



# Golder Associates

CONSULTING GEOTECHNICAL AND MINING ENGINEERS

REPORT TO  
THE MINISTRY OF HOUSING  
ON

SUBSURFACE INVESTIGATIONS  
AND  
PRELIMINARY ENGINEERING ASSESSMENT  
SENIOR CITIZENS' BUILDING  
COBALT ONTARIO

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January 1988

871-1445

EXECUTIVE SUMMARY

The investigations carried out around the Senior Citizens' Building have disclosed no evidence that the building is endangered by the mining workings beneath the structure.

Two stopes have been identified to extend beneath the building:

- a relatively narrow (<3 m wide) north-south trending stope that occurs at about the centreline of the building, and
- a steeply dipping, complexly shaped stope following the sinuous #3 Vein that crosses under the eastern end of the building.

Drilling at the back (north) of the building indicates that rock crown pillar thicknesses over both stopes is greater than 6 m. Rock thicknesses over the same stopes at the front of the building have also been found to be greater than 6 m. This thickness of rock is considered sufficient to assure the foundation stability of the building; however, two factors cause concern, namely:

- the extreme variability of longitudinal crown pillar profiles seen elsewhere (2 m square raises coming up 3 to 6 m above general crown level on some stoping areas), and
- the cracking and settlement observed in some of the floors and internal walls in the northeast corner of the building directly overlying the #3 Vein stope.

Together these suggest the possibility of a higher excavation level and/or wider stope geometry under the central section of the east wing of the building than at the drilling locations outside the building.

Further investigations by direct or indirect means from the surface will not necessarily remove this uncertainty.

In order to be completely assured, it is recommended that the condition and geometry of the rock in the crown pillar be determined by direct inspection from within the stope. Such direct inspection could be carried out in conjunction with the repair works needed in the adjacent front lawn and Highway area, as discussed in a separate report.

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## 1. INTRODUCTION

Golder Associates has been retained by the Ministry of Housing, Ontario (MOH) to investigate foundation conditions at the Senior Citizens' Building in Cobalt, Ontario. This investigation was directed towards evaluating the stability of the building with respect to underground mine workings in the vicinity.

Detailed geophysical surveying and drilling in the area of the building has continued since August 1987 as part of Phase II of the investigation of the Hwy. 11B corridor (Figure 1). Drilling along the south face of the building at 6 m centres was initially conducted under Ministry of Northern Development and Mines (MND&M) funding to evaluate overburden and bedrock thicknesses along the front building line. Additional radar profiling and drilling funded by the Ministry of Housing on a priority basis has been carried out around the building. Most of the drilling has been undertaken on the north and east sides at locations where access permitted and where radar anomalies were detected. This drilling has been directed towards establishing rock conditions at depth and to evaluating the proximity of underground mine workings.

The results of radar profiling carried out around the building by A-Cubed Ltd. are summarized in this report and detailed in a separate report entitled "Ground Penetrating Radar Investigation at the Senior Citizens' Home in Cobalt, Ontario".

In total, some 600 line metres of radar profiling was carried out as an aid to improving the targetting of subsurface investigations which comprised:

- 23 diamond drillholes (460 m) and
- 3 boreholes (49 m)

Of this drilling, approximately one third (181 m) was funded directly by the MOH, the remainder was drilled under the highway investigation programme funded by MND&M.

Logs for all of the boreholes and drillholes put down in the area of the building are presented in Appendices A and B respectively. The logs for other drillholes and boreholes relating to the Highway investigation are presented in a separate report (871-1347-1).

Review was also carried out of the available records for the area of the Senior Citizens' Building in order to aid understanding, both of the mining workings and of the construction methodology used for the building. In this regard, the original architectural plans by B.H. Martin Consultants Ltd. and the 1973 soils report by Racey, MacCallum and Bluteau were reviewed. Discussions were also conducted with Town officials and with other members of the Community knowledgeable about the area of the building.

## 2. BACKGROUND INFORMATION

### 2.1 Mining Data

Extensive, but unfortunately often incomplete, planimetric information is available on the attitude and location of drifting carried out around the Senior Citizens' Building in the early 1900's period of mining in the Cobalt area.

This data has been previously presented in reports covering the Watermains and Phase I of the Highway 11B investigations, and therefore has not been repeated here. The interested reader is referred to Golder Associates' reports 851-1172, dated October 1985, 861-1255-5, dated March 1987 and 871-1289, dated August 1987. Figure 2 which summarizes this data, is however, included in this report. It presents a compilation of the upper three levels of drifts and known stoped-out veins as obtained from the old mining records. This figure also shows the area of the highway "cave-in" as it existed in June 1987. This cave-in has subsequently been repaired.

Unfortunately, even with diligent searching of old records, little detailed information has been found on the geometry of stoping carried out in the area of the Senior Citizens' Building, especially with reference to workings undertaken by the lessors in the 1930's depression years. One useful longitudinal section was found, though, (Figure 3); this outlines the extent of pre-1922 workings adjacent to the City shaft (which lies in the front lawn area just in front of the Senior Citizens' Building and, which had reportedly been capped - at least partially - in the 1970's). Information was therefore sought regarding the configuration of the capping of the shaft. No details could be found from either Agnico Eagle Mines Ltd.'s records or from the records of the District Mining Engineer's office in Kirkland Lake.

Figures 4 and 5 provide some information relating the location of the Senior Citizens' Building to property boundaries and to old surface features relating to mining activity. Figure 6 is a copy of the Architect's drawing of the building outline showing the then assumed location of the shaft.

Figure 5 is particularly interesting in this regard, as it shows the location of several fenced-in open excavations including the City shaft. This drawing has been photographically enlarged from its original 1 inch to 100 ft. scale to 1:500 to match other master plans in this report. The existing building outline has been plotted to relate the geometry of the surface mine workings with the building location. As can be seen, the City Shaft occurs in the front lawn area and the other raise/collar building is shown in the parking lot area on the property, just opposite Helen Street.

## 2.2 Previous Site Investigation Data

As part of the preparations for construction of the Senior Citizens' Building, a site investigation was carried out in January 1973, by the firm of Racey, MacCallum and Bluteau Ltd. Four test pits were dug to investigate overburden conditions and 1 drillhole was put down to investigate the presence of known mining workings.

The locations of the test pits and the drillhole put down as part of this 1973 investigation (as determined from the dimensions given in the soils report) are shown on Figure 7. The locations of boreholes and drillholes put down as part of the investigation reported herein are also shown on Figure 7.

The 1973 investigation provides some data of relevance to assessing subsurface foundation conditions beneath the building, specifically:.

- Borehole BH1 indicates about 4 m of overburden and proved 15 m of bedrock at the location of the hole. Our plotting of the location of this borehole based on the data shown in the original report indicates that it is some 5 m from the nearest drift.
- Test Pit 1 records 2.1 m (7 ft.) of fill partly comprised of an old foundation, steel pipes, floor slab concrete etc. over bedrock.
- Test Pits 2 and 4 show a 0.8 m (2 ft.) thickness of bouldery fill over 1.7-2.1 m (5-7 ft.) of native glacial till over bedrock, and
- Test Pit 3, which is reported to be typical of the entire north-east corner of the MOH property area, records at least 10 ft. of clean crushed rock (possibly an old waste or ore pile from earlier mining days).

### 2.3 Hearsay Information

The lack of documented data on the geometry and location of old mining related features in the vicinity is more than matched by the wealth of hearsay information on past events relating to the area.

According to several Townspeople, subsidence involving the settlement of a large pile of waste rock occurred to the east of the present Senior Citizens' Building at some time prior to construction of the building. Possibly,

the clean crushed rock found in test pit 3, discussed above, could constitute the remnants of this collapsed stockpile - the pre-construction topography shown on Figure 6 shows a marked hollow labelled as a "disturbed area" to the east of the building. Unfortunately, nothing factual could be found to substantiate these inferences.

Other hearsay information relates to the placing of the electric power supply poles across the front lawn of the property. Apparently, when installing the pole immediately in front of the building, the grounding rod disappeared into the ground. Again, confirmation of this was sought, but again reliable documentation could not be found.

### 3. CONDITION OF THE BUILDING FABRIC

At the start of drilling for the Phase II investigations along the Highway 11B corridor in front of the Senior Citizens' Building, a pre-condition inspection was conducted by Morrison Hershfield Limited under subcontract to Golder Associates. Nine houses along Highway 11B were surveyed in addition to the Senior Citizens' Building.

The inspections were carried out on September 14 to 16, 1987. The portion of the survey relating to the Senior Citizens' Building consisted of a visual review of the interior and exterior of the building, of the paved walkways and parking area and of the retaining wall at the northwest corner of the property.

The survey of the two-storey Senior Citizens' building noted that the walls were constructed of concrete block with brick facing and that the building has no basement. The exterior of the building was found to be in good condition. Some minor vertical cracks in the parging of the foundation wall and evidence of uneven settlement of patio stones were however identified. Elsewhere, outside the building, the paved walkways and parking area were found to be in good condition. Only occasional longitudinal cracks were observed. The edge of the concrete walkway at the northeast corner of the building was however noted to be spalling at the area where it meets the building foundation wall.

The interior inspection only included a visual survey of the common areas of the building, as access was not permitted to each individual apartment. Cracks and significant settlement were detected at the mortar joints

of the concrete block walls in the storage room, lavatory closet and garbage room located at the northeast corner of the ground floor.

In general, based on the visual survey of the building and immediate area, it was concluded by the inspection that little or no structural deterioration had occurred in the 14 year old building. However, no specific comments were made regarding the settlement found in some of the first floor rooms.

In view of the fact that the settlement cracking, shown by the photographs collected during the inspections of the first floor storage room, garbage room and toilet/laundry area, corresponded directly with the inferred location of the #3 Vein workings (see Figure 2) some diamond drillholes were positioned to pass obliquely under the building to check for the possibility of the cracking being influenced by the presence of underground workings.

#### 4. FIELD DATA ACQUISITION AND RESULTS

Detailed subsurface investigation of the area in front of the Senior Citizens' Home was started as a priority in September 1987 as the first segment of the phase II investigation for the Highway 11B corridor (see also report 871-1347-1).

Vertical diamond drilling and soil augering at nominal 6 m (20 ft.) centres were carried out along the front building line of the Senior Citizens' Building to establish foundation conditions and to provide assurance of adequate rock cover over any mine workings. The preliminary results of this drilling were reported in October 1987 (report 871-1347).

The drilling indicated that, at the building line:

- there is between 2 m and 5 m of overburden (mostly mine waste - sand and crushed stone over silty sand till), and
- rock mass conditions beneath the overburden are relatively good at the west end (RQD values >50% generally) deteriorating towards the east end (RQD's less than 20% typically).

Although rock conditions were found to be adequate along the entire building line drilled, the systematic drilling did identify the presence of the north-south trending stope shown on the mining drawings at about the location inferred from the old mine records (compare Figure 7 (1:100 scale drawing) with Figure 2). As crown pillar thicknesses were uncertain elsewhere around the building, particularly in the east wing, where settlement cracks were evident, a detailed radar survey was carried out.

The ground penetrating radar survey around the entire MOH property was completed on October 8 & 9, 1987 by A-Cubed Inc. using their pulse-EKKO I system. Over 600 line metres were completed; the detailed results of which are reported separately. Figure 8, however, summarizes these results.

Essentially, three major anomaly areas were identified:

- a zone in front of the building adjacent and around the City Shaft and #1 Vein Stope location,
- a zone on the north side of the building where the narrow N-S stope was known to join from the City shaft to a raise in the back-yard of house #45 Galena Street, and
- a zone north-east of the building including much of the parking lot area where numerous anomalies were detected - notably in the area inferred from the 1973 site investigation test pit 3 and from Figures 2 and 7 to constitute the possible surface expression of the #3 vein stope.

In addition, some localized anomalous zones were identified adjacent to the south end of the west wall of the building (see Figure 8).

Follow-up drilling of the three major target zones, in areas immediately adjacent to the building, was subsequently conducted with funding provided by MOH. Three diamond cored holes were drilled north of the building; three holes were put down on the east side of the building and two holes (additional to the drilling along the building line, carried out as part of the Highway

investigation) were added on the south (front) side of the Senior Citizens' building.

All of the drilling of these new cored holes was carried out using a Boyles BBS-2 rig operated by McKnight Drilling Company, ie. the same contractor as used for the initial diamond coring carried out in September along the front building line.

The locations of the cored holes are shown on Figure 7; and detailed data on subsurface conditions is provided on the series of longitudinal and cross sections shown on Figures 9 to 20. Figure 21, provides a key index plan to the section locations.

In Galena Street to the west of the building, a series of airtrack holes were drilled as part of the Highway investigation to examine the City #1 Vein Stope at this location. The results of this airtrack drilling are also shown on Figure 7, in a coded form as follows:

- open circles, where a bedrock thickness of greater than 6 m was encountered beneath the overburden,
- half open/half black circles, representing "break-through" to a stope where a rock cap between 3 m and 6 m thick still exists,
- black triangles representing "breakthrough" to a stope where a rock cap less than 3 m thick exists, and
- black circles, where an open void or loosely backfilled stope was encountered with no rock crown pillar and only overburden or timbers bridging over the stope crown.

Based on the data from these holes and from the diamond drillholes, shading has been added to Figure 7 to indicate the zones where thin or presumed absent rock crown pillar is inferred. It should be noted that as only widely spaced vertical and angled diamond drilling was carried out in front of the Senior Citizens' Building, rather than a detailed programme of airtrack gridding, some interpolation has been made of the boundaries of the areas of thin rock, and of open zones adjacent to the concrete cap of the shaft.

A detailed description of the rationale for the various oriented drill holes put down in the front lawn area of the MOH property area is given in a separate report addressed to the Phase II investigation of the highway (871-1347-1). Within this report only the geometry of the workings close to the building has been addressed.

