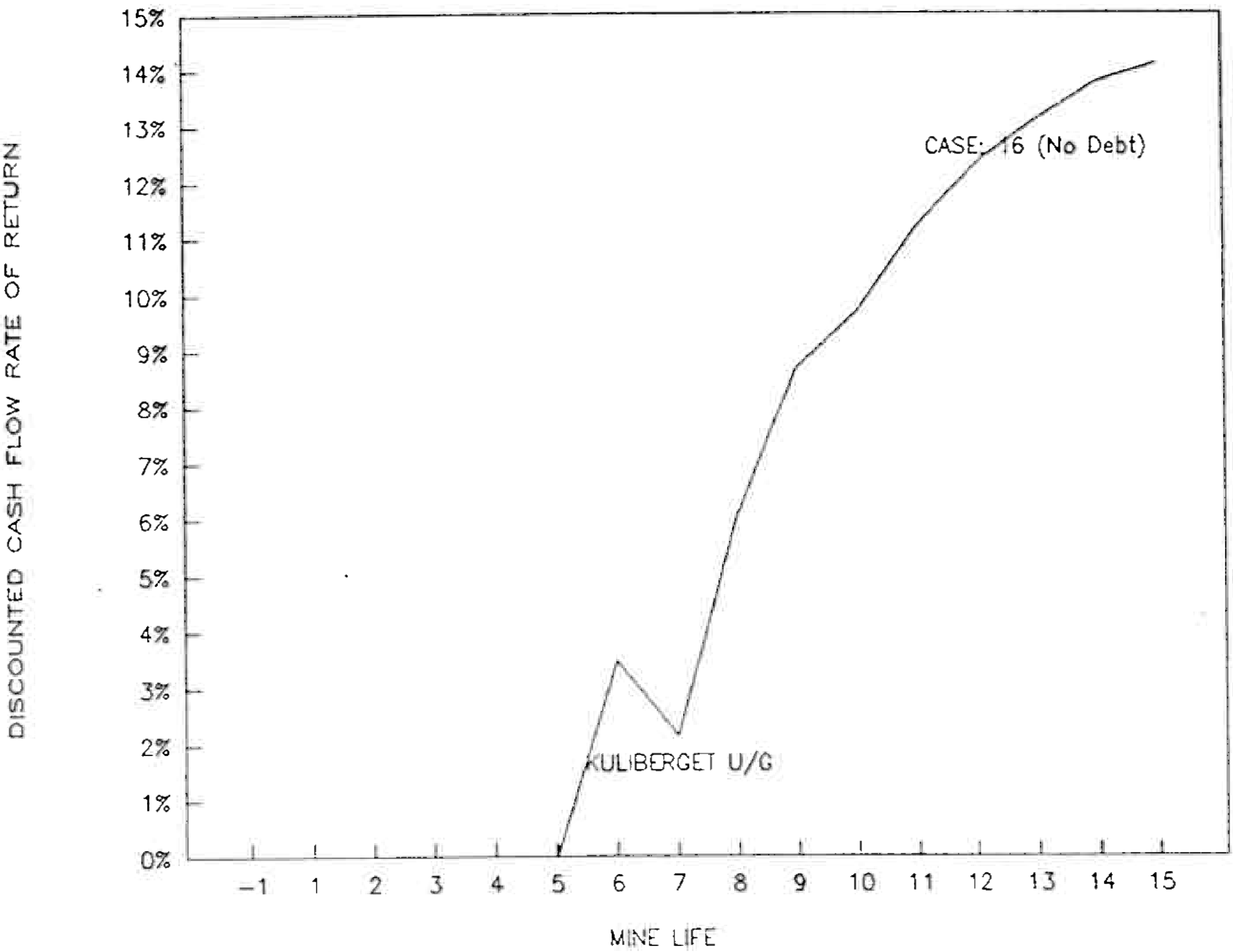
COMPARISON OF PRODUCT REVENUES



Criteria: No inflation. No debt. Stand-alone basis.

FIGURE 15.4

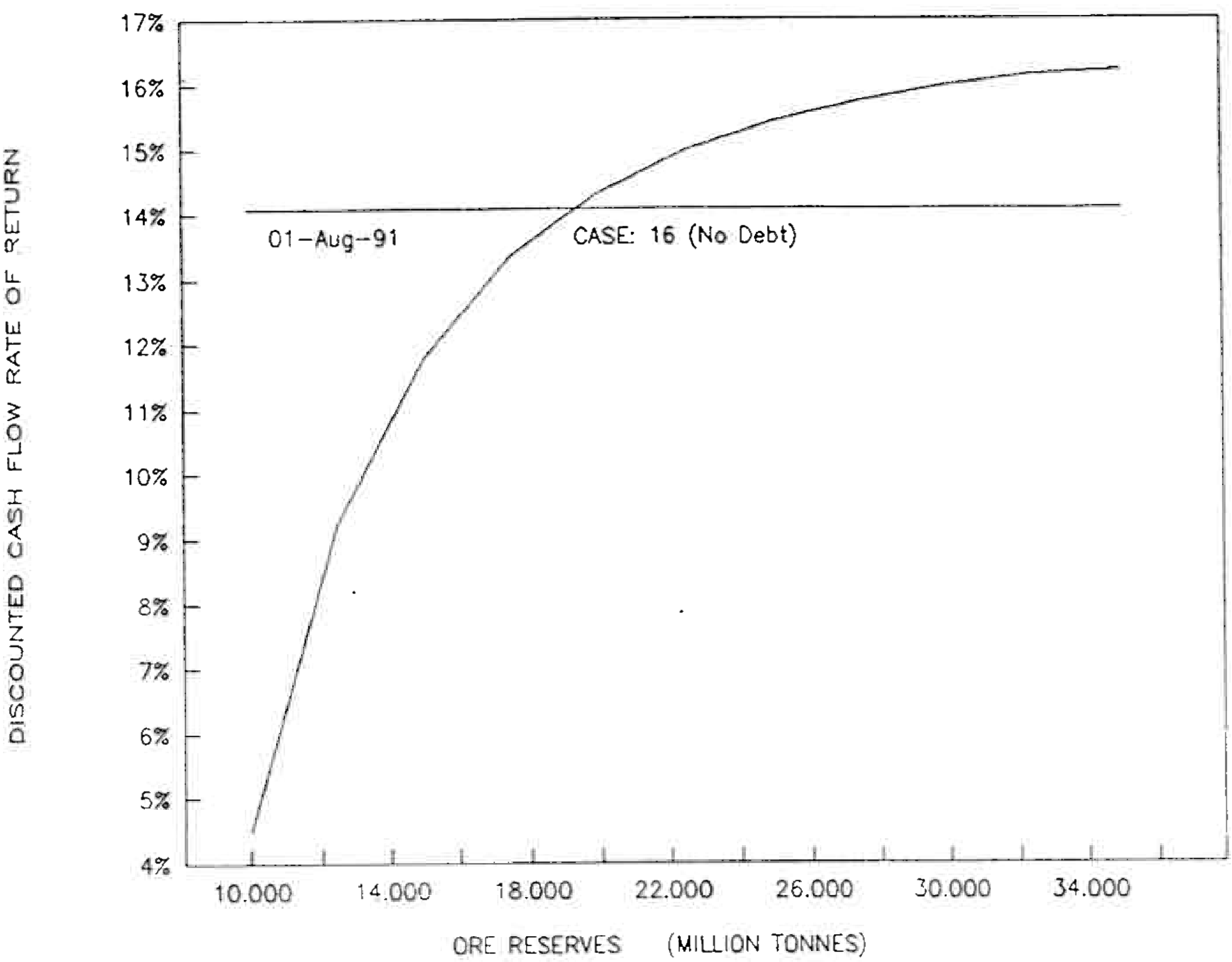
DCF ROR VS MINE LIFE



Criteria: No inflation. No debt. Stand-alone basis.

FIGURE 15.5

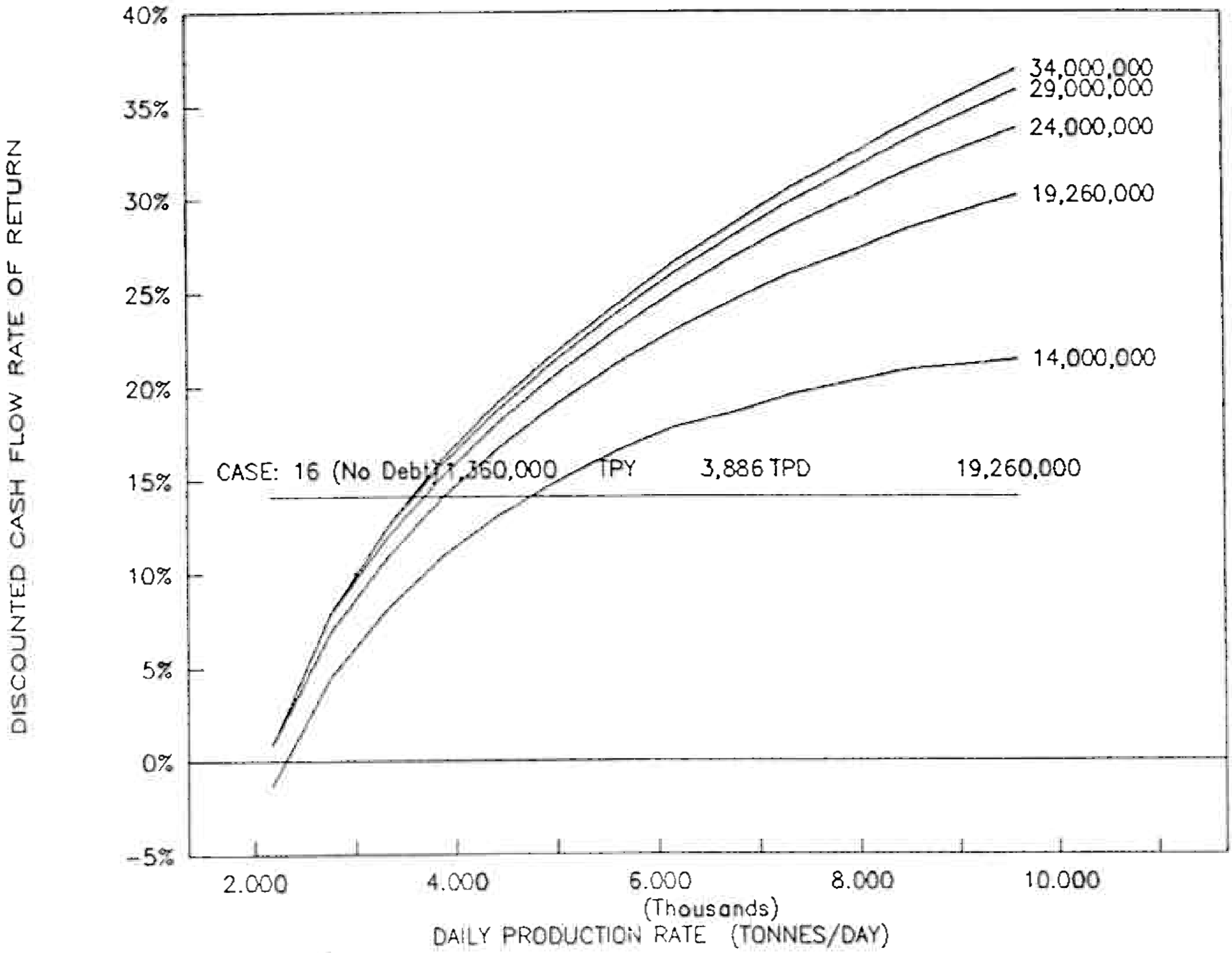
DCF ROR VS MINE RESERVES



Criteria: No inflation. No debt. Stand-alone basis.