Sections BB (Figure 10), CC (Figure 11) and DD (Figure 12) provide the principal reference drawings. These are essentially drawn parallel to the front and back building lines.

Two stopes were found to run under the building (see Figure 7); the #3 Vein Stope and an unnamed north-south stope at about the centreline of the building.

The #3 Vein Stope appears to accurately follow the old mine records, running from the City Shaft towards the northeast. Based on detailed drilling in the front of the building, the stope passes from the shaft eastwards under the building at the west corner of the entrance (Figure 7 and Figure 11). Drilling of DDH87-62 located the sidewall of the stope under the storage room, below the area where the pre-condition survey had found noticeable settlement cracks. At the back of the building DDH87-64 and DDH87-66 failed to intercept the

stope to the depth drilled (see Figure 12). At these holes, rock quality was not found to be high, RQD's ranging from 20 to 60%.

The crown was drilled at the front of the building by (DDH87-65) and some detailed data was gained on crown conditions. In this location, rock quality was found to vary considerably (RQD's ranging between zero and 80% throughout). No flush return was experienced in this hole below a depth of 7 m along hole, possibly as a result of open fractures connected with the stope. Iron staining on bedrock fracture surfaces was also common in the top 4 m of the rock beneath the overburden which was found to consist of approximately 2.5 m of loose, brown, sandy fill over 3.0 m of dense light brown sandy silt till with some boulders.

Although precise details of the stope geometry were not obtained, based on correlation with the mining records, the #3 Vein Stope appears to have a maximum width of about 3 m and to be at a depth of approximately 10 m at the front of the building and greater than 12 m at the rear. The geometry of the stope crown under the building however, was not determinable.

The geometry of the second N-S stope running under the middle of the building was also not clearly defined from the limited programme of drilling possible at each extremity. Current best estimates of the geometry are shown on Figures 7, 10 and 12. The thickness of the crown pillar over this stope is estimated at 7 m near the front wall (Figure 10) and at least the same depth at the rear (Figure 12); south from the building the rock crown pillar thickness decreases to 4 m at 1 m from the City Shaft (Figure 17). Rock quality in this area of the crown pillar at the building line is poor; RQD's ranging

from 10 to 40%. Drilling at the back of the building located the wall of the same stope at 30 m depth (Figure 12). Rock quality in this area, though, was found to be better, typically in the 40 to 60% range.

Despite careful attempts to locate the raise in the vicinity of the access stairway and path to the Senior Citizens' Building (refer Figure 5), positive proof of its location and geometry was not found. Several holes including DDH87-57 and DDH87-50 were drilled specifically to intersect this feature. Hole DDH87-57 did not encounter any underground workings while hole DDH87-50 intersected a drift or stoped-out area under the parking lot. The locations of these holes with respect to the estimated raise location are shown on Figure 7.

Although the raise was not identified in these drill-holes, its reported location has also been included on Figure 22, which presents an overall summary plan of areas of concern beneath and around the Senior Citizens' Building.

## 5. CONCLUSIONS AND RECOMMENDATIONS

The location of underground mine workings identified in this investigation, in the immediate vicinity of the Senior Citizens' Building, as shown on Figure 22, do not give cause for concern for the current stability of the building. There is however, significant concern for parts of the lawn area in front of the building as any cave-in of this area could encroach on the building. Recommendations for the repair of this area are given in our Report 871-1347-1.

The investigation carried out around the building, while sufficient for delineating the location of stopes in the area, has not identified the reasons for the cracking in the building at locations over the #3 Vein Stope. Rock crown pillar thicknesses over the stope, as established at the front and rear of the building, should be sufficient to prevent collapse; however, this cannot be confirmed in the area under the building where access for drilling was not available. Elsewhere in the area, significant variability has been identified in the longitudinal crown pillar profile of many of the stopes. It is possible that the settlement cracking seen in the building could be caused by a raise on similar variation in stope crown geometry akin to the area of thin rock crown pillar identified under Galena Street (Figure 9).

Further drilling would not be conclusive in determining whether or not a raise is present. It is recommended, therefore, that, during repair of the crown pillar in the area of the City Shaft, access is gained to the underground workings so that an inspection can be carried out from the mine workings. It is likely that inspection of the City #1 Stope crown can be carried out from a raft floating on the existing water level (elevation 291 m approx.) although some pumping to lower the general water

level may be required in order to allow inspection along the #3 Vein Stope.

In addition, it should be noted that the investigation presented in this report has been confined to the building foundation area. Further, subsurface evaluation of the car park area is warranted and should be carried out. This should, however, await the results of the proposed underground inspection of the #3 Vein stope area.

GOLDER ASSOCIATES

  
T.G. Carter, P. Eng.

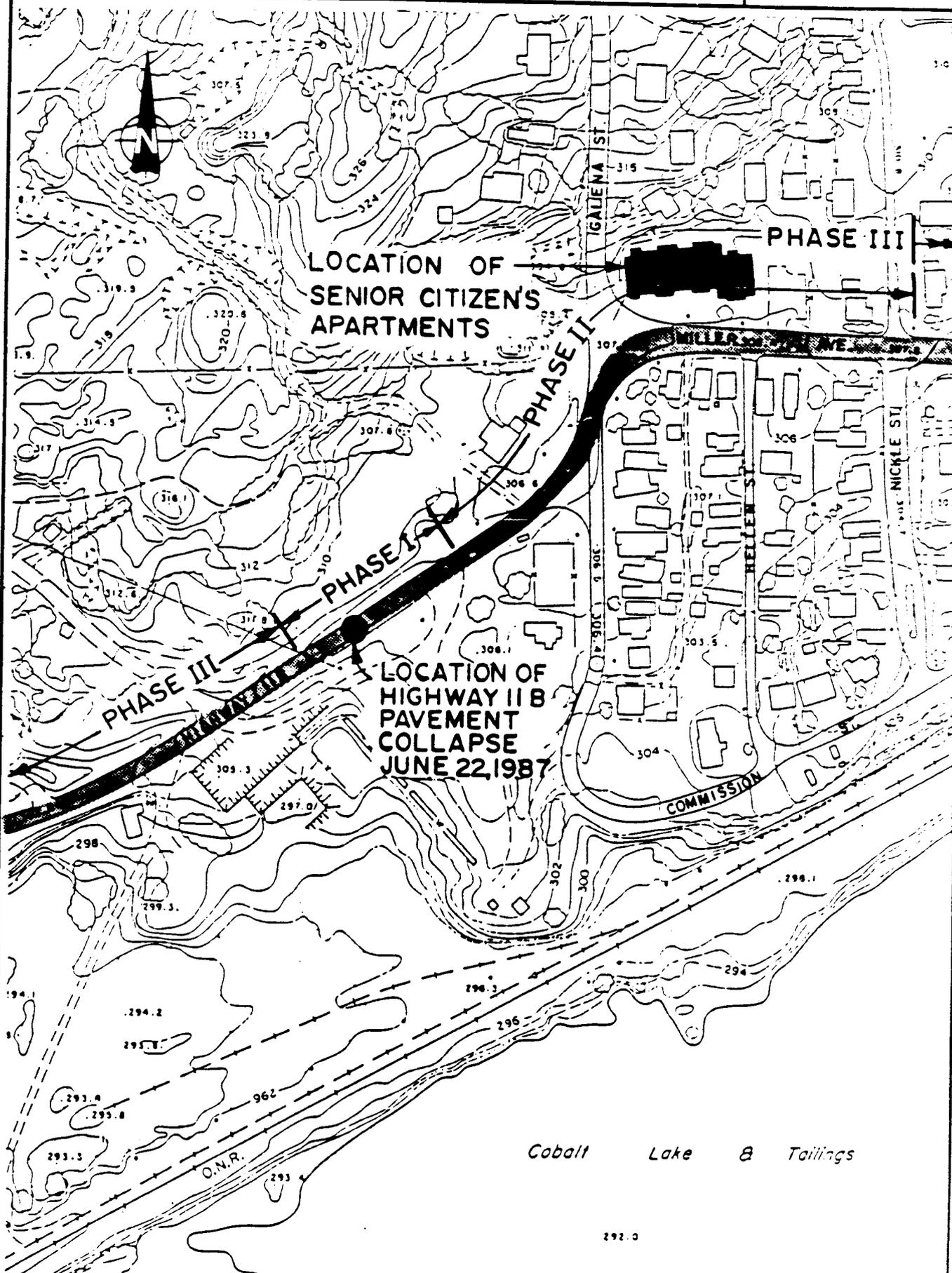
  
J.R. Busbridge, P. Eng.



TGC/JRB/dh

SITE LOCATION PLAN  
( SOUTH WEST CORNER OF TOWN OF COBALT )

FIGURE 1



Date OCT. 14, 1987  
Project 871-1445

SCALE 1:2,000

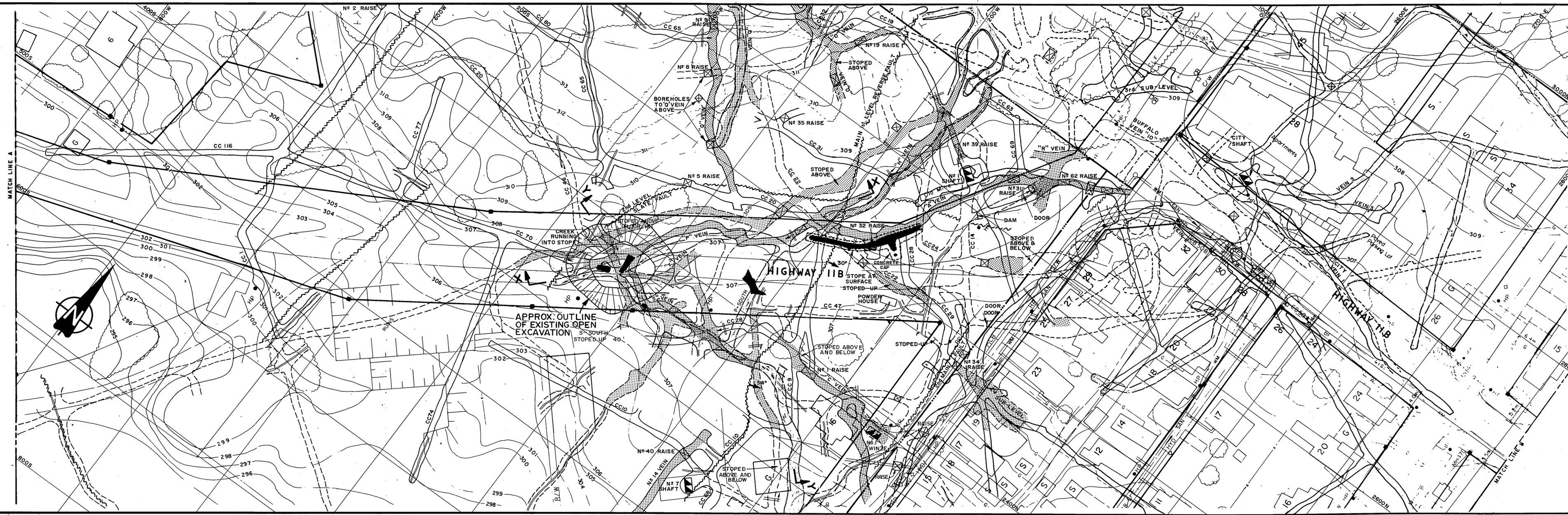
**Golder Associates**

Drawn LJO  
Chkd TJC

FOR UNPRODUCED PAGES

FORM G (A) 10-81 in (m) 1/1984

COMPOSITE PLAN SHOWING 'CROWN' PILLAR BREAKTHROUGH LOCATIONS AND OTHER NEAR SURFACE WORKINGS IN VICINITY OF HIGHWAY 11 B INTERSECTION AND MILLER AVENUE



LEGEND

- UNDERGROUND WORKINGS
- EL. 820' (250m)
  - EL. 918' (280m.) TOWNSITE
  - EL. 899' (271m.) BUFFALO
  - EL. 874' (266m.) CITY
  - ELEV. 950' (290m.)
  - ▣ 2 COMPARTMENT SHAFTS/WINZES
  - ▣ RAISES
  - ✂ DRIFT INACCESSIBLE BEYOND X-LINES (1946 INFORMATION)
  - ▨ STOPED OUT VEINS
  - SILVER VEINS IN PLACE
  - ~ FAULTS
  - MINING PROPERTY BOUNDARIES
  - ▩ AREAS WITH NO ROCK CAP ABOVE MINED OPENINGS