FIGURE 15.6

DCF ROR VS DAILY PRODUCTION RATE

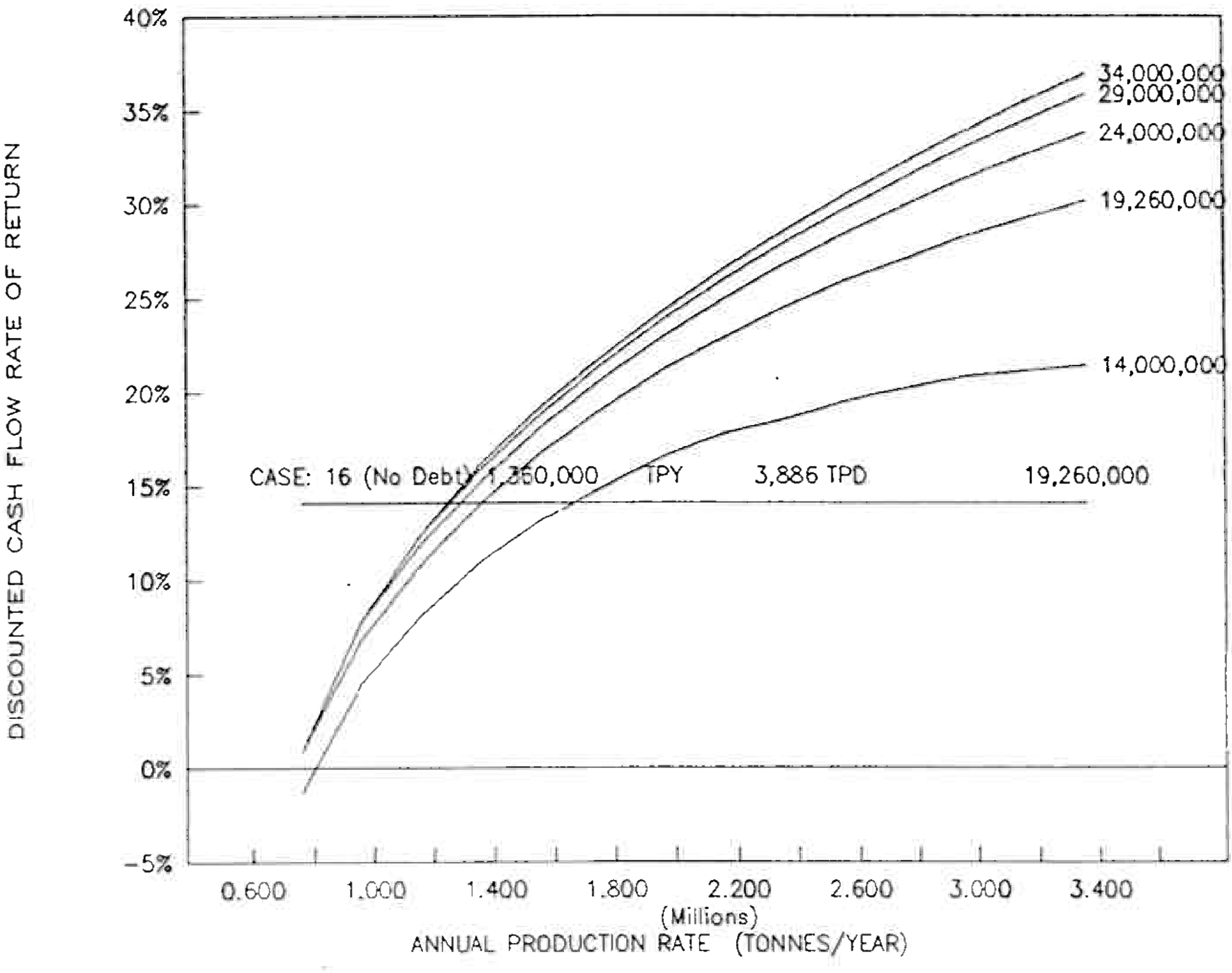


Criteria: No inflation. No debt. Stand-alone basis.

3754_15

FIGURE 15.7

DCF ROR VS ANNUAL PRODUCTION RATE



Criteria: No inflation. No debt. Stand-alone basis.

15.3 EVALUATION CRITERIA

The criteria used to define the economic environment of the evaluation and the components of the cash flow, are summarized below.

1. Currency

   All values are expressed in 2nd quarter 1991 US dollars unless otherwise noted.

2. Stand-Alone Basis

   The project is evaluated on a stand-alone basis.
   All expenditures prior to the decision to proceed are ignored.

3. Financing

   The project is evaluated on a 100% equity basis.

4. Government Grant

   A grant from the Norwegian government, at 23% of the capital costs, is included in the evaluation.

5. Inflation

   No inflation is included in the evaluation.

6. Taxes

   Norway Income Tax is calculated at a rate of 28%, based on the newly revised legislation. Building assets are written off on a declining balance basis, at a rate of 5% for buildings and 20% for equipment. Working Capital and inventories are not deducted for tax purposes.

Local Taxes are included in the Norway Income Tax.

Net Wealth Tax has been discontinued in the new tax legislation.

7. Salvage

Salvage is included as an allowance for revenue from the sale of equipment at the end of the project. The salvage amount is $600,000, approximately 2% of the total capital costs.

8. Decommissioning Fund

Decommissioning costs are estimated on the basis of $.10 per tonne mined. This item is a one time, lump sum allowance for rehabilitation in the last year of operation.

10. Working Capital and Initial Inventories

Working Capital is an allowance to cover the costs of operation from the time the first ore is mined to the time the first revenue is received. The amount is based on 2.5 months of operating costs. (3 months of labour costs and 2 months of consumables.)

Initial Inventories of equipment spare parts are estimated as $250,000.

11. Recaptured Cash Items

These include the accumulated "cash" items which are required at the beginning of the project to provide the reserves of Working Capital and Inventories of Spare Parts needed in the day to day operation of the mine. These items are recaptured in the last year of the project. Because they are considered as cash for tax purposes, they are not deductible in the tax calculations and are not taxable when recaptured.

12. Depreciation

Depreciation is a non-cash item and therefore is not included in the calculation of the cash flow. Depreciation is a deduction in the calculation of taxes.

13. Legal Reserve Fund

The Legal Reserve Fund (LRF) is a requirement of the Norwegian government to set aside funds to cover the amount of indebtedness of the company so that, in the event of premature closure of the mine, the debt could be serviced. The calculation of the LRF is based on criteria provided by White Resources.

There are 4 items which are contributions to the LRF:

- Excess Equity Investment
- the Government Grant
- 10% of the cash flow before the LRF
- the cash flow before the LRF less 10% of the sum of:
    - Share Capital ($150,000), plus
    - Revaluation Fund ($0), plus
    - LRF at start of current year.

Contributions are made to the LRF until the LRF is equal to the larger of:

- 20% of the Share Capital, or
- the sum of:
    - company debt at the end of the year, plus
    - the Share Capital, less
    - the Revaluation Fund.

The amount of the LRF is assumed to be set aside in an interest earning trust fund. The LRF is drawn down as the requirements diminish as debt is reduced.

15.4 RESERVES, PRODUCTION AND REVENUE

The mineable ore reserves are summarized as follows:

	Tonnes	Grade	Life
Kuliberget Pit	700,000	27.71%	.5
Gropa Pit	7,910,000	28.21%	5.8
Kuliberget U/G	10,650,000	28.07%	7.9
Total	19,260,000	28.13%	14.2

The production rates (based on 28% ore grade) and the selling prices used in this evaluation are as follows:

	Tonnes/Year	US$/tonne kr/t	Revenue
Heavy Media	250,000	$23.50 164,50	$5,875,000
Pigment	500	$1,100 7700,-	$ 550,000
Toner	40	40,000 280,000,-	1,600,000
Fines	149,860	$23.50 164,50	$3,521,710
Apatite	81,600	$50.00 350,-	$4,800,000
Products	482,000		$15,626,710
Tailings	878,000		
Total	1,360,000		

The production of pigment and toner are fixed in each year, while the other products vary as the grade of the ore varies.

Production is assumed to be at 90% of full capacity in the first year of operation.

15.5 CAPITAL COSTS

The capital costs used in the evaluation are summarized in the table below.

Mine	$ 3,110,000
Mill	$16,847,000
Construction Indirects	$ 1,996,000
EPCM	$2,193,000
Contingency	$ 2,414,000
Sub-Total	$26,560,000
Start-Up	$ 100,000
Initial Inventories	$ 250,000
Working Capital	$ 2,205,000
Total Initial Capital	$29,115,000
Mine On-going Capital	$10,140,000
Total	$39,255,000 · 7 = 274,785,000,-

15.6 OPERATING COSTS

The operating costs used in the evaluation are summarized in the table below.

Mining	
Kuliberget Pit, 6 months	$2.12 $/tonne Ore
Gropa Pit	
- 5 years @ 0.665:1 strip ratio	$3.56 $/tonne Ore
- 0.8 years @ zero strip ratio	$2.75 $/tonne Ore
Kuliberget Underground	
average over 7.8 years	$3.83 $/tonne Ore
Mill	$3.61 $/tonne Ore
Management & Administration	$300,000 $/year
Site Rental	$231,000 $/year
WRC Consultancy Fee	$100,000 $/year
Average Cost over mine life	$7.71 $/tonne Ore ~ 54. kr/t

15.7 CASH FLOW CALCULATION

The detailed calculations of the Base Case cash flow are presented on the following pages. These are followed by the corresponding calculations for the 67% debt case.

CASE: 16 (No Debt) ANDORJA MAGNETITE PROJECT, NORWAY - 3754 [illegible]ug-91 09:07 AM

GENERAL: Base Case. Kuliberget & Gropa Pits, Kuliberget U/G.
ECONOMICS: No inflation. No debt. No Acquisition Costs. Excludes: site development, road to mine, pipeline from Lake, power to plant, dock.
TAXES: Based on tax revisions per C&L letter of May 3/91. Cash distribution restricted by LRF requirements; interest on LRF.