NOTES

1. GRID SHOWN IS 100 FT. GRID FOR MINING LAYOUT PLANS.

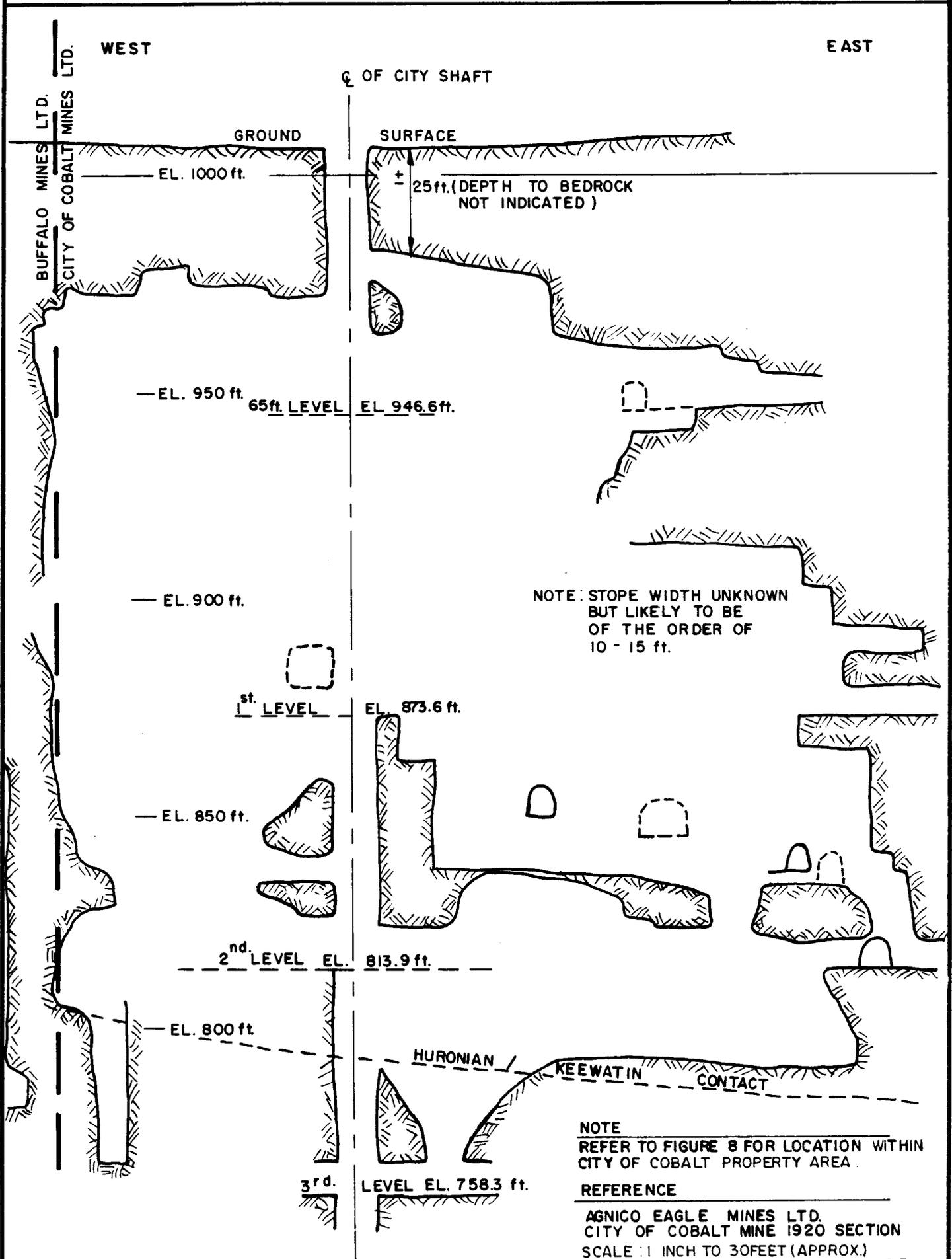
REFERENCE

1. 1" to 40' scale composite plan and 1st, 2nd, and 3rd level plans Buffalo property dated 1916, with some later pencil annotations (records from Agnico Eagle Mines Ltd.)
2. 1" to 40' scale composite plans for 1st and 2nd levels for Townsite, City and Buffalo Mine showing summary geology (from Agnico Eagle Mines Ltd.)
3. 1" to 40' scale 1st and 2nd level plans of Townsite property, pencil annotated prints marked "H.A. Kenty June 3, 1946, provided by Agnico Eagle Mines Ltd.
4. 1" to 40' scale and 1" to 20' scale tracings for 65ft, 1st and 2nd level for City of Cobalt property annotated in places by H.A. Kenty (from Agnico Eagle Mines Ltd.)
5. Sundry untitled stope sections and level plans for the Townsite, City and Buffalo workings

SCALE 1:500

**SECTION ALONG MILLER AVENUE THROUGH CITY SHAFT AND VEIN - I STOPE**

**FIGURE 3**



Date OCT 2, 1985  
Project 871-1445

**Golder Associates**

Drawn G.P.  
Chkd. J.L.

FORM G.A.-D-9 (M)

1973 O.L.S. SURVEY PLAN OF SENIOR CITIZEN BUILDING  
 LOCATION AND PROPERTY BOUNDARIES

FIGURE 4



PLAN SHOWING LOCATION OF BUILDING ON  
 PART OF HELEN STREET (CLOSED)  
 LOTS 473 · 474 and PART OF LOTS 459 · 460  
 PLAN M 47 N.B.  
 TOWN OF COBALT  
 SCALE - 1 INCH = 30 FEET

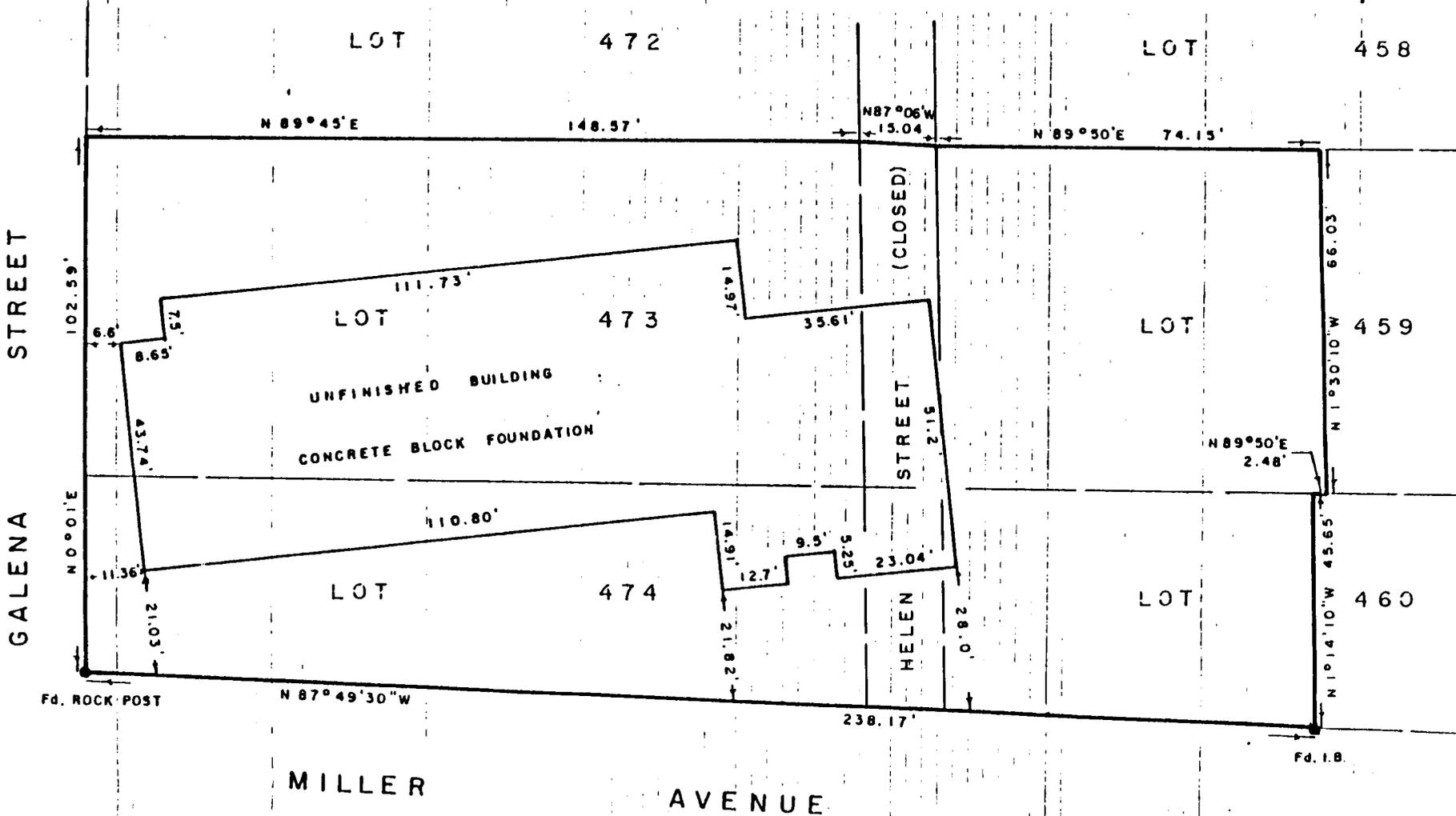
*D. F. Adamus*  
 D. F. ADAMUS  
 ONTARIO LAND SURVEYOR

NEW LISKEARD · ONTARIO  
 NOVEMBER 19, 1973.

Date JAN. 13, 1988  
 Project 871-1445

Golder Associates

Drawn L.O.  
 Chkd *TL*



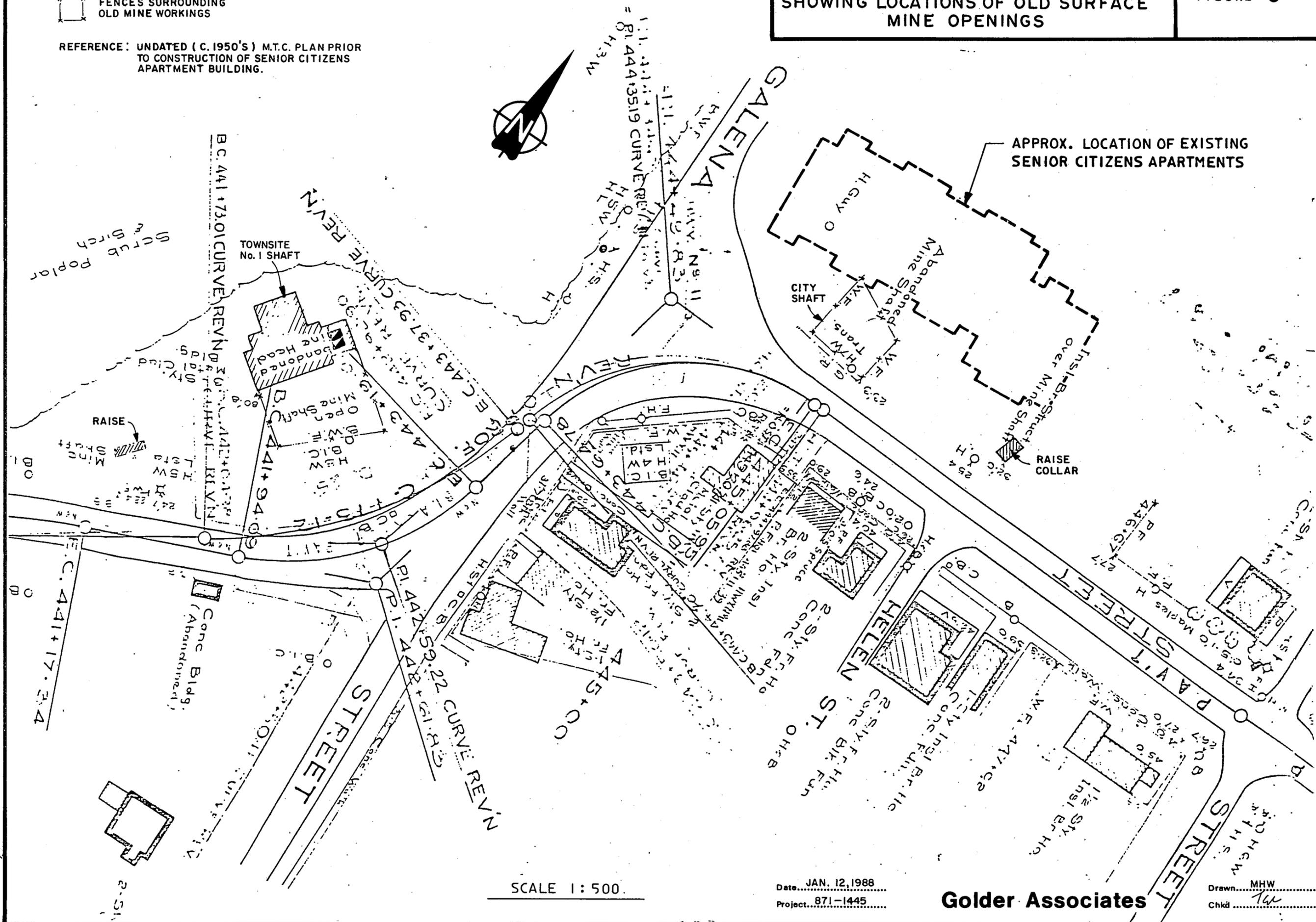
NOTES 1034 / 13

LEGEND

FENCES SURROUNDING OLD MINE WORKINGS

REFERENCE: UNDATED (C. 1950'S) M.T.C. PLAN PRIOR TO CONSTRUCTION OF SENIOR CITIZENS APARTMENT BUILDING.