All values in US dollars.			-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	TOTAL
PRODUCTION **********		Reserves 19,260,000 tonnes																	
Product	482,000	tonnes/yr	0	432,576	485,611	485,611	485,611	485,611	485,611	484,241	483,204	483,204	483,204	483,204	483,204	483,204	483,204	126,486	6,853,783
Tailings	878,000	tonnes/yr	0	791,424	874,389	874,389	874,389	874,389	874,389	875,759	876,796	876,796	876,796	876,796	876,796	876,796	876,796	229,514	12,406,217
Mined Ore	1,360,000	tonnes/yr	0	1,224,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	356,000	19,260,000
Accumulated			0	1,224,000	2,584,000	3,944,000	5,304,000	6,664,000	8,024,000	9384000	10744000	12104000	13464000	14824000	16184000	17544000	18904000	19260000	
Gross Revenue		$1000	$0	$13,838	$15,728	$15,728	$15,728	$15,728	$15,728	$15,689	$15,660	$15,660	$15,660	$15,660	$15,660	$15,660	$15,660	$4,099	$221,888
		$/t Ore	$0.00	$11.31	$11.56	$11.56	$11.56	$11.56	$11.56	$11.54	$11.52	$11.52	$11.52	$11.52	$11.52	$11.52	$11.52	$11.52	$11.52
CASH FLOW *********																			
+ Gross Revenue			$0	$13,838	$15,728	$15,728	$15,728	$15,728	$15,728	$15,689	$15,660	$15,660	$15,660	$15,660	$15,660	$15,660	$15,660	$4,099	$221,888
- Operating Costs			$0	($8,831)	($10,382)	($10,382)	($10,382)	($10,382)	($9,958)	($10,117)	($10,749)	($10,749)	($10,749)	($10,749)	($10,749)	($10,749)	($10,749)	($2,814)	($148,493)
= Net Operating Income			$0	$5,007	$5,346	$5,346	$5,346	$5,346	$5,770	$5,573	$4,911	$4,911	$4,911	$4,911	$4,911	$4,911	$4,911	$1,286	$73,395
- Interest Payment		12.00%	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
= Net After Interest			$0	$5,007	$5,346	$5,346	$5,346	$5,346	$5,770	$5,573	$4,911	$4,911	$4,911	$4,911	$4,911	$4,911	$4,911	$1,286	$73,395
- Norway Taxes		28.0%	$0	($469)	($719)	($845)	($895)	($988)	($1,183)	($890)	($815)	($903)	($890)	($965)	($1,026)	($1,066)	($1,109)	($129)	($12,892)
= Net Income After Tax			$0	$4,538	$4,626	$4,501	$4,451	$4,357	$4,587	$4,683	$4,096	$4,008	$4,021	$3,946	$3,885	$3,845	$3,802	$1,157	$60,503
- Capital Costs			($26,910)	($3,394)	$0	$0	($930)	$0	$0	($5,850)	$0	$0	($1,975)	$0	$0	($175)	$0	$0	($39,234)
+ Salvage		$600	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$600	$600
+ Recaptured Cash Items			$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,434	$2,434
- Decommissioning	$0.10	$1,926	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	($1,926)	($1,926)
+ Government Grant		23.0%	$6,189	$781	-	-	-	-	-	-	-	-	-	-	-	-	-	-	$6,970
= Cash Flow Before Debt			($20,721)	$1,924	$4,626	$4,501	$3,521	$4,357	$4,587	($1,167)	$4,096	$4,008	$2,046	$3,946	$3,885	$3,670	$3,802	$2,265	$29,347
+ Principal Received		0.0%	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
+ Accrued Interest			$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
- Principal Repaid			$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
= Cash Flow Before Legal Reserve Fund			($20,721)	$1,924	$4,626	$4,501	$3,521	$4,357	$4,587	($1,167)	$4,096	$4,008	$2,046	$3,946	$3,885	$3,670	$3,802	$2,265	$29,347
- Legal Reserve Fund Contribution		100.0%	$0	($0)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	($0)
+ LRF Interest After Tax	10.0%	7.2%	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
= Cash Flow Before Withholding Tax			($20,721)	$1,924	$4,626	$4,501	$3,521	$4,357	$4,587	($1,167)	$4,096	$4,008	$2,046	$3,946	$3,885	$3,670	$3,802	$2,265	$29,347
- Withholding Tax		0.0%	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
= Cash Flow			($20,721)	$1,924	$4,626	$4,501	$3,521	$4,357	$4,587	($1,167)	$4,096	$4,008	$2,046	$3,946	$3,885	$3,670	$3,802	$2,265	$29,347
Accumulated			($20,721)	($18,797)	($14,170)	($9,669)	($6,149)	($1,791)	$2,796	$1,628	$5,725	$9,732	$11,778	$15,724	$19,609	$23,279	$27,081	$29,347	
DCF ROR		14.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	3.5%	2.2%	6.1%	8.7%	9.7%	11.2%	12.3%	13.1%	13.8%	14.1%	
Payout Period		5.4 years																	
Mine Life		14.2 years																	

NPV		
0.0%	$29,347	(Mid-year Convention)
5.0%	$13,798	
10.0%	$4,730	
15.0%	($835)	
20.0%	($4,407)	
25.0%	($6,788)	

1. Inflation			-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Rate		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

CASE: 16 (No Debt) ANDORJA MAGNETITE PROJECT, NORWAY - 3756 02-Aug-91 09:07 AM

GENERAL: Base Case. Kuliberget & Gropa Pits, Kuliberget U/G.
ECONOMICS: No inflation. No debt. No Acquisition Costs. Excludes: site development, road to mine, pipeline from lake, power to plant, dock.
TAXES: Based on tax revisions per C&L letter of May 3/91. Cash distribution restricted by LRF requirements; interest on LRF.

FIMAS FORMAT
****

All values in US dollars.		-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	TOTAL
PRODUCTION AND OPERATING DATA																		
Production	Tonnes																	
Mined Ore	1,360,000 tonnes/yr	0	1,224,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	356,000	19,260,000
Remaining Reserves	End Of Year	19,260,000	18036000	16676000	15316000	13956000	12596000	11236000	9876000	8516000	7156000	5796000	4436000	3076000	1716000	356000	0	
Ore Grade	Magnetite Content	0.00%	27.92%	28.21%	28.21%	28.21%	28.21%	28.21%	28.13%	28.07%	28.07%	28.07%	28.07%	28.07%	28.07%	28.07%	28.07%	28.11%
	Product Content	0.00%	35.35%	35.71%	35.71%	35.71%	35.71%	35.71%	35.61%	35.53%	35.53%	35.53%	35.53%	35.53%	35.53%	35.53%	35.53%	35.59%
Saleable Production	Tonnes	0	432,576	485,611	485,611	485,611	485,611	485,611	484,241	483,204	483,204	483,204	483,204	483,204	483,204	483,204	126,486	6,853,783
Price Per Tonne	$/Tonne Product	$0.00	$31.99	$32.39	$32.39	$32.39	$32.39	$32.39	$32.40	$32.41	$32.41	$32.41	$32.41	$32.41	$32.41	$32.41	$32.41	$32.37
CALCULATIONS																		
Gross Revenue		$0	$13,838	$15,728	$15,728	$15,728	$15,728	$15,728	$15,689	$15,660	$15,660	$15,660	$15,660	$15,660	$15,660	$15,660	$4,099	$221,888
Operating Costs @ per Tonne Ore		$0	($8,200)	($9,751)	($9,751)	($9,751)	($9,751)	($9,327)	($9,486)	($10,118)	($10,118)	($10,118)	($10,118)	($10,118)	($10,118)	($10,118)	($2,649)	($139,494)
A&G		$0	($300)	($300)	($300)	($300)	($300)	($300)	($300)	($300)	($300)	($300)	($300)	($300)	($300)	($300)	($79)	($4,279)
Site Rental		$0	($231)	($231)	($231)	($231)	($231)	($231)	($231)	($231)	($231)	($231)	($231)	($231)	($231)	($231)	($60)	($3,294)
MRC Consultancy Fee		$0	($100)	($100)	($100)	($100)	($100)	($100)	($100)	($100)	($100)	($100)	($100)	($100)	($100)	($100)	($26)	($1,426)
Depreciation		$0	($3,332)	($2,777)	($2,328)	($2,150)	($1,816)	($1,544)	($2,393)	($2,002)	($1,684)	($1,731)	($1,465)	($1,247)	($1,104)	($952)	($826)	($27,352)
Net Operating Income		$0	$1,675	$2,568	$3,017	$3,196	$3,530	$4,226	$3,180	$2,909	$3,227	$3,180	$3,446	$3,664	$3,807	$3,959	$460	$46,043
Interest Payments		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Net Income Before Tax		$0	$1,675	$2,568	$3,017	$3,196	$3,530	$4,226	$3,180	$2,909	$3,227	$3,180	$3,446	$3,664	$3,807	$3,959	$460	$46,043
Corporate Income Tax		$0	($469)	($719)	($845)	($895)	($988)	($1,183)	($890)	($815)	($903)	($890)	($965)	($1,026)	($1,066)	($1,109)	($129)	($12,892)
Net After Norway Taxes		$0	$1,206	$1,849	$2,172	$2,301	$2,541	$3,043	$2,289	$2,095	$2,323	$2,289	$2,481	$2,638	$2,741	$2,851	$331	$33,151
Add Back Depreciation		$0	$3,332	$2,777	$2,328	$2,150	$1,816	$1,544	$2,393	$2,002	$1,684	$1,731	$1,465	$1,247	$1,104	$952	$826	$27,352
Salvage/Decommission/Recaptured Cash		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,108	$1,108
Principal Received		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Government Grant		$6,189	$781	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$6,970
Capital Investments		($26,910)	($3,394)	$0	$0	($930)	$0	$0	($5,850)	$0	$0	($1,975)	$0	$0	($175)	$0	$0	($39,234)
Principal Payments		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Yearly Cash Flow		($20,721)	$1,924	$4,626	$4,501	$3,521	$4,357	$4,587	($1,167)	$4,096	$4,008	$2,046	$3,946	$3,885	$3,670	$3,802	$2,265	$29,347
Legal Reserve Fund	Contributions	$0	($0)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	($0)
	Interest Earned	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Cash Flow With LRF		($20,721)	$1,924	$4,626	$4,501	$3,521	$4,357	$4,587	($1,167)	$4,096	$4,008	$2,046	$3,946	$3,885	$3,670	$3,802	$2,265	$29,347
Company Debt (End Of Year)		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	

Cash Flow		Yearly	With LRF
DCFROR		14.1%	14.1%
NPV	0.0%	$29,347	$29,347
	5.0%	$13,798	$13,798
	10.0%	$4,730	$4,730
	15.0%	($835)	($835)
	20.0%	($4,407)	($4,407)
	25.0%	($6,788)	($6,788)

CASE: 16 (No Debt) ANDORJA MAGNETITE PROJECT, NORWAY - 3754 02-Aug-91 09:07 AM

GENERAL: Base Case. Kuliberget & Gropa Pits, Kuliberget U/G.
ECONOMICS: No inflation. No debt. No Acquisition Costs. Excludes: site development, road to mine, pipeline from lake, power to plant, dock.
TAXES: Based on tax revisions per C&L letter of May 3/91. Cash distribution restricted by LRF requirements; interest on LRF.

All values in US dollars.

PRODUCTION

			-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	TOTAL
Annual Production Factor			0%	90%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	
Mined	Kuliberget Pit	tonnes	0	700,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	700,000
	Gropa Pit - A	tonnes	0	524,000	1,360,000	1,360,000	1,360,000	1,360,000	836,000	0	0	0	0	0	0	0	0	0	6,800,000
	Gropa Pit - B	tonnes	0	0	0	0	0	0	524,000	586,000	0	0	0	0	0	0	0	0	1,110,000
	Kuliberget U/G	tonnes	0	0	0	0	0	0	0	774,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	356,000	10,650,000
	Total	tonnes	0	1,224,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	356,000	19,260,000
Grade	Kuliberget Pit	27.71%	0	193,970	0	0	0	0	0	0	0	0	0	0	0	0	0	0	193,970
	Gropa Pit - A	28.21%	0	147,820	383,656	383,656	383,656	383,656	235,836	0	0	0	0	0	0	0	0	0	1,918,280
	Gropa Pit - B	28.21%	0	0	0	0	0	0	147,820	165,311	0	0	0	0	0	0	0	0	313,131
	Kuliberget U/G	28.07%	0	0	0	0	0	0	0	217,262	381,752	381,752	381,752	381,752	381,752	381,752	381,752	99,929	2,989,455
	Average	28.11%	0.00%	27.92%	28.21%	28.21%	28.21%	28.21%	28.21%	28.13%	28.07%	28.07%	28.07%	28.07%	28.07%	28.07%	28.07%	28.07%	28.11%
	Grade Factor	28.00% Base Grade	0.000	0.997	1.008	1.008	1.008	1.008	1.008	1.005	1.003	1.003	1.003	1.003	1.003	1.003	1.003	1.003	1.004
	Product Content	35.44% Product	0.00%	35.35%	35.71%	35.71%	35.71%	35.71%	35.71%	35.61%	35.53%	35.53%	35.53%	35.53%	35.53%	35.53%	35.53%	35.53%	35.59%
Reserves Year End	Kuliberget Pit		700,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Gropa Pit - A		6,800,000	6,276,000	4,916,000	3,556,000	2,196,000	836,000	0	0	0	0	0	0	0	0	0	0	
	Gropa Pit - B		1,110,000	1,110,000	1,110,000	1,110,000	1,110,000	1,110,000	586,000	0	0	0	0	0	0	0	0	0	
	Kuliberget U/G		10,650,000	10650000	10650000	10650000	10650000	10650000	10650000	9876000	8516000	7156000	5796000	4436000	3076000	1716000	356000	0	
	Total		19,260,000	18036000	16676000	15316000	13956000	12596000	11236000	9876000	8516000	7156000	5796000	4436000	3076000	1716000	356000	0	
Product	Heavy Media	250,000 tonnes/yr	0	224,390	251,875	251,875	251,875	251,875	251,875	251,164	250,625	250,625	250,625	250,625	250,625	250,625	250,625	65,605	3,554,908
	Pigment	500 tonnes/yr	0	405	500	500	500	500	500	500	500	500	500	500	500	500	500	131	7,036
	Toner	40 tonnes/yr	0	32	40	40	40	40	40	40	40	40	40	40	40	40	40	10	563
	Sinter Feed	149,860 tonnes/yr	0	134,508	150,984	150,984	150,984	150,984	150,984	150,558	150,235	150,235	150,235	150,235	150,235	150,235	150,235	39,326	2,130,954
	Super Slig	- tonnes/yr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Apatite	81,600 tonnes/yr	0	73,241	82,212	82,212	82,212	82,212	82,212	81,980	81,804	81,804	81,804	81,804	81,804	81,804	81,804	21,413	1,160,322
	Product	482,000 tonnes/yr	0	432,576	485,611	485,611	485,611	485,611	485,611	484,241	483,204	483,204	483,204	483,204	483,204	483,204	483,204	126,486	6,853,783
	Tailing	878,000 tonnes/yr	0	791,424	874,389	874,389	874,389	874,389	874,389	875,759	876,796	876,796	876,796	876,796	876,796	876,796	876,796	229,514	12,406,217
	Mined Ore	1,360,000 tonnes/yr	0	1,224,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	356,000	19,260,000
Revenue		$/tonne																	
	Heavy Media	37.6% $23.50	$0	$5,273	$5,919	$5,919	$5,919	$5,919	$5,919	$5,902	$5,890	$5,890	$5,890	$5,890	$5,890	$5,890	$5,890	$1,542	83,540
	Pigment	3.5% $1,100	$0	$446	$550	$550	$550	$550	$550	$550	$550	$550	$550	$550	$550	$550	$550	$144	7,739
	Toner	10.1% $40,000	$0	$1,296	$1,600	$1,600	$1,600	$1,600	$1,600	$1,600	$1,600	$1,600	$1,600	$1,600	$1,600	$1,600	$1,600	$419	22,515
	Sinter Feed	22.6% $23.50	$0	$3,161	$3,548	$3,548	$3,548	$3,548	$3,548	$3,538	$3,531	$3,531	$3,531	$3,531	$3,531	$3,531	$3,531	$924	50,077
	Super Slig	0.0% $40.00	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	0
	Apatite	26.1% $50.00	$0	$3,662	$4,111	$4,111	$4,111	$4,111	$4,111	$4,099	$4,090	$4,090	$4,090	$4,090	$4,090	$4,090	$4,090	$1,071	58,016
	Gross Revenue	100.0% $32.37	$0	$13,838	$15,728	$15,728	$15,728	$15,728	$15,728	$15,689	$15,660	$15,660	$15,660	$15,660	$15,660	$15,660	$15,660	$4,099	$221,888
	With Inflation		$0	$13,838	$15,728	$15,728	$15,728	$15,728	$15,728	$15,689	$15,660	$15,660	$15,660	$15,660	$15,660	$15,660	$15,660	$4,099	$221,888
	Unit Price	$/t Product	$0.00	$31.99	$32.39	$32.39	$32.39	$32.39	$32.39	$32.40	$32.41	$32.41	$32.41	$32.41	$32.41	$32.41	$32.41	$32.41	$32.37
		$/t Ore	$0.00	$11.31	$11.56	$11.56	$11.56	$11.56	$11.56	$11.54	$11.52	$11.52	$11.52	$11.52	$11.52	$11.52	$11.52	$11.52	$11.52

CASE: 16 (No Debt) ANDORJA MAGNETITE PROJECT, NORWAY - 3754 02-Aug-91 09:07 AM

GENERAL: Base Case. Kuliberget & Gropa Pits, Kuliberget U/G.
ECONOMICS: No inflation. No debt. No Acquisition Costs. Excludes: site development, road to mine, pipeline from lake, power to plant, dock.
TAXES: Based on tax revisions per C&L letter of May 3/91. Cash distribution restricted by LRF requirements; interest on LRF.

All values in US dollars.

			-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	TOTAL
OPERATING COSTS																			
Mine:	Kuliberget Pit	$2.12 $/t Ore	$0	$1,566	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,566
	Gropa Pit - A	$3.56 $/t Ore	$0	$1,969	$4,842	$4,842	$4,842	$4,842	$2,976	$0	$0	$0	$0	$0	$0	$0	$0	$0	$24,312
	Gropa Pit - B	$2.75 $/t Ore	$0	$0	$0	$0	$0	$0	$1,441	$1,612	$0	$0	$0	$0	$0	$0	$0	$0	$3,053
	Kuliberget U/G	$3.83 $/t Ore	$0	$0	$0	$0	$0	$0	$0	$2,964	$5,209	$5,209	$5,209	$5,209	$5,209	$5,209	$5,209	$1,363	$40,790
Mill		$3.61 $/t Ore	$0	$4,664	$4,910	$4,910	$4,910	$4,910	$4,910	$4,910	$4,910	$4,910	$4,910	$4,910	$4,910	$4,910	$4,910	$1,285	$69,774
Other		- $/t Ore	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Sub-Total			$0	$8,200	$9,751	$9,751	$9,751	$9,751	$9,327	$9,486	$10,118	$10,118	$10,118	$10,118	$10,118	$10,118	$10,118	$2,649	$139,494
Management & Admin		$300 $1000/yr	$0	$300	$300	$300	$300	$300	$300	$300	$300	$300	$300	$300	$300	$300	$300	$79	$4,279
Site Rental		$231 $1000/yr	$0	$231	$231	$231	$231	$231	$231	$231	$231	$231	$231	$231	$231	$231	$231	$60	$3,294
WRC Consultancy Fee		$100 $1000/yr	$0	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$26	$1,426
Sub-Total			$0	$8,831	$10,382	$10,382	$10,382	$10,382	$9,958	$10,117	$10,749	$10,749	$10,749	$10,749	$10,749	$10,749	$10,749	$2,814	$148,493
Variance & Inflation			$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total		$1000	$0	$8,831	$10,382	$10,382	$10,382	$10,382	$9,958	$10,117	$10,749	$10,749	$10,749	$10,749	$10,749	$10,749	$10,749	$2,814	$148,493
		$7.71 $/t Ore	$0.00	$7.21	$7.63	$7.63	$7.63	$7.63	$7.32	$7.44	$7.90	$7.90	$7.90	$7.90	$7.90	$7.90	$7.90	$7.90	$7.71
1.	Production Factor		0.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.262	
2.	Assume labour percentage in first year =			50.0%															

			-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	TOTAL
CAPITAL COSTS																			
Mine	Building		$580	$820	-	-	-	-	-	$660	-	-	$600	-	-	-	-	-	$2,660
	Equipment		$2,530	$390	-	-	$930	-	-	$5,190	-	-	$1,375	-	-	$175	-	-	$10,590
Mill	Building		$6,847	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	$6,847
	Equipment		$10,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	$10,000
Other	Equipment		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	$0
Construction Indirects	Equipment		$1,996	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	$1,996
EPCM	Equipment		$2,193	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	$2,193
Contingency	Equipment		$2,414	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	$2,414
Sub-Total			$26,560	$1,210	$0	$0	$930	$0	$0	$5,850	$0	$0	$1,975	$0	$0	$175	$0	$0	$36,700
Start-Up			$100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	$100
Initial Inventories			$250	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	$250
Working Capital		2.5 months	-	$2,184	-	-	-	-	-	-	-	-	-	-	-	-	-	-	$2,184
Sub-Total			$26,910	$3,394	$0	$0	$930	$0	$0	$5,850	$0	$0	$1,975	$0	$0	$175	$0	$0	$39,234
Variance & Inflation			$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total			$26,910	$3,394	$0	$0	$930	$0	$0	$5,850	$0	$0	$1,975	$0	$0	$175	$0	$0	$39,234

CASE: ... Debt)   ANDORJA MAGNETITE PROJECT, NORWAY - 3754 02-Aug-91 09:07 AM

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TAXES: Based on tax revisions per C&L letter of May 3/91. Cash distribution restricted by LRF requirements; interest on LRF.