HIGHWAY 11B REALIGNMENT INFORMATION SHOWING LOCATIONS OF OLD SURFACE MINE OPENINGS



SCALE 1:500

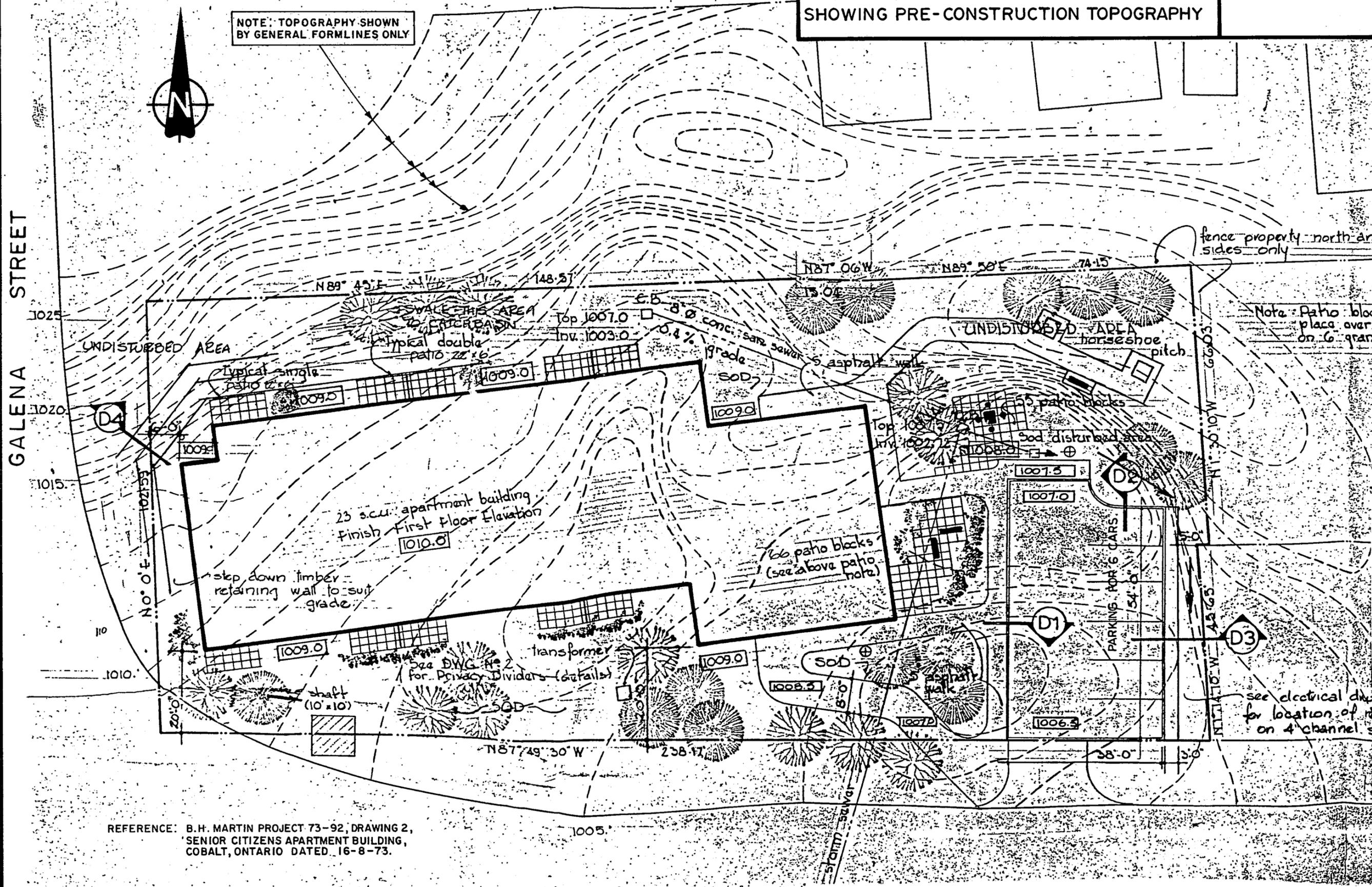
Date: JAN. 12, 1988  
Project: 871-1445

Golder Associates

Drawn: MHW  
Chkd: TGW

ARCHITECTURAL LAYOUT FOR  
SENIOR CITIZENS BUILDING  
SHOWING PRE-CONSTRUCTION TOPOGRAPHY

FIGURE 6



NOTE: TOPOGRAPHY SHOWN BY GENERAL FORMLINES ONLY



GALENA STREET

1025  
1020  
1015  
1010

REFERENCE: B.H. MARTIN PROJECT 73-92, DRAWING 2,  
SENIOR CITIZENS APARTMENT BUILDING,  
COBALT, ONTARIO DATED 16-8-73.

MILLER AVE

Date: JAN. 13, 1988  
Project: 871-1445

SCALE 1:250  
**Golder Associates**

Drawn: MHW  
Chkd: [Signature]

manhole (benchmark)  
top 1008.33

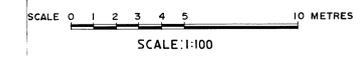


**LEGEND**

- AREAS WITH NO ROCK CAP ABOVE MINED OPENINGS
- AREAS WITH LESS THAN 3.0m OF ROCK CAP COVER
- DRILLED LOCATIONS**
- HOLE NUMBER
- NO BEDROCK ENCOUNTERED ABOVE MINED OPENINGS (OVERBURDEN THICKNESS IN)
- LESS THAN 3.0m OF BEDROCK ABOVE MINED OPENINGS
- FROM 3 TO 6m OF BEDROCK ABOVE MINED OPENINGS
- GREATER THAN 6m OF BEDROCK ENCOUNTERED
- BREAK THROUGH INTO MINE STOPE
- ANGLED DIAMOND DRILLHOLES
- DIAMOND DRILLHOLES AND AUGER HOLES  
REFER TO PERCUSSION HOLES ONLY
- UNDERGROUND WORKINGS - DRIFTS, CROSS-CUTS, STOPES**
- ELEV. 950FT. (290m) UPPER SUB-LEVEL CITY COBALT 65' LEVEL
- ELEV. 918FT. (280m) TOWNSITE 1ST LEVEL CITY OF COBALT 1ST LEVEL
- ELEV. 874FT. (266m) TOWNSITE 1ST LEVEL CITY OF COBALT 1ST LEVEL
- ELEV. 820FT. (250m) TOWNSITE 2ND LEVEL CITY OF COBALT 2ND LEVEL
- RAISES
- 2 COMPARTMENT SHAFT
- CHAIN LINKED FENCING
- BOREHOLE LOCATION IN PLAN
- TEST PIT LOCATION IN PLAN
- APPROXIMATE LINE OF CLEAN BOULDER FILL (PROBABLY MINE WASTE ROCK)

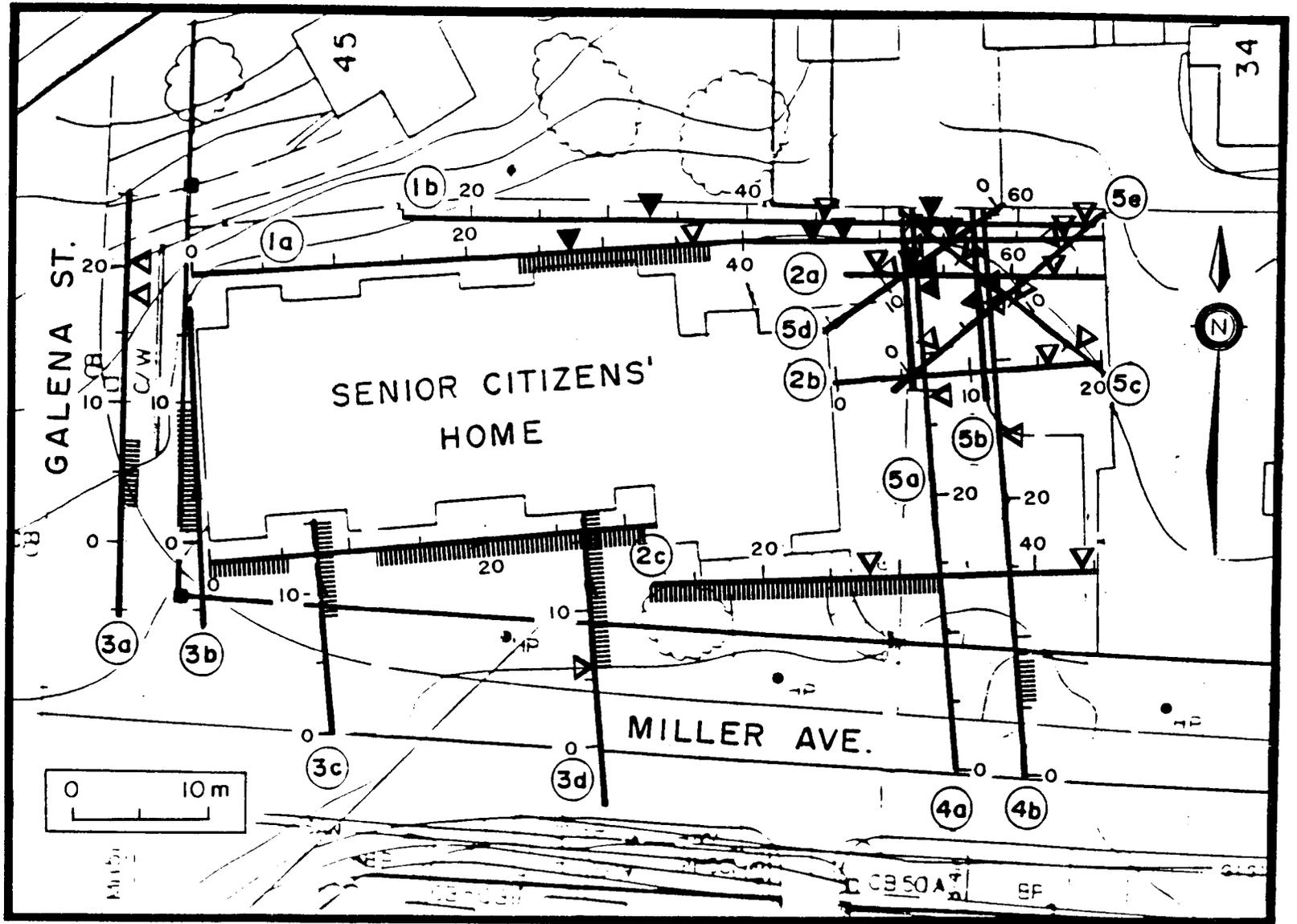
**REFERENCE**

BOREHOLE, TEST PIT LOCATIONS AND APPROXIMATE LINE OF CLEAN BOULDER FILL OBTAINED FROM FIGURE 1 1973 INVESTIGATION BY RACEY, McCALLUM & BLUTEAU LTD.



RADAR ANOMALY MAP OF AREA  
AROUND THE SENIOR CITIZENS HOME

FIGURE 8

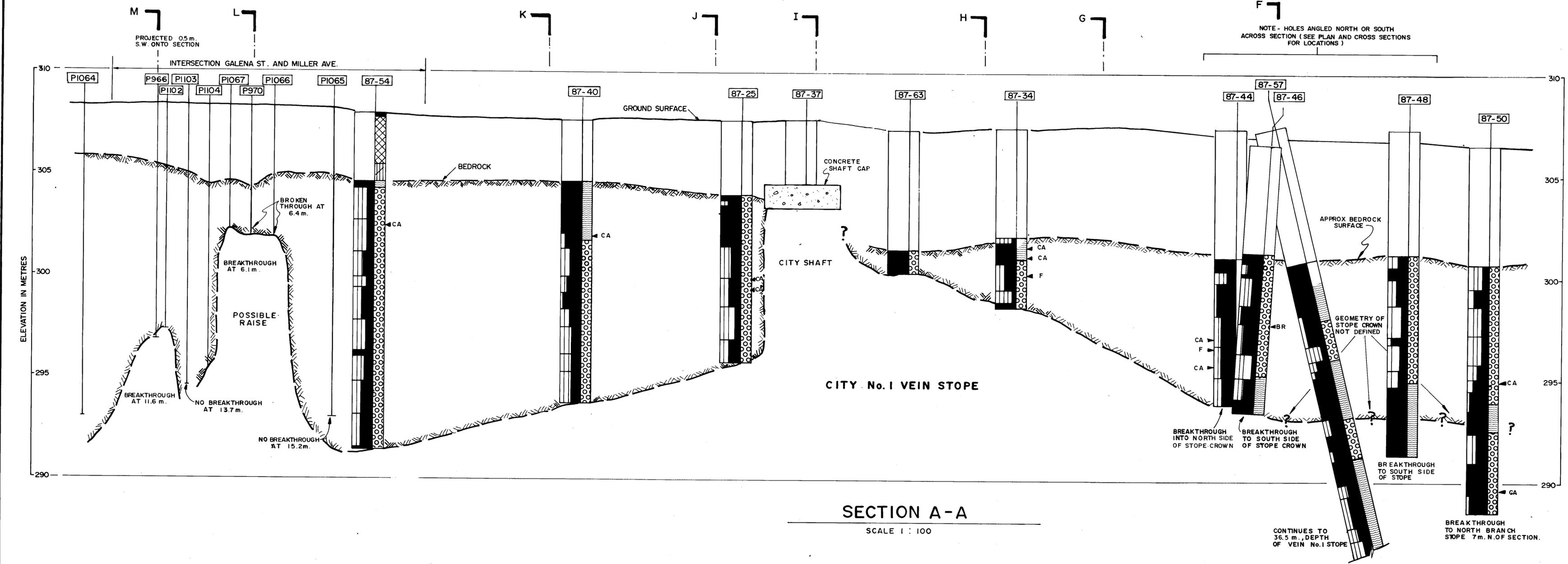


REFERENCE:  
A-CUBED INC. PROJECT 5073D FIGURE 4

Date JAN. 13 1988  
Project 871-1445

Continous Zone of Reflections  
Golder Associates

Drawn JCF  
Checked TAC



SECTION A-A

SCALE 1 : 100

LEGEND

- EXISTING GROUND LEVEL
- OVERBURDEN / BEDROCK INTERFACE
- INTERPOLATED OUTLINE OF UNDERGROUND OPENINGS
- PI069 ... PROBEHOLE IN ELEVATION
- BH 87-1
- BOREHOLE IN ELEVATION ...
- 87-29 DIAMOND DRILLHOLE IN ELEVATION
- SYMBOLIC LOG - LITHOLOGY SEE DESCRIPTIONS BELOW
- ROCK QUALITY DESIGNATION (RQD) - PERCENT

STRUCTURAL SYMBOLS

- BR ► BRECCIA
- SH ► SHEARED ZONE
- W ► WOOD ENCOUNTERED
- F ► FAULT
- CA ► CALCITE VEIN
- \* ► ZONE OF WATER LOSS

LITHOLOGY

OVERBURDEN

- BROWN SAND AND GRAVEL & FILL RANDOM MINE WASTE ROCK
- BROWN SAND AND GRAVEL WITH MINOR CLAY AND SUBROUNDED BOULDERS UP TO 2m. - TILL
- SANDY SILT WITH MINOR CLAY AND BOULDERS
- UNDIFFERENTIATED OVERBURDEN

BEDROCK

- ARGILLITE - GREYISH GREEN, FINE GRAINED, MINOR CHLORITIC ALTERATION, OCCASIONAL CALCITE HEALED FRACTURES AND QUARTZ STRINGERS, TRACE PYRITE.
- CONGLOMERATE - PINKISH GREY TO GREENISH GREY, MASSIVE, FINE GRAINED, SUBROUNDED SAND TO GRAVEL SIZE CLASTS, OCCASIONAL CARBONATE FRACTURES, TRACE PYRITE.

- NOTES
- REFER TO FIGURE 21 FOR LOCATION OF SECTIONS.
  - REFER TO APPENDIX A FOR DETAILED LITHOLOGICAL DESCRIPTIONS AT HOLE LOCATIONS.
  - THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT.

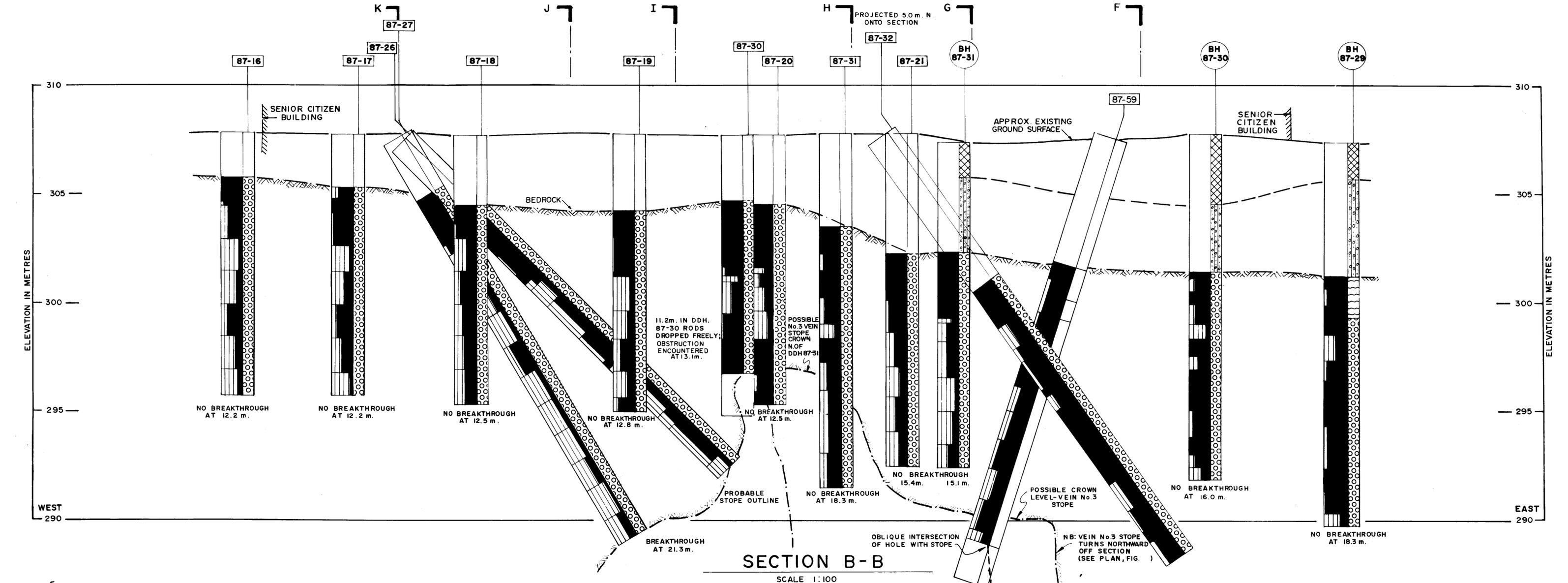
Date... DEC. 16, 1987  
Project... 87-1445

Golder Associates

Drawn... I.G.  
Chkd... T.C.

LONGITUDINAL SECTION B-B  
ALONG THE SOUTH SIDE OF  
SENIOR CITIZENS APARTMENT BUILDING

FIGURE 10



**LEGEND**

- EXISTING GROUND LEVEL
- OVERBURDEN / BEDROCK INTERFACE
- INTERPOLATED OUTLINE OF UNDERGROUND OPENINGS
- PROBEHOLE IN ELEVATION (P1069)
- BOREHOLE IN ELEVATION (BH 87-1)
- DIAMOND DRILLHOLE IN ELEVATION (87-29)
- SYMBOLIC LOG - LITHOLOGY (SEE DESCRIPTIONS BELOW)
- ROCK QUALITY DESIGNATION (RQD) - PERCENT

**STRUCTURAL SYMBOLS**

- BR BRECCIA
- SH SHEARED ZONE
- W WOOD ENCOUNTERED
- F FAULT
- CA CALCITE VEIN
- \* ZONE OF WATER LOSS

**LITHOLOGY**

**OVERBURDEN**

- BROWN SAND AND GRAVEL & RANDOM MINE WASTE ROCK
- BROWN SAND AND GRAVEL WITH MINOR CLAY AND SUBROUNDED BOULDERS UP TO 2m. - TILL
- SANDY SILT WITH MINOR CLAY AND BOULDERS
- UNDIFFERENTIATED OVERBURDEN

**BEDROCK**

- ARGILLITE - GREYISH GREEN, FINE GRAINED, MINOR CHLORITIC ALTERATION, OCCASIONAL CALCITE HEALED FRACTURES AND QUARTZ STRINGERS, TRACE PYRITE.
- CONGLOMERATE - PINKISH GREY TO GREENISH GREY, MASSIVE, FINE GRAINED, SUBROUNDED SAND TO GRAVEL SIZE CLASTS, OCCASIONAL CARBONATE FRACTURES, TRACE PYRITE

- NOTES**
- REFER TO FIGURE 21 FOR LOCATION OF SECTIONS.
  - REFER TO APPENDIX A FOR DETAILED LITHOLOGICAL DESCRIPTIONS AT HOLE LOCATIONS.
  - THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT.

SECTION B-B  
SCALE 1:100

SCALE 1:100

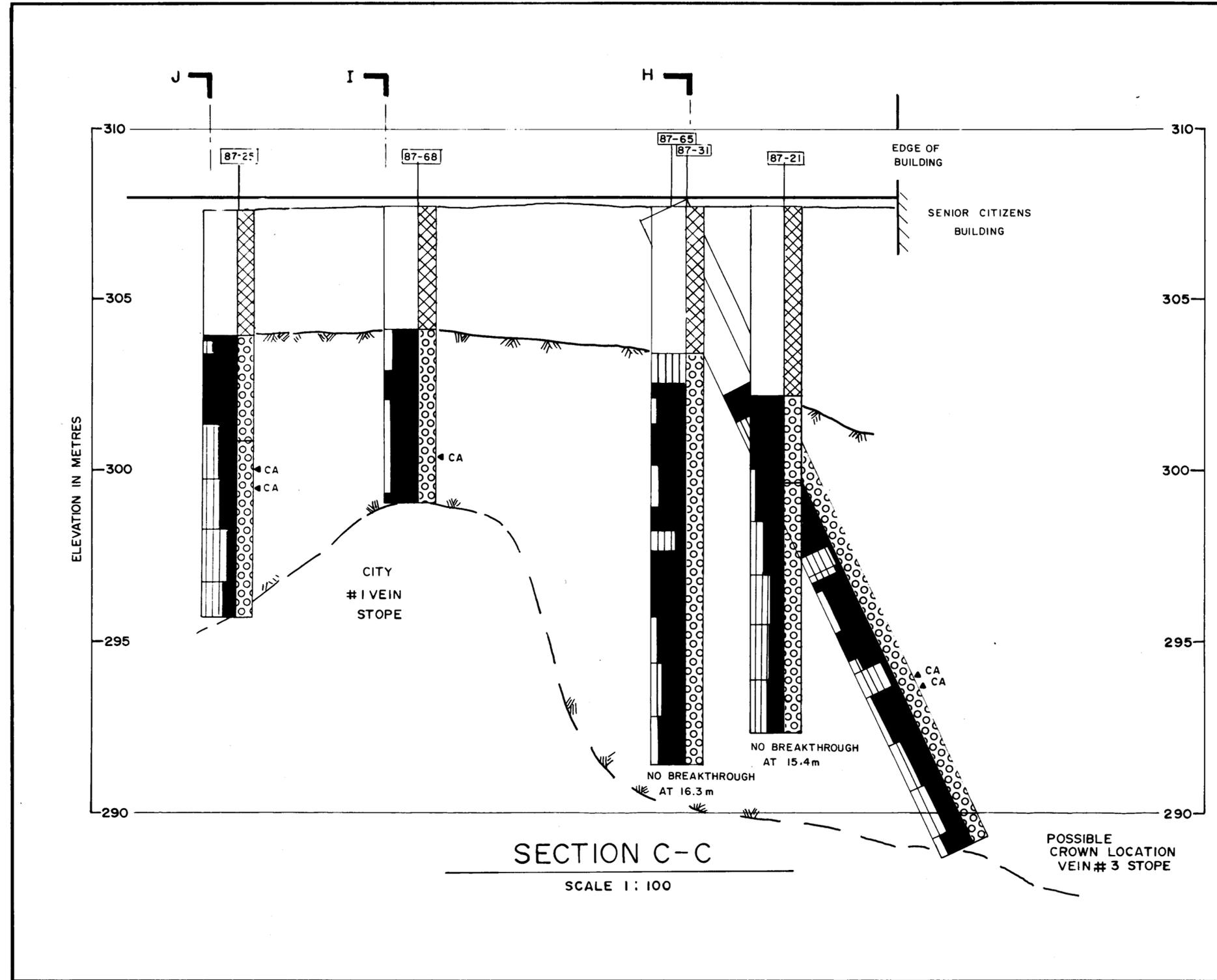
Date: OCT 8th 87  
Project: 87-1445

Golder Associates

Drawn: JCF  
Checked: JCF

LONGITUDINAL SECTION C-C  
CITY No. 3 VEIN STOPE ALONGSIDE  
SENIOR CITIZENS APARTMENT BUILDING

FIGURE 11



SECTION C-C  
SCALE 1:100

**LEGEND**

- EXISTING GROUND LEVEL
- OVERBURDEN / BEDROCK INTERFACE
- INTERPOLATED OUTLINE OF UNDERGROUND OPENINGS
- PROBEHOLE IN ELEVATION
- BOREHOLE IN ELEVATION
- DIAMOND DRILLHOLE IN ELEVATION
- SYMBOLIC LOG - LITHOLOGY  
SEE DESCRIPTIONS BELOW
- ROCK QUALITY DESIGNATION (RQD) - PERCENT

**STRUCTURAL SYMBOLS**

- BR ► BRECCIA
- SH ► SHEARED ZONE
- W ► WOOD ENCOUNTERED
- F ► FAULT
- CA ► CALCITE VEIN
- \* ► ZONE OF WATER LOSS

**LITHOLOGY**

**OVERBURDEN**

- BROWN SAND AND GRAVEL & RANDOM MINE WASTE ROCK FILL
- BROWN SAND AND GRAVEL WITH MINOR CLAY AND SUBROUNDED BOULDERS UP TO 2m. - TILL
- SANDY SILT WITH MINOR CLAY AND BOULDERS
- UNDIFFERENTIATED OVERBURDEN

**BEDROCK**

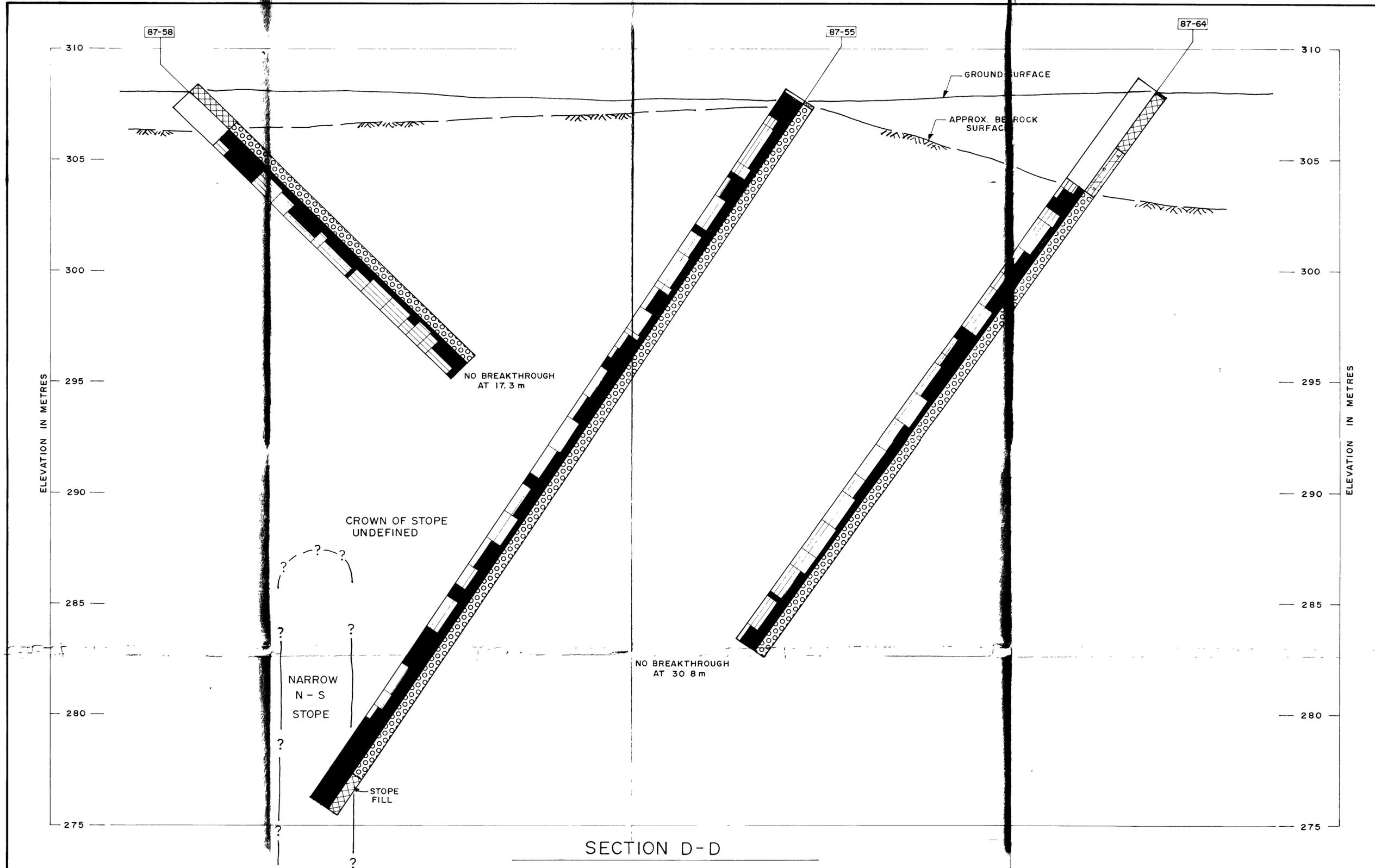
- ARGILLITE - GREYISH GREEN, FINE GRAINED, MINOR CHLORITIC ALTERATION, OCCASIONAL CALCITE HEALED FRACTURES AND QUARTZ STRINGERS, TRACE PYRITE.
- CONGLOMERATE - PINKISH GREY TO GREENISH GREY, MASSIVE, FINE GRAINED, SUBROUNDED SAND TO GRAVEL SIZE CLASTS, OCCASIONAL CARBONATE FRACTURES, TRACE PYRITE