All values in US dollars.			-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	TOTAL
LOANS																			
*****																			
Capital Basis for Debt Calculation			$26,910	$3,394	-	-	-	-	-	-	-	-	-	-	-	-	-	-	$30,304
Debt Principal	Opening Balance		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Received	0.0%	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Accrued Interest		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Principal Repaid		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Closing Balance		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Interest Expenses	Rate	12.00%	12.00%	12.00%	12.00%	12.00%	12.00%	12.00%	12.00%	12.00%	12.00%	12.00%	12.00%	12.00%	12.00%	12.00%	12.00%	12.00%	
	Calculated		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Accrued, add to loan		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Paid		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Assume: Principal received mid-year. Repayments made at year end.																		
Repayment Schedule	Proposed		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Outstanding Balance		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Positive Cash Flow		$0	$1,924	$4,626	$4,501	$3,521	$4,357	$4,587	$0	$4,096	$4,008	$2,046	$3,946	$3,885	$3,670	$3,802	$2,265	$51,235
	Actual Payment		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Year Count	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Amortization Schedule	Loan Life		12.0 years																
	Total Debt		$0																
	Interest Rate		12.00%																
	Amortization Factor		0.1614																
	Interest (Actual)		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	
	Principal Proposed		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	
	Principal + Interest		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	
Ideal	Principal Balance		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Interest		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Principal		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Principal + Interest		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	

CASE: 16 (No Debt) ANDORJA MAGNETITE PROJECT, NORWAY - 3754 02-Aug-91 09:07 AM

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			-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	TOTAL
LEGAL RESERVE FUND																			
LRF	Opening Balance		$0	$6,039	$6,820	$6,820	$6,820	$6,820	$6,820	$6,820	$6,820	$6,820	$6,820	$6,820	$6,820	$6,820	$6,820	$6,820	$0
	Input 1 Government Grant		$6,039	$781	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$6,820
	Input 2 (% of Cash Flow)		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Input 3 (% of Cash Flow Less LRF)		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Return to Cash Flow		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Closing Balance		$6,039	$6,820	$6,820	$6,820	$6,820	$6,820	$6,820	$6,820	$6,820	$6,820	$6,820	$6,820	$6,820	$6,820	$6,820	$6,820	$6,820
	Contribution From/To Cash Flow		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Share Capital			$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	-
Revaluation Fund			$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	-
Company Debt (end of year)			$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	-
Accumulated Grant			$6,189	$6,970	$6,970	$6,970	$6,970	$6,970	$6,970	$6,970	$6,970	$6,970	$6,970	$6,970	$6,970	$6,970	$6,970	$6,970	-
LRF Base 1	% of Share Capital	20%	$30	$30	$30	$30	$30	$30	$30	$30	$30	$30	$30	$30	$30	$30	$30	$30	-
LRF Base 2	Debt + Grant - Share Cap - Reval		$6,039	$6,820	$6,820	$6,820	$6,820	$6,820	$6,820	$6,820	$6,820	$6,820	$6,820	$6,820	$6,820	$6,820	$6,820	$6,820	-
LRF Used	Maximum of Above		$6,039	$6,820	$6,820	$6,820	$6,820	$6,820	$6,820	$6,820	$6,820	$6,820	$6,820	$6,820	$6,820	$6,820	$6,820	$6,820	-
Input 1	Government Grant		$6,189	$781	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$6,970
	Input Required to Match LRF		$6,039	$781	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$6,820
Input 2	Cash Flow Before LRF		$0	$1,924	$4,626	$4,501	$3,521	$4,357	$4,587	$0	$4,096	$4,008	$2,046	$3,946	$3,885	$3,670	$3,802	$2,265	$51,235
	% of Cash Flow Before LRF	10.0%	$0	$192	$463	$450	$352	$436	$459	$0	$410	$401	$205	$395	$389	$367	$380	$227	$5,123
	Input Required to Match LRF		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Input 3	Share Capital + Revaluation Fund		$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	-
	Reserve Fund at Start of Year		$0	$6,039	$6,820	$6,820	$6,820	$6,820	$6,820	$6,820	$6,820	$6,820	$6,820	$6,820	$6,820	$6,820	$6,820	$6,820	-
	Portion of Total of Above	10.0%	$15	$619	$697	$697	$697	$697	$697	$697	$697	$697	$697	$697	$697	$697	$697	$697	-
	Cash Flow Before LRF Less % Above		($15)	$1,305	$3,929	$3,804	$2,824	$3,660	$3,890	($697)	$3,399	$3,311	$1,349	$3,249	$3,188	$2,973	$3,105	$1,568	-
	Input Required to Match LRF		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Return	Over Contribution Incl Govt Grant		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Opening Balance		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Input Excluding Govt Grant		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Return to Cash Flow		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Closing Balance		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0

CASE: 16 (No Debt)   ANDORJA MAGNETITE PROJECT, NORWAY - 3754 02-Aug-91 09:07 AM

GENERAL: Base Case. Kuliberget & Gropa Pits, Kuliberget U/G.
ECONOMICS: No inflation. No debt. No Acquisition Costs. Excludes: site development, road to mi..., pipeline from lake, power to plan..., ...
TAXES: Based on tax revisions per C&L letter of May 3/91. Cash distribution restricted by LRF requirements; interest on LRF.

All values in US dollars.

		-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	TOTAL
NORWAY INCOME TAX																		
+ Gross Revenue		$0	$13,838	$15,728	$15,728	$15,728	$15,728	$15,728	$15,689	$15,660	$15,660	$15,660	$15,660	$15,660	$15,660	$15,660	$4,099	$221,888
- Operating Costs		$0	($8,831)	($10,382)	($10,382)	($10,382)	($10,382)	($9,958)	($10,117)	($10,749)	($10,749)	($10,749)	($10,749)	($10,749)	($10,749)	($10,749)	($2,814)	($148,493)
- Interest Payment		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
= Net Income Before Depreciation		$0	$5,007	$5,346	$5,346	$5,346	$5,346	$5,770	$5,573	$4,911	$4,911	$4,911	$4,911	$4,911	$4,911	$4,911	$1,286	$73,395
- Buildings (Declining Balance)	5.00%	$0	($748)	($710)	($675)	($641)	($609)	($578)	($582)	($553)	($526)	($529)	($503)	($478)	($454)	($431)	($410)	($8,427)
- Equipment (Declining Balance)	20.00%	$0	($2,584)	($2,067)	($1,654)	($1,509)	($1,207)	($966)	($1,811)	($1,448)	($1,159)	($1,202)	($962)	($769)	($650)	($520)	($416)	($18,925)
= Net Income Before Losses		$0	$1,675	$2,568	$3,017	$3,196	$3,530	$4,226	$3,180	$2,909	$3,227	$3,180	$3,446	$3,664	$3,807	$3,959	$460	$46,043
+ Losses (Current and Prior Years)		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
= Federal Taxable Income		$0	$1,675	$2,568	$3,017	$3,196	$3,530	$4,226	$3,180	$2,909	$3,227	$3,180	$3,446	$3,664	$3,807	$3,959	$460	$46,043
Federal Income Tax	28.00%	$0	$469	$719	$845	$895	$988	$1,183	$890	$815	$903	$890	$965	$1,026	$1,066	$1,109	$129	
FEDERAL INCOME TAX - DETAILED CALCULATIONS																		
ALLOCATION TO TAX POOLS - No Inflation or Variance																		
Equipment		$14,130	$820	$0	$0	$0	$0	$0	$660	$0	$0	$600	$0	$0	$0	$0	$0	$16,210
Buildings		$12,530	$390	$0	$0	$930	$0	$0	$5,190	$0	$0	$1,375	$0	$0	$175	$0	$0	$20,590
No Write-off		$250	$2,184	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,434
		$26,910	$3,394	$0	$0	$930	$0	$0	$5,850	$0	$0	$1,975	$0	$0	$175	$0	$0	$39,234
ALLOCATION TO TAX POOLS - With Inflation & Variance																		
Buildings		$14,130	$820	$0	$0	$0	$0	$0	$660	$0	$0	$600	$0	$0	$0	$0	$0	$16,210
Equipment		$12,530	$390	$0	$0	$930	$0	$0	$5,190	$0	$0	$1,375	$0	$0	$175	$0	$0	$20,590
No Write-off		$250	$2,184	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,434
		$26,910	$3,394	$0	$0	$930	$0	$0	$5,850	$0	$0	$1,975	$0	$0	$175	$0	$0	$39,234
BUILDINGS																		
Net Income Available		$0	$5,007	$5,346	$5,346	$5,346	$5,346	$5,770	$5,573	$4,911	$4,911	$4,911	$4,911	$4,911	$4,911	$4,911	$1,286	$73,395
Maximum Deduction		$707	$748	$710	$675	$641	$609	$578	$582	$553	$526	$529	$503	$478	$454	$431	$410	$13,025
+ Opening Balance		$0	$14,130	$14,203	$13,492	$12,818	$12,177	$11,568	$10,990	$11,067	$10,514	$9,988	$10,059	$9,556	$9,078	$8,624	$8,193	$0
+ Current Input		$14,130	$820	$0	$0	$0	$0	$0	$660	$0	$0	$600	$0	$0	$0	$0	$0	$16,210
- Deduction	5.00%	$0	$748	$710	$675	$641	$609	$578	$582	$553	$526	$529	$503	$478	$454	$431	$410	$8,427
= Closing Balance		$14,130	$14,203	$13,492	$12,818	$12,177	$11,568	$10,990	$11,067	$10,514	$9,988	$10,059	$9,556	$9,078	$8,624	$8,193	$7,783	$7,783
EQUIPMENT																		
Net Income Available		$0	$4,259	$4,635	$4,671	$4,705	$4,737	$5,192	$4,990	$4,358	$4,385	$4,382	$4,408	$4,433	$4,457	$4,480	$876	$64,968
Maximum Deduction		$2,506	$2,584	$2,067	$1,654	$1,509	$1,207	$966	$1,811	$1,448	$1,159	$1,202	$962	$769	$650	$520	$416	$24,761
+ Opening Balance		$0	$12,530	$10,336	$8,269	$6,615	$6,036	$4,829	$3,863	$7,242	$5,794	$4,635	$4,808	$3,847	$3,077	$2,602	$2,081	$0
+ Current Input		$12,530	$390	$0	$0	$930	$0	$0	$5,190	$0	$0	$1,375	$0	$0	$175	$0	$0	$20,590
- Deduction	20.00%	$0	$2,584	$2,067	$1,654	$1,509	$1,207	$966	$1,811	$1,448	$1,159	$1,202	$962	$769	$650	$520	$416	$18,925
= Closing Balance		$12,530	$10,336	$8,269	$6,615	$6,036	$4,829	$3,863	$7,242	$5,794	$4,635	$4,808	$3,847	$3,077	$2,602	$2,081	$1,665	$1,665
LOSSES																		
Net Income Available		$0	$1,675	$2,568	$3,017	$3,196	$3,530	$4,226	$3,180	$2,909	$3,227	$3,180	$3,446	$3,664	$3,807	$3,959	$460	$46,043
+ Opening Balance		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
+ Losses in Current Year		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
- Losses From Prior Years		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
= Closing Balance		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0

CASE: 17A (67% Debt) ANDORJA MAGNETITE PROJECT, NORWAY - 3754 08-Aug-91 05:04 PM

GENERAL: Base Case. Kuliberget & Grepa Pits, Kuliberget U/G.
ECONOMICS: No inflation. 67% debt. No Acquisition Costs. Excludes: site development, road to mine, pipeline from lake, power to plant, dock.
TAXES: Based on tax revisions per C&L letter of May 3/91. Cash distribution restricted by LRF requirements; interest on LRF.

All values in US dollars.