- NOTES**
1. REFER TO FIGURE 21 FOR LOCATION OF SECTIONS.
  2. REFER TO APPENDIX A FOR DETAILED LITHOLOGICAL DESCRIPTIONS AT HOLE LOCATIONS.
  3. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT.

Date: DEC. 17, 1987  
Project: 871-1445

Golder Associates

Drawn: P.L.  
Chkd: [Signature]



**LEGEND**

- EXISTING GROUND LEVEL
- OVERBURDEN / BEDROCK INTERFACE
- INTERPOLATED OUTLINE OF UNDERGROUND OPENINGS
- PROBEHOLE IN ELEVATION
- BOREHOLE IN ELEVATION
- DIAMOND DRILLHOLE IN ELEVATION
- SYMBOLIC LOG - LITHOLOGY SEE DESCRIPTIONS BELOW
- ROCK QUALITY DESIGNATION (RQD) - PERCENT

**STRUCTURAL SYMBOLS**

- BR ► BRECCIA
- SH ► SHEARED ZONE
- W ► WOOD ENCOUNTERED
- F ► FAULT
- CA ► CALCITE VEIN
- \* ► ZONE OF WATER LOSS

**LITHOLOGY**

**OVERBURDEN**

- BROWN SAND AND GRAVEL & RANDOM MINE WASTE ROCK FILL
- BROWN SAND AND GRAVEL WITH MINOR CLAY AND SUBROUNDED BOULDERS UP TO 2m - TILL
- SANDY SILT WITH MINOR CLAY AND BOULDERS
- UNDIFFERENTIATED OVERBURDEN

**BEDROCK**

- ARGILLITE - GREYISH GREEN, FINE GRAINED, MINOR CHLORITIC ALTERATION, OCCASIONAL CALCITE HEALED FRACTURES AND QUARTZ STRINGERS, TRACE PYRITE.
- CONGLOMERATE - PINKISH GREY TO GREENISH GREY, MASSIVE, FINE GRAINED, SUBROUNDED SAND TO GRAVEL SIZE CLASTS, OCCASIONAL CARBONATE FRACTURES, TRACE PYRITE.

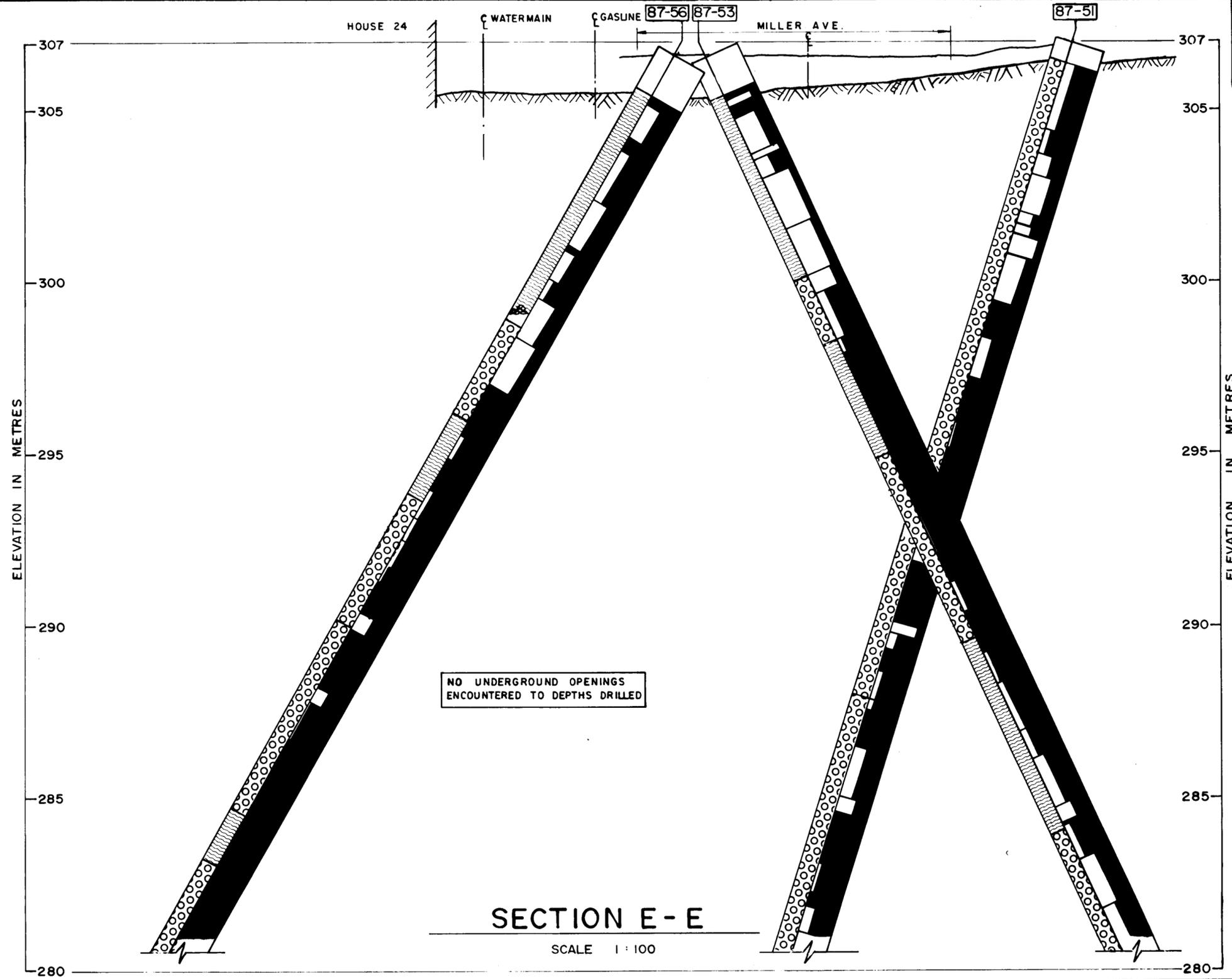
- NOTES**
1. REFER TO FIGURE 21 FOR LOCATION OF SECTIONS.
  2. REFER TO APPENDIX A FOR DETAILED LITHOLOGICAL DESCRIPTIONS AT HOLE LOCATIONS.
  3. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT.

SECTION D-D

SCALE 1 : 100

CROSS SECTION E - E  
ACROSS MILLER AVE, SOUTH OF  
SENIOR CITIZENS APARTMENT BUILDING

FIGURE 13



SECTION E - E

SCALE 1 : 100

LEGEND

- EXISTING GROUND LEVEL
- OVERBURDEN / BEDROCK INTERFACE
- INTERPOLATED OUTLINE OF UNDERGROUND OPENINGS

- PROBEHOLE IN ELEVATION
- BOREHOLE IN ELEVATION
- DIAMOND DRILLHOLE IN ELEVATION
- SYMBOLIC LOG - LITHOLOGY SEE DESCRIPTIONS BELOW
- ROCK QUALITY DESIGNATION (RQD) - PERCENT

STRUCTURAL SYMBOLS

- BR ► BRECCIA
- SH ► SHEARED ZONE
- W ► WOOD ENCOUNTERED
- F ► FAULT
- CA ► CALCITE VEIN
- \* ► ZONE OF WATER LOSS

LITHOLOGY

- OVERBURDEN
- BROWN SAND AND GRAVEL & RANDOM MINE WASTE ROCK } FILL
  - BROWN SAND AND GRAVEL WITH MINOR CLAY AND SUBROUNDED BOULDERS UP TO 2m. - TILL
  - SANDY SILT WITH MINOR CLAY AND BOULDERS
  - UNDIFFERENTIATED OVERBURDEN
- BEDROCK
- ARGILLITE - GREYISH GREEN, FINE GRAINED, MINOR CHLORITIC ALTERATION, OCCASIONAL CALCITE HEALED FRACTURES AND QUARTZ STRINGERS, TRACE PYRITE.
  - CONGLOMERATE - PINKISH GREY TO GREENISH GREY, MASSIVE, FINE GRAINED, SUBROUNDED SAND TO GRAVEL SIZE CLASTS, OCCASIONAL CARBONATE FRACTURES, TRACE PYRITE

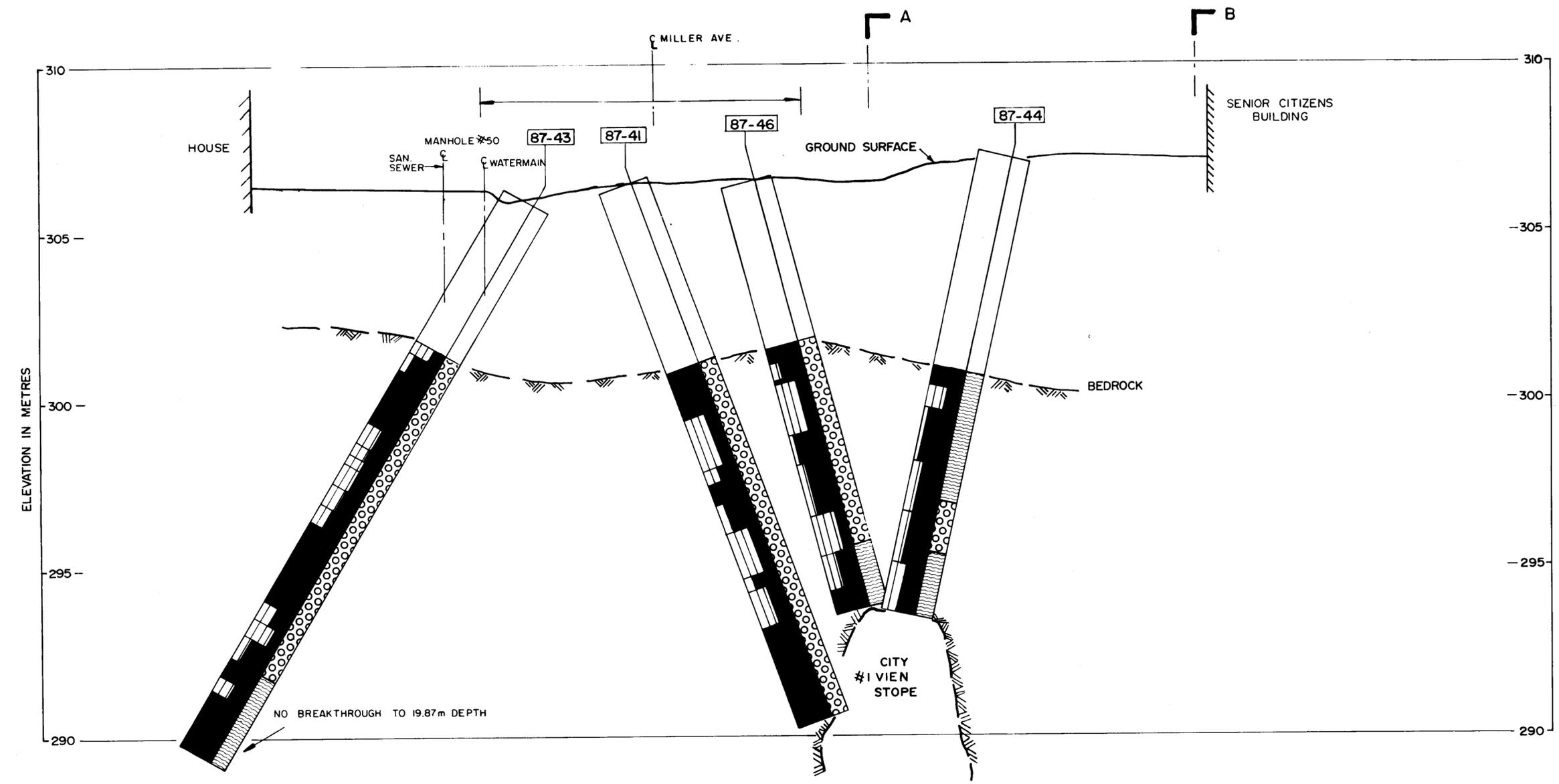
NOTES

1. REFER TO FIGURE 21 FOR LOCATION OF SECTIONS.
2. REFER TO APPENDIX A FOR DETAILED LITHOLOGICAL DESCRIPTIONS AT HOLE LOCATIONS.
3. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT.