FINAS FORMAT
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		-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	TOTAL
PRODUCTION AND OPERATING DATA																		
Production	Tonnes																	
Mined Ore	1,360,000 tonnes/yr	0	1,224,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	356,000	19,260,000
Remaining Reserves	End Of Year	19,260,000	18036000	16676000	15316000	13956000	12596000	11236000	9876000	8516000	7156000	5796000	4436000	3076000	1716000	356000	0	
Ore Grade	Magnetite Content	0.00%	27.92%	28.21%	28.21%	28.21%	28.21%	28.21%	28.13%	28.07%	28.07%	28.07%	28.07%	28.07%	28.07%	28.07%	28.07%	28.11%
	Product Content	0.00%	35.35%	35.71%	35.71%	35.71%	35.71%	35.71%	35.61%	35.53%	35.53%	35.53%	35.53%	35.53%	35.53%	35.53%	35.53%	35.59%
Saleable Production	Tonnes	0	432,576	485,611	485,611	485,611	485,611	485,611	484,241	483,204	483,204	483,204	483,204	483,204	483,204	483,204	126,486	6,853,783
Price Per Tonne	$/Tonne Product	$0.00	$31.99	$32.39	$32.39	$32.39	$32.39	$32.39	$32.40	$32.41	$32.41	$32.41	$32.41	$32.41	$32.41	$32.41	$32.41	$32.37
CALCULATIONS																		
Gross Revenue		$0	$13,838	$15,728	$15,728	$15,728	$15,728	$15,728	$15,689	$15,660	$15,660	$15,660	$15,660	$15,660	$15,660	$15,660	$4,099	$221,888
Operating Costs @ per Tonne Ore		$0	($8,200)	($9,751)	($9,751)	($9,751)	($9,751)	($9,327)	($9,486)	($10,118)	($10,118)	($10,118)	($10,118)	($10,118)	($10,118)	($10,118)	($2,649)	($139,494)
A&G		$0	($300)	($300)	($300)	($300)	($300)	($300)	($300)	($300)	($300)	($300)	($300)	($300)	($300)	($300)	($79)	($4,279)
Site Rental		$0	($231)	($231)	($231)	($231)	($231)	($231)	($231)	($231)	($231)	($231)	($231)	($231)	($231)	($231)	($60)	($3,294)
WHC Consultancy Fee		$0	($100)	($100)	($100)	($100)	($100)	($100)	($100)	($100)	($100)	($100)	($100)	($100)	($100)	($100)	($26)	($1,426)
Depreciation		$0	($2,577)	($2,902)	($2,454)	($2,251)	($1,897)	($1,609)	($2,445)	($2,043)	($1,717)	($1,758)	($1,486)	($1,264)	($1,118)	($962)	($835)	($27,317)
Net Operating Income		$0	$2,430	$2,444	$2,891	$3,095	$3,449	$4,161	$3,128	$2,868	$3,194	$3,153	$3,425	$3,647	$3,793	$3,949	$451	$46,078
Interest Payments		$0	($2,430)	($2,444)	($2,323)	($2,187)	($2,035)	($1,865)	($1,674)	($1,674)	($1,461)	($1,222)	($1,081)	($797)	($478)	($121)	$0	($21,793)
Net Income Before Tax		$0	$0	$0	$569	$908	$1,414	$2,296	$1,454	$1,193	$1,732	$1,931	$2,344	$2,850	$3,315	$3,827	$451	$24,285
Corporate Income Tax		$0	$0	$0	$0	($111)	($396)	($643)	($407)	($334)	($485)	($541)	($656)	($798)	($928)	($1,072)	($126)	($6,497)
Net After Norway Taxes		$0	$0	$0	$569	$797	$1,018	$1,653	$1,047	$859	$1,247	$1,390	$1,688	$2,052	$2,387	$2,756	$325	$17,788
Add Back Depreciation		$0	$2,577	$2,902	$2,454	$2,251	$1,897	$1,609	$2,445	$2,043	$1,717	$1,758	$1,486	$1,264	$1,118	$962	$835	$27,317
Salvage/Decommission/Recaptured Cash		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,108	$1,108
Principal Received		$18,030	$2,274	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$20,304
Government Grant		$6,189	$1,030	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$7,219
Capital Investments		($26,910)	($3,394)	$0	$0	($930)	$0	$0	($5,850)	$0	$0	($1,975)	$0	$0	($175)	$0	$0	($39,234)
Principal Payments		$0	($1,023)	($1,009)	($1,130)	($1,266)	($1,417)	($1,587)	$0	($1,778)	($1,991)	($1,173)	($2,371)	($2,656)	($2,974)	($1,011)	$0	($21,386)
Yearly Cash Flow		($2,691)	$1,464	$1,893	$1,893	$853	$1,497	$1,675	($2,359)	$1,124	$973	$0	$802	$661	$355	$2,708	$2,268	$13,116
Legal Reserve Fund	Contributions	$0	($722)	($1,019)	($917)	($85)	($382)	($538)	$0	$1,778	$1,886	$0	$0	$0	$0	$0	$0	$0
	Interest Earned	$0	$52	$125	$191	$198	$225	$264	$264	$136	($0)	($0)	($0)	($0)	($0)	($0)	($0)	$1,455
Cash Flow With LRF		($2,691)	$794	$999	$1,167	$965	$1,341	$1,400	($2,095)	$3,038	$2,860	$0	$802	$661	$355	$2,708	$2,268	$14,571
Company Debt (End Of Year)		$19,111	$20,363	$19,354	$18,224	$16,959	$15,541	$13,954	$13,954	$12,176	$10,185	$9,011	$6,640	$3,985	$1,011	$0	$0	

Cash Flow		Yearly	With LRF
DCFROR		ERR	35.9%
NPV	0.0%	$13,116	$14,571
	5.0%	$8,174	$8,552
	10.0%	$5,398	$5,168
	15.0%	$3,718	$3,151
	20.0%	$2,627	$1,883
	25.0%	$1,876	$1,046

CASE: 17A (67% Debt) ANBORJA MAGNETITE PROJECT, NORWAY - 3754 08-Aug-91 05:04 PM

GENERAL: Base Case. Kuliberget & Gropa Pits, Kuliberget U/G.
ECONOMICS: No inflation. 67% debt. No Acquisition Costs. Excludes: site development, road to mine, pipeline from lake, power to plant, dock.
TAXES: Based on tax revisions per C&L letter of May 3/91. Cash distribution restricted by LRF requirements; interest on LRF.

All values in US dollars.

PRODUCTION
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			-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	TOTAL
Annual Production Factor			0%	90%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	
Mined	Kuliberget Pit	tonnes	0	700,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	700,000
	Gropa Pit - A	tonnes	0	524,000	1,360,000	1,360,000	1,360,000	1,360,000	836,000	0	0	0	0	0	0	0	0	0	6,800,000
	Gropa Pit - B	tonnes	0	0	0	0	0	0	524,000	586,000	0	0	0	0	0	0	0	0	1,110,000
	Kuliberget U/G	tonnes	0	0	0	0	0	0	0	774,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	356,000	10,650,000
	Total	tonnes	0	1,224,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	356,000	19,260,000
Grade	Kuliberget Pit	27.71%	0	193,970	0	0	0	0	0	0	0	0	0	0	0	0	0	0	193,970
	Gropa Pit - A	28.21%	0	147,820	383,656	383,656	383,656	383,656	235,836	0	0	0	0	0	0	0	0	0	1,918,280
	Gropa Pit - B	28.21%	0	0	0	0	0	0	147,820	165,311	0	0	0	0	0	0	0	0	313,131
	Kuliberget U/G	28.07%	0	0	0	0	0	0	0	217,262	381,752	381,752	381,752	381,752	381,752	381,752	381,752	99,929	2,989,455
	Average	28.11%	0.00%	27.92%	28.21%	28.21%	28.21%	28.21%	28.21%	28.13%	28.07%	28.07%	28.07%	28.07%	28.07%	28.07%	28.07%	28.07%	28.11%
	Grade Factor	28.00% Base Grade	0.000	0.997	1.008	1.008	1.008	1.008	1.008	1.005	1.003	1.003	1.003	1.003	1.003	1.003	1.003	1.003	1.004
	Product Content	35.44% Product	0.00%	35.35%	35.71%	35.71%	35.71%	35.71%	35.71%	35.61%	35.53%	35.53%	35.53%	35.53%	35.53%	35.53%	35.53%	35.53%	35.59%
Reserves Year End	Kuliberget Pit		700,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Gropa Pit - A		6,800,000	6,276,000	4,916,000	3,556,000	2,196,000	836,000	0	0	0	0	0	0	0	0	0	0	
	Gropa Pit - B		1,110,000	1,110,000	1,110,000	1,110,000	1,110,000	1,110,000	586,000	0	0	0	0	0	0	0	0	0	
	Kuliberget U/G		10,650,000	10650000	10650000	10650000	10650000	10650000	10650000	9876000	8516000	7156000	5796000	4436000	3076000	1716000	356000	0	
	Total		19,260,000	18036000	16676000	15316000	13956000	12596000	11236000	9876000	8516000	7156000	5796000	4436000	3076000	1716000	356000	0	
Product	Heavy Media	250,000 tonnes/yr	0	224,390	251,875	251,875	251,875	251,875	251,875	251,164	250,625	250,625	250,625	250,625	250,625	250,625	250,625	65,605	3,554,908
	Pigment	500 tonnes/yr	0	405	500	500	500	500	500	500	500	500	500	500	500	500	500	131	7,036
	Toner	40 tonnes/yr	0	32	40	40	40	40	40	40	40	40	40	40	40	40	40	10	563
	Sinter Feed	149,860 tonnes/yr	0	134,508	150,984	150,984	150,984	150,984	150,984	150,558	150,235	150,235	150,235	150,235	150,235	150,235	150,235	39,326	2,130,954
	Super Slig	- tonnes/yr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Apatite	81,600 tonnes/yr	0	73,241	82,212	82,212	82,212	82,212	82,212	81,980	81,804	81,804	81,804	81,804	81,804	81,804	81,804	21,413	1,160,322
	Product	482,000 tonnes/yr	0	432,576	485,611	485,611	485,611	485,611	485,611	484,241	483,204	483,204	483,204	483,204	483,204	483,204	483,204	126,486	6,853,783
	Tailings	878,000 tonnes/yr	0	791,424	874,389	874,389	874,389	874,389	874,389	875,759	876,796	876,796	876,796	876,796	876,796	876,796	876,796	229,514	12,406,217
	Mined Ore	1,360,000 tonnes/yr	0	1,224,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000	356,000	19,260,000
Revenue		$/tonne																	
	Heavy Media	37.6% $23.50	$0	$5,273	$5,919	$5,919	$5,919	$5,919	$5,919	$5,902	$5,890	$5,890	$5,890	$5,890	$5,890	$5,890	$5,890	$1,542	83,540
	Pigment	3.5% $1,100	$0	$446	$550	$550	$550	$550	$550	$550	$550	$550	$550	$550	$550	$550	$550	$144	7,739
	Toner	10.1% $40,000	$0	$1,296	$1,600	$1,600	$1,600	$1,600	$1,600	$1,600	$1,600	$1,600	$1,600	$1,600	$1,600	$1,600	$1,600	$419	22,515
	Sinter Feed	22.6% $23.5[illegible]	$0	$3,161	$3,548	$3,548	$3,548	$3,548	$3,548	$3,538	$3,531	[illegible]	[illegible]	$3,531	$3,531	$3,531	$3,531	$924	50,077
	Super Slig	0.0% $40.00	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	0
	Apatite	26.1% $50.00	$0	$3,662	$4,111	$4,111	$4,111	$4,111	$4,111	$4,099	$4,090	$4,090	$4,090	$4,090	$4,090	$4,090	$4,090	$1,071	58,016
	Gross Revenue	100.0% $32.37	$0	$13,838	$15,728	$15,728	$15,728	$15,728	$15,728	$15,689	$15,660	$15,660	$15,660	$15,660	$15,660	$15,660	$15,660	$4,099	$221,888
	With Inflation		$0	$13,838	$15,728	$15,728	$15,728	$15,728	$15,728	$15,689	$15,660	$15,660	$15,660	$15,660	$15,660	$15,660	$15,660	$4,099	$221,888
	Unit Price	$/t Product	$0.00	$31.99	$32.39	$32.39	$32.39	$32.39	$32.39	$32.40	$32.41	$32.41	$32.41	$32.41	$32.41	$32.41	$32.41	$32.41	$32.37
		$/t Ore	$0.00	$11.31	$11.56	$11.56	$11.56	$11.56	$11.56	$11.54	$11.52	$11.52	$11.52	$11.52	$11.52	$11.52	$11.52	$11.52	$11.52

CASE: 17A (67% Debt) ANBORJA MAGNETITE PROJECT, NORWAY - 3754 08-Aug-91 05:04 PM

GENERAL: Base Case. Kuliberget & Gropa Pits, Kuliberget U/G.
ECONOMICS: No inflation. 67% debt. No Acquisition Costs. Excludes: site development, road to mine, pipeline from lake, power to plant, dock.
TAXES: Based on tax revisions per C&L letter of May 3/91. Cash distribution restricted by LRF requirements; interest on LRF.

All values in US dollars.

OPERATING COSTS

			-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	TOTAL
Mine:	Kuliberget Pit	$2.12 $/t Ore	$0	$1,566	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,566
	Gropa Pit - A	$3.56 $/t Ore	$0	$1,969	$4,842	$4,842	$4,842	$4,842	$2,976	$0	$0	$0	$0	$0	$0	$0	$0	$0	$24,312
	Gropa Pit - B	$2.75 $/t Ore	$0	$0	$0	$0	$0	$0	$1,441	$1,612	$0	$0	$0	$0	$0	$0	$0	$0	$3,053
	Kuliberget U/G	$3.83 $/t Ore	$0	$0	$0	$0	$0	$0	$0	$2,964	$5,209	$5,209	$5,209	$5,209	$5,209	$5,209	$5,209	$1,363	$40,790
Mill		$3.61 $/t Ore	$0	$4,664	$4,910	$4,910	$4,910	$4,910	$4,910	$4,910	$4,910	$4,910	$4,910	$4,910	$4,910	$4,910	$4,910	$1,285	$69,774
Other		- $/t Ore	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Sub-Total			$0	$8,200	$9,751	$9,751	$9,751	$9,751	$9,327	$9,486	$10,118	$10,118	$10,118	$10,118	$10,118	$10,118	$10,118	$2,649	$139,494
Management & Admin		$300 $1000/yr	$0	$300	$300	$300	$300	$300	$300	$300	$300	$300	$300	$300	$300	$300	$300	$79	$4,279
Site Rental		$231 $1000/yr	$0	$231	$231	$231	$231	$231	$231	$231	$231	$231	$231	$231	$231	$231	$231	$60	$3,294
WRC Consultancy Fee		$100 $1000/yr	$0	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$26	$1,426
Sub-Total			$0	$8,831	$10,382	$10,382	$10,382	$10,382	$9,958	$10,117	$10,749	$10,749	$10,749	$10,749	$10,749	$10,749	$10,749	$2,814	$148,493
Variance & Inflation			$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total		$1000	$0	$8,831	$10,382	$10,382	$10,382	$10,382	$9,958	$10,117	$10,749	$10,749	$10,749	$10,749	$10,749	$10,749	$10,749	$2,814	$148,493
		$7.71 $/t Ore	$0.00	$7.21	$7.63	$7.63	$7.63	$7.63	$7.32	$7.44	$7.90	$7.90	$7.90	$7.90	$7.90	$7.90	$7.90	$7.90	$7.71
1.	Production Factor		0.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.262	
2.	Assume labour percentage in first year =			50.0%															

CAPITAL COSTS

			-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	TOTAL
Mine	Building		$580	$820	-	-	-	-	-	$660	-	-	$600	-	-	-	-	-	$2,660
	Equipment		$2,530	$390	-	-	$930	-	-	$5,190	-	-	$1,375	-	-	$175	-	-	$10,590
Mill	Building		$6,847	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	$6,847
	Equipment		$10,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	$10,000
Other	Equipment		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	$0
Construction Indirects	Equipment		$1,996	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	$1,996
EPCM	Equipment		$2,193	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	$2,193
Contingency	Equipment		$2,414	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	$2,414
Sub-Total			$26,560	$1,210	$0	$0	$930	$0	$0	$5,850	$0	$0	$1,975	$0	$0	$175	$0	$0	$36,700
Start-Up			$100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	$100
Initial Inventories			$250	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	$250
Working Capital		2.5 months	-	$2,184	-	-	-	-	-	-	-	-	-	-	-	-	-	-	$2,184
Sub-Total			$26,910	$3,394	$0	$0	$930	$0	$0	$5,850	$0	$0	$1,975	$0	$0	$175	$0	$0	$39,234
Variance & Inflation			$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total			$26,910	$3,394	$0	$0	$930	$0	$0	$5,850	$0	$0	$1,975	$0	$0	$175	$0	$0	$39,234

CASE: 17A (67% Debt)   ANDORJA MAGNETITE PROJECT, NORWAY - 3754 08-Aug-91 05:04 PM

GENERAL: Base Case. Kuliberget & Gropa Pits, Kuliberget U/G.
ECONOMICS: No inflation. 67% debt. No Acquisition Costs. Excludes: site development, road to mine, pipeline from lake, power to plant, dock.
TAXES: Based on tax revisions per C&L letter of May 3/91. Cash distribution restricted by LRF requirements; interest on LRF.

All values in US dollars.			-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	TOTAL
LOANS																			
*****																			
Capital Basis for Debt Calculation			$26,910	$3,394	-	-	-	-	-	-	-	-	-	-	-	-	-	-	$30,304
Debt Principal	Opening Balance		$0	$19,111	$20,363	$19,354	$18,224	$16,959	$15,541	$13,954	$13,954	$12,176	$10,185	$9,011	$6,640	$3,985	$1,011	$0	$0
	Received	67.0%	$18,030	$2,274	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$20,304
	Accrued Interest		$1,082	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,082
	Principal Repaid		$0	($1,023)	($1,009)	($1,130)	($1,266)	($1,417)	($1,587)	$0	($1,778)	($1,991)	($1,173)	($2,371)	($2,656)	($2,974)	($1,011)	$0	($21,386)
	Closing Balance		$19,111	$20,363	$19,354	$18,224	$16,959	$15,541	$13,954	$13,954	$12,176	$10,185	$9,011	$6,640	$3,985	$1,011	$0	$0	($0)
Interest Expenses	Rate	12.00%	12.00%	12.00%	12.00%	12.00%	12.00%	12.00%	12.00%	12.00%	12.00%	12.00%	12.00%	12.00%	12.00%	12.00%	12.00%	12.00%	
	Calculated		$1,082	$2,430	$2,444	$2,323	$2,187	$2,035	$1,865	$1,674	$1,674	$1,461	$1,222	$1,081	$797	$478	$121	$0	$22,875
	Accrued, add to loan		($1,082)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	($1,082)
	Paid		$0	$2,430	$2,444	$2,323	$2,187	$2,035	$1,865	$1,674	$1,674	$1,461	$1,222	$1,081	$797	$478	$121	$0	$21,793
	Assume: Principal received mid-year. Repayments made at year end.																		
Repayment Schedule	Proposed		$2,371	$1,023	$1,009	$1,130	$1,266	$1,417	$1,587	$1,778	$1,778	$1,991	$2,230	$2,371	$2,656	$2,974	$3,331	$3,452	$66,889
	Outstanding Balance		$19,111	$21,386	$20,363	$19,354	$18,224	$16,959	$15,541	$13,954	$13,954	$12,176	$10,185	$9,011	$6,640	$3,985	$1,011	$0	$21,386
	Positive Cash Flow		$0	$2,487	$2,902	$3,023	$2,118	$2,915	$3,262	$0	$2,902	$2,965	$1,173	$3,173	$3,316	$3,330	$3,718	$2,268	$39,552
	Actual Payment		$0	$1,023	$1,009	$1,130	$1,266	$1,417	$1,587	$0	$1,778	$1,991	$1,173	$2,371	$2,656	$2,974	$1,011	$0	$21,386
	Year Count	13.0	0.0	1.0	1.0	1.0	1.0	1.0	1.0	0.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.0	13.0
Amortization Schedule	Loan Life		12.0 years																
	Total Debt		$21,386																
	Interest Rate		12.00%																
	Amortization Factor		0.1614																
	Interest (Actual)		$1,082	$2,430	$2,444	$2,323	$2,187	$2,035	$1,865	$1,674	$1,674	$1,461	$1,222	$1,081	$797	$478	$121	$0	
	Principal Proposed		$2,371	$1,023	$1,009	$1,130	$1,266	$1,417	$1,587	$1,778	$1,778	$1,991	$2,230	$2,371	$2,656	$2,974	$3,331	$3,452	
	Principal + Interest		$3,452	$3,452	$3,452	$3,452	$3,452	$3,452	$3,452	$3,452	$3,452	$3,452	$3,452	$3,452	$3,452	$3,452	$3,452	$3,452	
Ideal	Principal Balance		$21,386	$20,500	$19,507	$18,396	$17,151	$15,756	$14,194	$12,445	$10,486	$8,292	$5,835	$3,083	$0	$0	$0	$0	
	Interest		$2,566	$2,460	$2,341	$2,207	$2,058	$1,891	$1,703	$1,493	$1,258	$995	$700	$370	$0	$0	$0	$0	$20,044
	Principal		$886	$992	$1,112	$1,245	$1,394	$1,562	$1,749	$1,959	$2,194	$2,457	$2,752	$3,083	$0	$0	$0	$0	$21,386
	Principal + Interest		$3,452	$3,452	$3,452	$3,452	$3,452	$3,452	$3,452	$3,452	$3,452	$3,452	$3,452	$3,452	$0	$0	$0	$0	$41,429

CASE: 17A (67% Debt) ANDORJA MAGNETITE PROJECT, NORWAY - 3754 08-Aug-91 05:04 PM

GENERAL: Base Case. Kuliberget & Gropa Pits, Kuliberget U/G.
ECONOMICS: No inflation. 67% debt. No Acquisition Costs. Excludes: site development, road to mine, pipeline from lake, power to plant, dock.
TAXES: Based on tax revisions per C&L letter of May 3/91. Cash distribution restricted by LRF requirements; interest on LRF.

All values in US dollars.