Date: DEC. 17, 1987  
Project: 871-1445

Golder Associates

Drawn: P.L.  
Chkd: T.C.



SECTION F - F

SCALE 1 : 100

LEGEND

- EXISTING GROUND LEVEL
- OVERBURDEN / BEDROCK INTERFACE
- INTERPOLATED OUTLINE OF UNDERGROUND OPENINGS
- PROBEHOLE IN ELEVATION (PI069)
- BOREHOLE IN ELEVATION (BH 87-1)
- DIAMOND DRILLHOLE IN ELEVATION (87-29)
- SYMBOLIC LOG - LITHOLOGY (SEE DESCRIPTIONS BELOW)
- ROCK QUALITY DESIGNATION (RQD) - PERCENT

STRUCTURAL SYMBOLS

- BR ► BRECCIA
- SH ► SHEARED ZONE
- W ► WOOD ENCOUNTERED
- F ► FAULT
- CA ► CALCITE VEIN
- \* ► ZONE OF WATER LOSS

LITHOLOGY

- OVERBURDEN
- BROWN SAND AND GRAVEL & RANDOM MINE WASTE ROCK - FILL
  - BROWN SAND AND GRAVEL WITH MINOR CLAY AND SUBROUNDED BOULDERS UP TO 2m. - TILL
  - SANDY SILT WITH MINOR CLAY AND BOULDERS
  - UNDIFFERENTIATED OVERBURDEN
- BEDROCK
- ARGILLITE - GREYISH GREEN, FINE GRAINED, MINOR CHLORITIC ALTERATION, OCCASIONAL CALCITE HEALED FRACTURES AND QUARTZ STRINGERS, TRACE PYRITE.
  - CONGLOMERATE - PINKISH GREY TO GREENISH GREY, MASSIVE, FINE GRAINED, SUBROUNDED SAND TO GRAVEL SIZE CLASTS, OCCASIONAL CARBONATE FRACTURES, TRACE PYRITE

NOTES

1. REFER TO FIGURE 21 FOR LOCATION OF SECTIONS.
2. REFER TO APPENDIX A FOR DETAILED LITHOLOGICAL DESCRIPTIONS AT HOLE LOCATIONS.
3. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT.

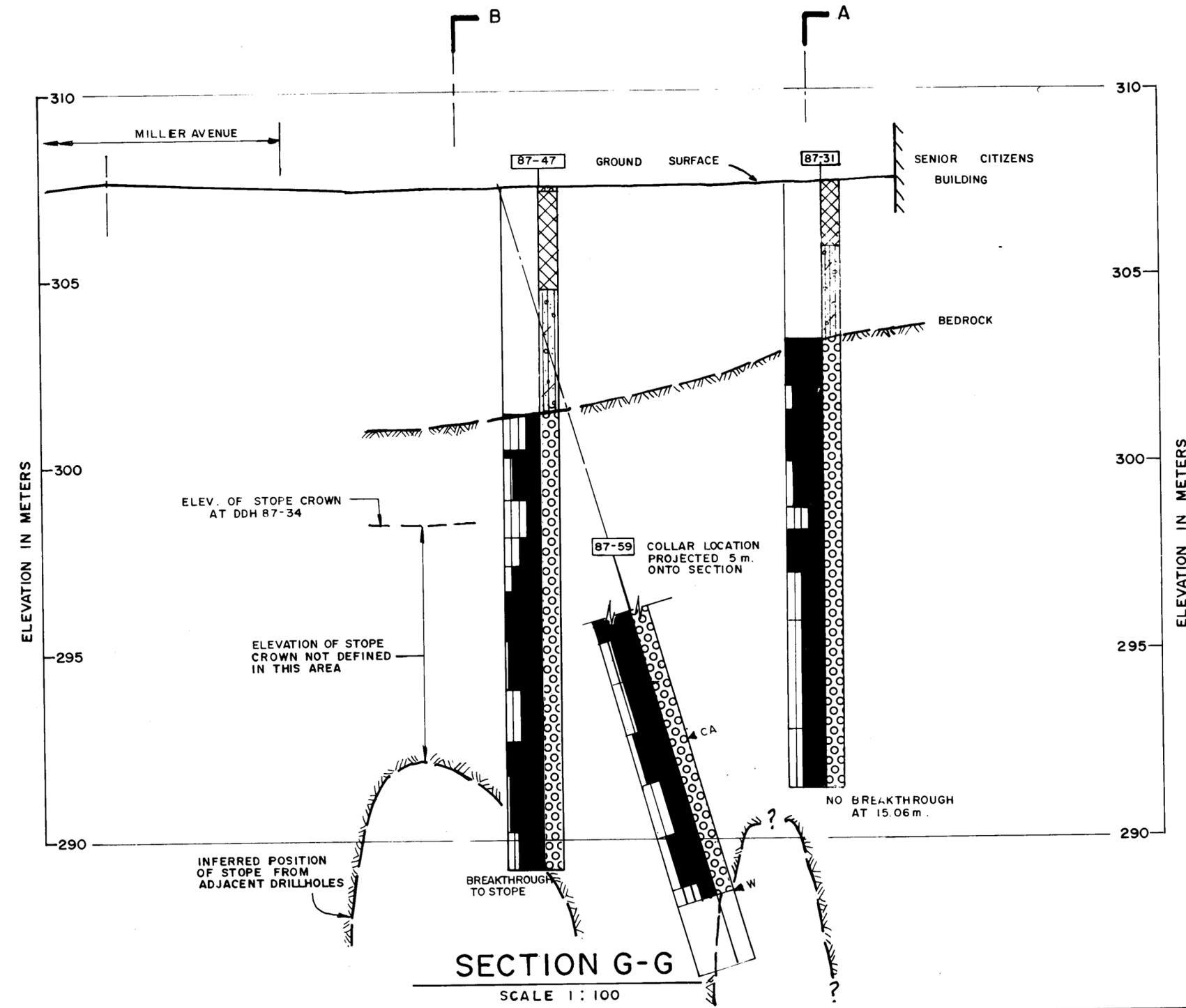
Date: DEC. 16, 1987  
Project: 871-1445

Golder Associates

Drawn: I.G.  
Checked: J.C.

CROSS SECTION G-G  
ACROSS MILLER AVE., SOUTH OF  
SENIOR CITIZENS APARTMENT BUILDING

FIGURE 15



SECTION G-G  
SCALE 1:100

**LEGEND**

- EXISTING GROUND LEVEL
- OVERBURDEN / BEDROCK INTERFACE
- INTERPOLATED OUTLINE OF UNDERGROUND OPENINGS
- PROBEHOLE IN ELEVATION
- BOREHOLE IN ELEVATION
- DIAMOND DRILLHOLE IN ELEVATION
- SYMBOLIC LOG - LITHOLOGY SEE DESCRIPTIONS BELOW
- ROCK QUALITY DESIGNATION (RQD) - PERCENT

**STRUCTURAL SYMBOLS**

- BR ▶ BRECCIA
- SH ▶ SHEARED ZONE
- W ▶ WOOD ENCOUNTERED
- F ▶ FAULT
- CA ▶ CALCITE VEN
- \* ZONE OF WATER LOSS

**LITHOLOGY**

**OVERBURDEN**

- BROWN SAND AND GRAVEL & RANDOM MINE WASTE ROCK - FILL
- BROWN SAND AND GRAVEL WITH MINOR CLAY AND SUBROUNDED BOULDERS UP TO 2m. - TILL
- SANDY SILT WITH MINOR CLAY AND BOULDERS
- UNDIFFERENTIATED OVERBURDEN

**BEDROCK**

- ARGILLITE - GREYISH GREEN, FINE GRAINED, MINOR CHLORITIC ALTERATION, OCCASIONAL CALCITE HEALED FRACTURES AND QUARTZ STRINGERS, TRACE PYRITE.
- CONGLOMERATE - PINKISH GREY TO GREENISH GREY, MASSIVE, FINE GRAINED, SUBROUNDED SAND TO GRAVEL SIZE CLASTS, OCCASIONAL CARBONATE FRACTURES, TRACE PYRITE

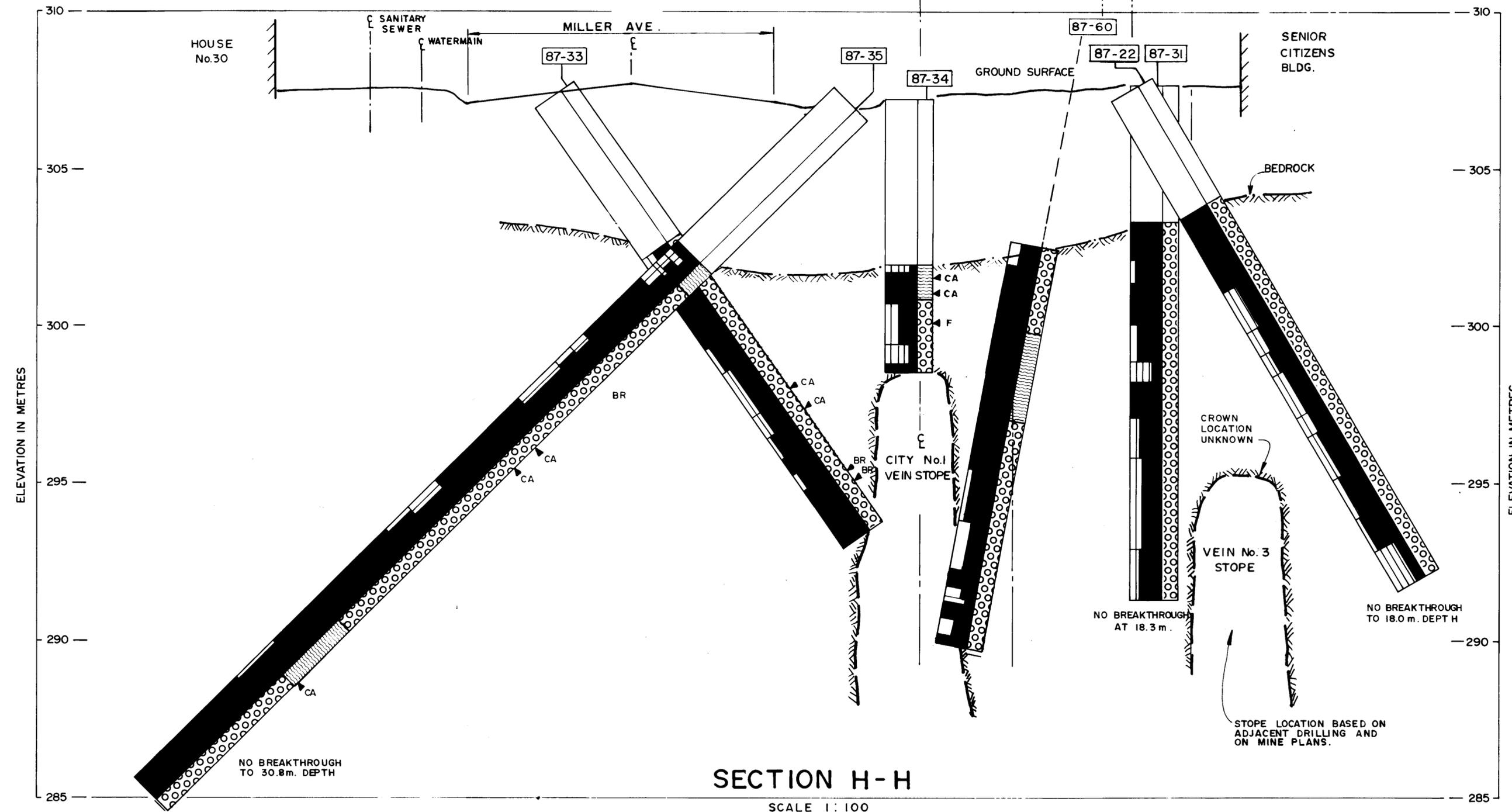
- NOTES**
1. REFER TO FIGURE 21 FOR LOCATION OF SECTIONS.
  2. REFER TO APPENDIX A FOR DETAILED LITHOLOGICAL DESCRIPTIONS AT HOLE LOCATIONS.
  3. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT.

Date: DEC. 15, 1987  
Project: 871-1445

Golder Associates

Drawn: P.L.  
Chkd: T.W.