LEGAL RESERVE FUND
****

			-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	TOTAL
LRF	Opening Balance		$0	$8,730	$10,482	$11,501	$12,419	$12,504	$12,885	$13,424	$13,804	$12,026	$10,140	$10,140	$10,140	$10,140	$10,140	$10,140	$0
	Input 1 Govt Grant + Excess Equity		$8,730	$1,030	$0	$0	$0	$0	$0	$380	$0	$0	$0	$0	$0	$0	$0	$0	$10,140
	Input 2 (% of Cash Flow)		$0	$146	$189	$189	$85	$150	$167	$0	$0	$0	$0	$0	$0	$0	$0	$0	$927
	Input 3 (% of Cash Flow Less LRF)		$0	$576	$830	$728	$0	$232	$371	$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,737
	Return to Cash Flow		$0	$0	$0	$0	$0	$0	$0	$0	($1,778)	($1,886)	$0	$0	$0	$0	$0	$0	($3,664)
	Closing Balance		$8,730	$10,482	$11,501	$12,419	$12,504	$12,885	$13,424	$13,804	$12,026	$10,140	$10,140	$10,140	$10,140	$10,140	$10,140	$10,140	$10,140
	Contribution From/To Cash Flow		$0	$722	$1,019	$917	$85	$382	$538	$0	($1,778)	($1,886)	$0	$0	$0	$0	$0	$0	($0)
Share Capital			$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	-
Revaluation Fund			$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	-
Company Debt (end of year)			$19,111	$20,363	$19,354	$18,224	$16,959	$15,541	$13,954	$13,954	$12,176	$10,185	$9,011	$6,640	$3,985	$1,011			-
Accumulated Grant			$6,189	$7,219	$7,219	$7,219	$7,219	$7,219	$7,219	$7,219	$7,219	$7,219	$7,219	$7,219	$7,219	$7,219	$7,219	$7,219	-
Accumulated Equity (Negative Cash Flow)			$2,691	$2,691	$2,691	$2,691	$2,691	$2,691	$2,691	$5,050	$5,050	$5,050	$5,050	$5,050	$5,050	$5,050	$5,050	$5,050	-
LRF Base 1	% of Share Capital	20%	$30	$30	$30	$30	$30	$30	$30	$30	$30	$30	$30	$30	$30	$30	$30	$30	-
LRF Base 2	Debt - Share Cap - Revaluation		$18,961	$20,213	$19,204	$18,074	$16,809	$15,391	$13,804	$13,804	$12,026	$10,035	$8,861	$6,490	$3,835	$861	$0	$0	-
LRF Used	Maximum of Above		$18,961	$20,213	$19,204	$18,074	$16,809	$15,391	$13,804	$13,804	$12,026	$10,035	$8,861	$6,490	$3,835	$861	$30	$30	-
Input 1	Government Grant		$6,189	$1,030	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$7,219
	Excess Equity over Share Capital		$2,541	$0	$0	$0	$0	$0	$0	$2,209	$0	$0	$0	$0	$0	$0	$0	$0	$4,600
	Govt Grant + Excess Equity		$8,730	$1,030	$0	$0	$0	$0	$0	$2,209	$0	$0	$0	$0	$0	$0	$0	$0	$11,818
	Input Required to Match LRF		$8,730	$1,030	$0	$0	$0	$0	$0	$380	$0	$0	$0	$0	$0	$0	$0	$0	$10,140
Input 2	Cash Flow Before LRF		$0	$1,464	$1,893	$1,893	$853	$1,497	$1,675	$0	$1,124	$973	$0	$802	$661	$355	$2,708	$2,268	$18,166
	% of Cash Flow Before LRF	10.0%	$0	$146	$189	$189	$85	$150	$167	$0	$112	$97	$0	$80	$66	$36	$271	$227	$1,817
	Input Required to Match LRF		$0	$146	$189	$189	$85	$150	$167	$0	$0	$0	$0	$0	$0	$0	$0	$0	$927
Input 3	Share Capital + Revaluation Fund		$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	-
	Reserve Fund at Start of Year		$0	$8,730	$10,482	$11,501	$12,419	$12,504	$12,885	$13,424	$13,804	$12,026	$10,140	$10,140	$10,140	$10,140	$10,140	$10,140	-
	Portion of Total of Above	10.0%	$15	$888	$1,063	$1,165	$1,257	$1,265	$1,304	$1,357	$1,395	$1,218	$1,029	$1,029	$1,029	$1,029	$1,029	$1,029	-
	Cash Flow Before LRF Less % Above		($15)	$576	$830	$728	($404)	$232	$371	($1,357)	($271)	($244)	($1,029)	($227)	($368)	($674)	$1,679	$1,239	
	Input Required to Match LRF		$0	$576	$830	$728	$0	$232	$371	$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,737
Return	Over Contribution Incl Govt Grant		$0	$0	$0	$0	$0	$0	$0	$0	$1,778	$1,991	$1,278	$3,649	$6,305	$9,279	$10,110	$10,110	$145,599
	Opening Balance		$0	$0	$722	$1,742	$2,659	$2,744	$3,126	$3,664	$3,664	$1,886	$0	$0	$0	$0	$0	$0	$20,207
	Input Excluding Govt Grant		$0	$722	$1,019	$917	$85	$382	$538	$0	$0	$0	$0	$0	$0	$0	$0	$0	$3,664
	Return to Cash Flow		$0	$0	$0	$0	$0	$0	$0	$0	($1,778)	($1,886)	$0	$0	$0	$0	$0	$0	($3,664)
	Closing Balance		$0	$722	$1,742	$2,659	$2,744	$3,126	$3,664	$3,664	$1,886	$0	$0	$0	$0	$0	$0	$0	$20,207

CASE: 17A (67% Debt)   ANDORJA MAGNETITE PROJECT, NORWAY - 3754 0[illegible]g-91 05:04 PM

GENERAL: Base Case. Kuliberget & Gropa Pits, Kuliberget U/G.
ECONOMICS: No inflation. 67% debt. No Acquisition Costs. Excludes: site development, road to mine, pipeline from lake, power to plant, dock.
TAXES: Based on tax revisions per C&L letter of May 3/91. Cash distribution restricted by LRF requirements; interest on LRF.

All values in US dollars.		-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	TOTAL
NORWAY INCOME TAX																		
+ Gross Revenue		$0	$13,838	$15,728	$15,728	$15,728	$15,728	$15,728	$15,689	$15,660	$15,660	$15,660	$15,660	$15,660	$15,660	$15,660	$4,099	$221,888
- Operating Costs		$0	($8,831)	($10,382)	($10,382)	($10,382)	($10,382)	($9,958)	($10,117)	($10,749)	($10,749)	($10,749)	($10,749)	($10,749)	($10,749)	($10,749)	($2,814)	($148,493)
- Interest Payment		($1,082)	($2,430)	($2,444)	($2,323)	($2,187)	($2,035)	($1,865)	($1,674)	($1,674)	($1,461)	($1,222)	($1,081)	($797)	($478)	($121)	$0	($22,875)
= Net Income Before Depreciation		($1,082)	$2,577	$2,902	$3,023	$3,159	$3,311	$3,905	$3,898	$3,237	$3,450	$3,689	$3,830	$4,114	$4,433	$4,790	$1,286	$50,520
- Buildings (Declining Balance)	5.00%	$0	($748)	($710)	($675)	($641)	($609)	($578)	($582)	($553)	($526)	($529)	($503)	($478)	($454)	($431)	($410)	($8,427)
- Equipment (Declining Balance)	20.00%	$0	($1,830)	($2,192)	($1,780)	($1,610)	($1,288)	($1,030)	($1,862)	($1,490)	($1,192)	($1,228)	($983)	($786)	($664)	($531)	($425)	($18,890)
= Net Income Before Losses		($1,082)	$0	$0	$569	$908	$1,414	$2,296	$1,454	$1,193	$1,732	$1,931	$2,344	$2,850	$3,315	$3,827	$451	$23,203
+ Losses (Current and Prior Years)		$1,082	$0	$0	($569)	($513)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
= Federal Taxable Income		$0	$0	$0	$0	$395	$1,414	$2,296	$1,454	$1,193	$1,732	$1,931	$2,344	$2,850	$3,315	$3,827	$451	$23,203
Federal Income Tax	28.00%	$0	$0	$0	$0	$111	$396	$643	$407	$334	$485	$541	$656	$798	$928	$1,072	$126	
FEDERAL INCOME TAX - DETAILED CALCULATIONS																		
ALLOCATION TO TAX POOLS - No Inflation or Variance																		
Equipment		$14,130	$820	$0	$0	$0	$0	$0	$660	$0	$0	$600	$0	$0	$0	$0	$0	$16,210
Buildings		$12,530	$390	$0	$0	$930	$0	$0	$5,190	$0	$0	$1,375	$0	$0	$175	$0	$0	$20,590
No Write-off		$250	$2,184	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,434
		$26,910	$3,394	$0	$0	$930	$0	$0	$5,850	$0	$0	$1,975	$0	$0	$175	$0	$0	$39,234
ALLOCATION TO TAX POOLS - With Inflation & Variance																		
Buildings		$14,130	$820	$0	$0	$0	$0	$0	$660	$0	$0	$600	$0	$0	$0	$0	$0	$16,210
Equipment		$12,530	$390	$0	$0	$930	$0	$0	$5,190	$0	$0	$1,375	$0	$0	$175	$0	$0	$20,590
No Write-off		$250	$2,184	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,434
		$26,910	$3,394	$0	$0	$930	$0	$0	$5,850	$0	$0	$1,975	$0	$0	$175	$0	$0	$39,234
BUILDINGS																		
Net Income Available		($1,082)	$2,577	$2,902	$3,023	$3,159	$3,311	$3,905	$3,898	$3,237	$3,450	$3,689	$3,830	$4,114	$4,433	$4,790	$1,286	$50,520
Maximum Deduction		$707	$748	$710	$675	$641	$609	$578	$582	$553	$526	$529	$503	$478	$454	$431	$410	$13,025
+ Opening Balance		$0	$14,130	$14,203	$13,492	$12,818	$12,177	$11,568	$10,990	$11,067	$10,514	$9,988	$10,059	$9,556	$9,078	$8,624	$8,193	$0
+ Current Input		$14,130	$820	$0	$0	$0	$0	$0	$660	$0	$0	$600	$0	$0	$0	$0	$0	$16,210
- Deduction	5.00%	$0	$748	$710	$675	$641	$609	$578	$582	$553	$526	$529	$503	$478	$454	$431	$410	$8,427
= Closing Balance		$14,130	$14,203	$13,492	$12,818	$12,177	$11,568	$10,990	$11,067	$10,514	$9,988	$10,059	$9,556	$9,078	$8,624	$8,193	$7,783	$7,783
EQUIPMENT																		
Net Income Available		($1,082)	$1,830	$2,192	$2,348	$2,518	$2,702	$3,327	$3,316	$2,683	$2,924	$3,159	$3,327	$3,636	$3,979	$4,359	$876	$42,093
Maximum Deduction		$2,506	$2,584	$2,218	$1,780	$1,610	$1,288	$1,030	$1,862	$1,490	$1,192	$1,228	$983	$786	$664	$531	$425	$25,576
+ Opening Balance		$0	$12,530	$11,090	$8,898	$7,119	$6,439	$5,151	$4,121	$7,449	$5,959	$4,767	$4,914	$3,931	$3,145	$2,656	$2,125	$0
+ Current Input		$12,530	$390	$0	$0	$930	$0	$0	$5,190	$0	$0	$1,375	$0	$0	$175	$0	$0	$20,590
- Deduction	20.00%	$0	$1,830	$2,192	$1,780	$1,610	$1,288	$1,030	$1,862	$1,490	$1,192	$1,228	$983	$786	$664	$531	$425	$18,890
= Closing Balance		$12,530	$11,090	$8,898	$7,119	$6,439	$5,151	$4,121	$7,449	$5,959	$4,767	$4,914	$3,931	$3,145	$2,656	$2,125	$1,700	$1,700
LOSSES																		
Net Income Available		($1,082)	$0	$0	$569	$908	$1,414	$2,296	$1,454	$1,193	$1,732	$1,931	$2,344	$2,850	$3,315	$3,827	$451	$23,203
+ Opening Balance		$0	$1,082	$1,082	$1,082	$513	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
+ Losses in Current Year		$1,082	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,082
- Losses From Prior Years		$0	$0	$0	$569	$513	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,082
= Closing Balance		$1,082	$1,082	$1,082	$513	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0