CROSS SECTION H-H  
ACROSS MILLER AVE., SOUTH OF  
SENIOR CITIZENS APARTMENT BUILDING



**LEGEND**

- EXISTING GROUND LEVEL
- OVERBURDEN / BEDROCK INTERFACE
- INTERPOLATED OUTLINE OF UNDERGROUND OPENINGS
- P1069 ..... PROBEHOLE IN ELEVATION
- BOREHOLE IN ELEVATION... [Symbol] BH 87-1
- 87-29 DIAMOND DRILLHOLE IN ELEVATION
- SYMBOLIC LOG - LITHOLOGY SEE DESCRIPTIONS BELOW
- ROCK QUALITY DESIGNATION (RQD) - PERCENT

**STRUCTURAL SYMBOLS**

- BR ► BRECCIA
- SH ► SHEARED ZONE
- W ► WOOD ENCOUNTERED
- F ► FAULT
- CA ► CALCITE VEIN
- \* ► ZONE OF WATER LOSS

**LITHOLOGY**

**OVERBURDEN**

- BROWN SAND AND GRAVEL & RANDOM MINE WASTE ROCK } FILL
- BROWN SAND AND GRAVEL WITH MINOR CLAY AND SUBROUNDED BOULDERS UP TO 2m. - TILL
- SANDY SILT WITH MINOR CLAY AND BOULDERS
- UNDIFFERENTIATED OVERBURDEN

**BEDROCK**

- ARGILLITE - GREYISH GREEN, FINE GRAINED, MINOR CHLORITIC ALTERATION, OCCASIONAL CALCITE HEALED FRACTURES AND QUARTZ STRINGERS, TRACE PYRITE.
- CONGLOMERATE - PINKISH GREY TO GREENISH GREY, MASSIVE, FINE GRAINED, SUBROUNDED SAND TO GRAVEL SIZE CLASTS, OCCASIONAL CARBONATE FRACTURES, TRACE PYRITE

- NOTES**
1. REFER TO FIGURE 21 FOR LOCATION OF SECTIONS.
  2. REFER TO APPENDIX A FOR DETAILED LITHOLOGICAL DESCRIPTIONS AT HOLE LOCATIONS.
  3. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT.

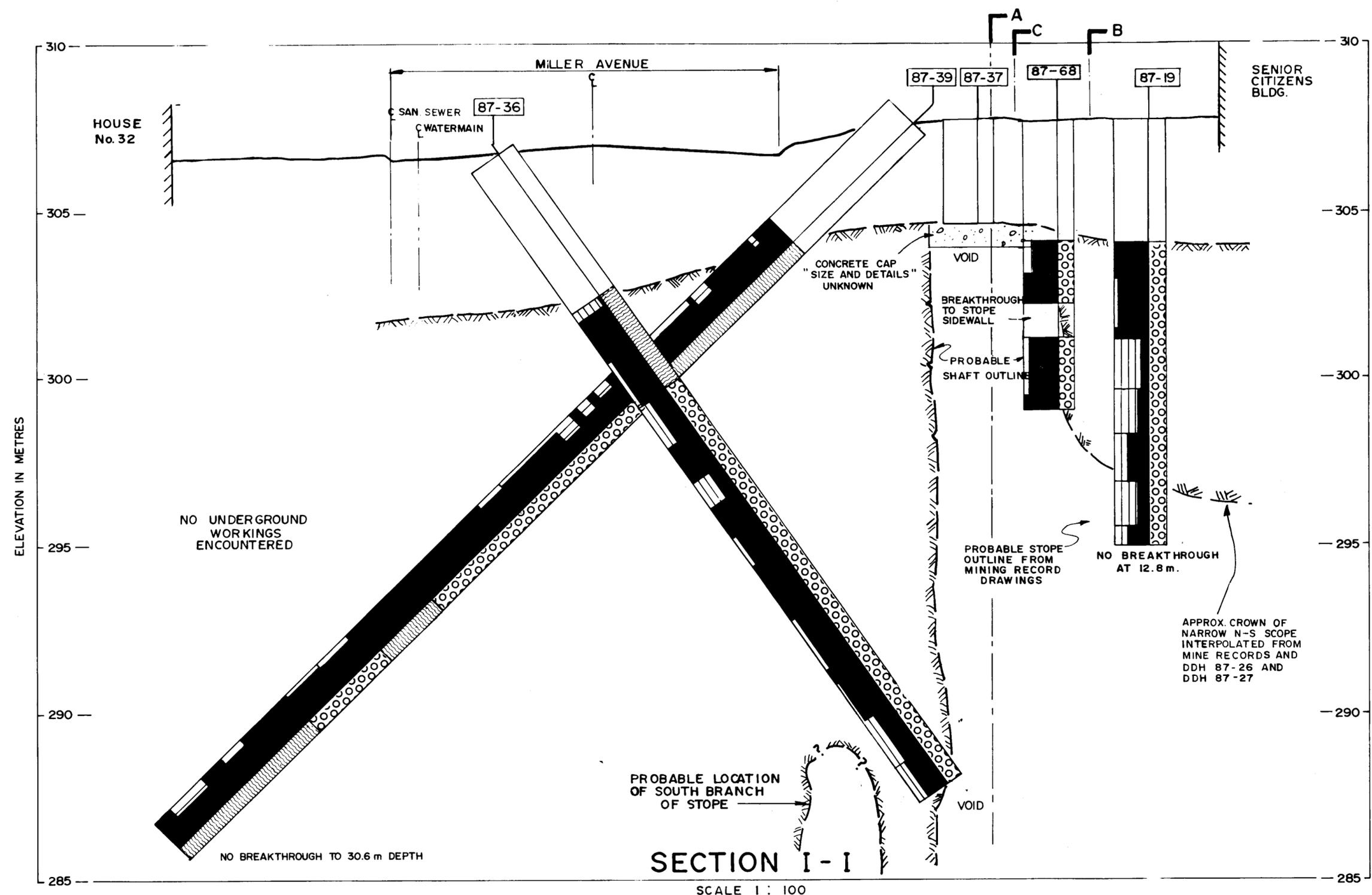
Date: DEC. 14, 1987  
Project: 871-1445

Golder Associates

Drawn: I.G.  
Chkd: [Signature]

CROSS SECTION I-I  
ACROSS MILLER AVE., SOUTH OF  
SENIOR CITIZENS APARTMENT BUILDING

FIGURE 17



**LEGEND**

- EXISTING GROUND LEVEL
- OVERBURDEN / BEDROCK INTERFACE
- INTERPOLATED OUTLINE OF UNDERGROUND OPENINGS
- PROBEHOLE IN ELEVATION
- BOREHOLE IN ELEVATION
- DIAMOND DRILLHOLE IN ELEVATION
- SYMBOLIC LOG - LITHOLOGY SEE DESCRIPTIONS BELOW
- ROCK QUALITY DESIGNATION (RQD) - PERCENT

**STRUCTURAL SYMBOLS**

- BR ► BRECCIA
- SH ► SHEARED ZONE
- W ► WOOD ENCOUNTERED
- F ► FAULT
- CA ► CALCITE VEN
- \* ► ZONE OF WATER LOSS

**LITHOLOGY**

**OVERBURDEN**

- BROWN SAND AND GRAVEL & FILL  
RANDOM MINE WASTE ROCK
- BROWN SAND AND GRAVEL WITH MINOR CLAY AND SUBROUNDED BOULDERS UP TO 2m. - TILL
- SANDY SILT WITH MINOR CLAY AND BOULDERS
- UNDIFFERENTIATED OVERBURDEN

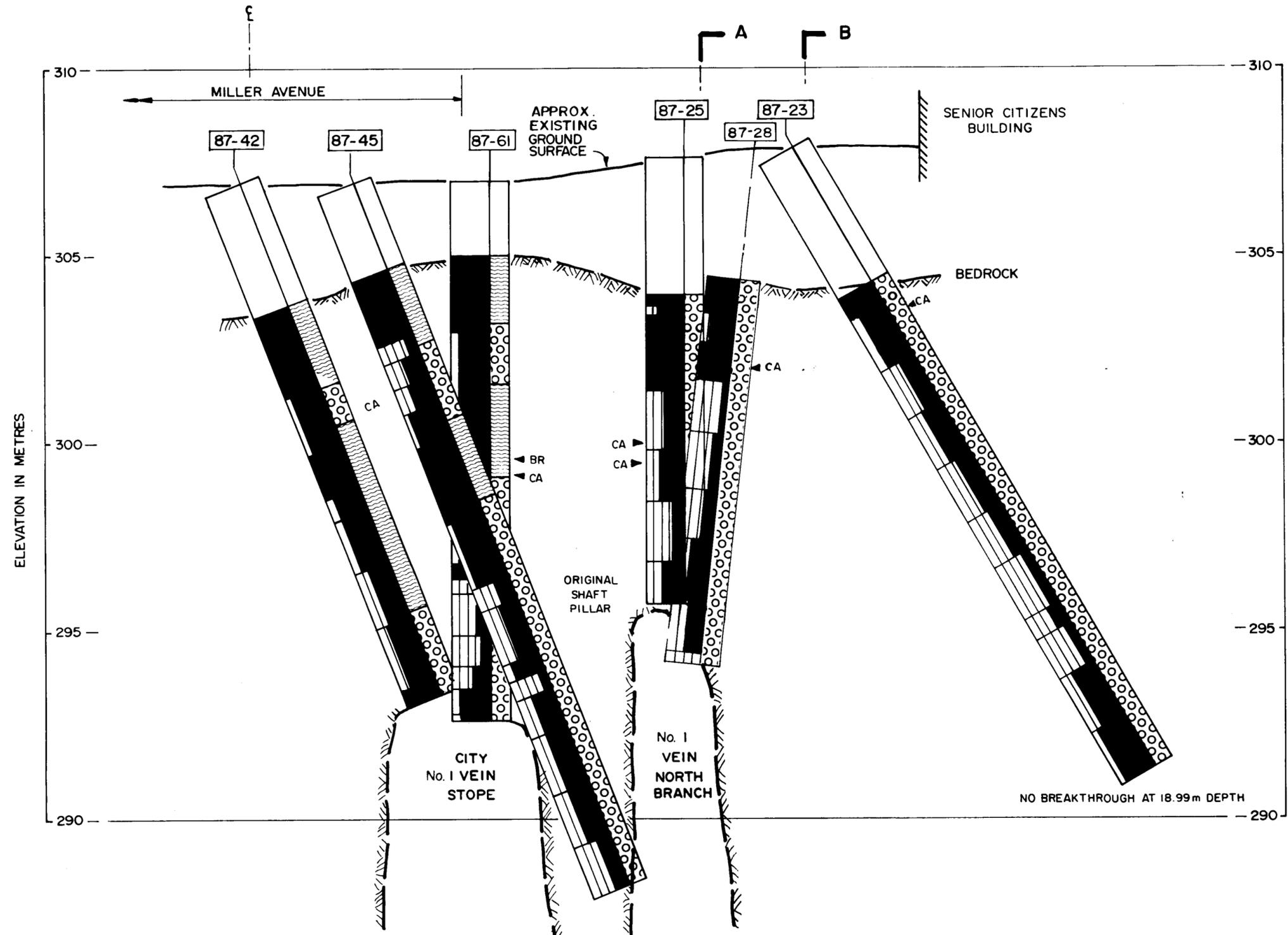
**BEDROCK**

- ARGILLITE - GREYISH GREEN, FINE GRAINED, MINOR CHLORITIC ALTERATION, OCCASIONAL CALCITE HEALED FRACTURES AND QUARTZ STRINGERS, TRACE PYRITE.
- CONGLOMERATE - PINKISH GREY TO GREENISH GREY, MASSIVE, FINE GRAINED, SUBROUNDED SAND TO GRAVEL SIZE CLASTS, OCCASIONAL CARBONATE FRACTURES, TRACE PYRITE

- NOTES**
1. REFER TO FIGURE 21 FOR LOCATION OF SECTIONS.
  2. REFER TO APPENDIX A FOR DETAILED LITHOLOGICAL DESCRIPTIONS AT HOLE LOCATIONS.
  3. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT.

SECTION I-I  
SCALE 1 : 100

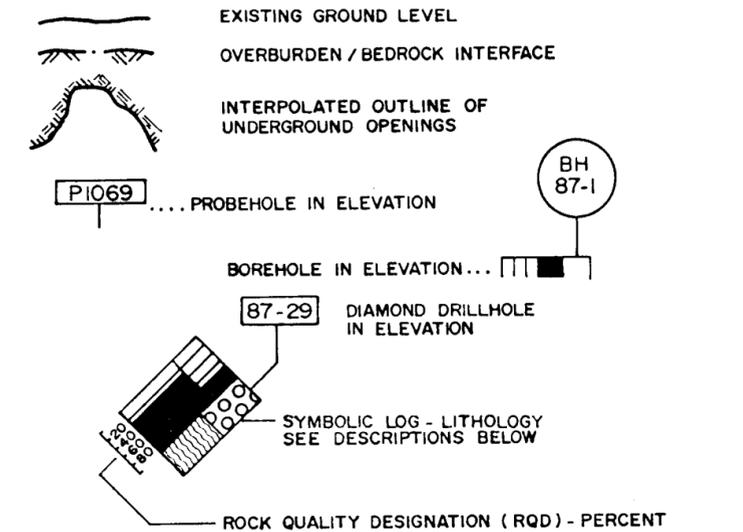
CROSS SECTION J-J  
ACROSS MILLER AVE., SOUTH OF  
SENIOR CITIZENS APARTMENT BUILDING



SECTION J-J

SCALE 1:100

LEGEND



STRUCTURAL SYMBOLS

- BR ▶ BRECCIA
- SH ▶ SHEARED ZONE
- W ▶ WOOD ENCOUNTERED
- F ▶ FAULT
- CA ▶ CALCITE VEIN
- \* ZONE OF WATER LOSS

LITHOLOGY

OVERBURDEN

- BROWN SAND AND GRAVEL & RANDOM MINE WASTE ROCK } FILL
- BROWN SAND AND GRAVEL WITH MINOR CLAY AND SUBROUNDED BOULDERS UP TO 2m. - TILL
- SANDY SILT WITH MINOR CLAY AND BOULDERS
- UNDIFFERENTIATED OVERBURDEN

BEDROCK

- ARGILLITE - GREYISH GREEN, FINE GRAINED, MINOR CHLORITIC ALTERATION, OCCASIONAL CALCITE HEALED FRACTURES AND QUARTZ STRINGERS, TRACE PYRITE.
- CONGLOMERATE - PINKISH GREY TO GREENISH GREY, MASSIVE, FINE GRAINED, SUBROUNDED SAND TO GRAVEL SIZE CLASTS, OCCASIONAL CARBONATE FRACTURES, TRACE PYRITE

NOTES

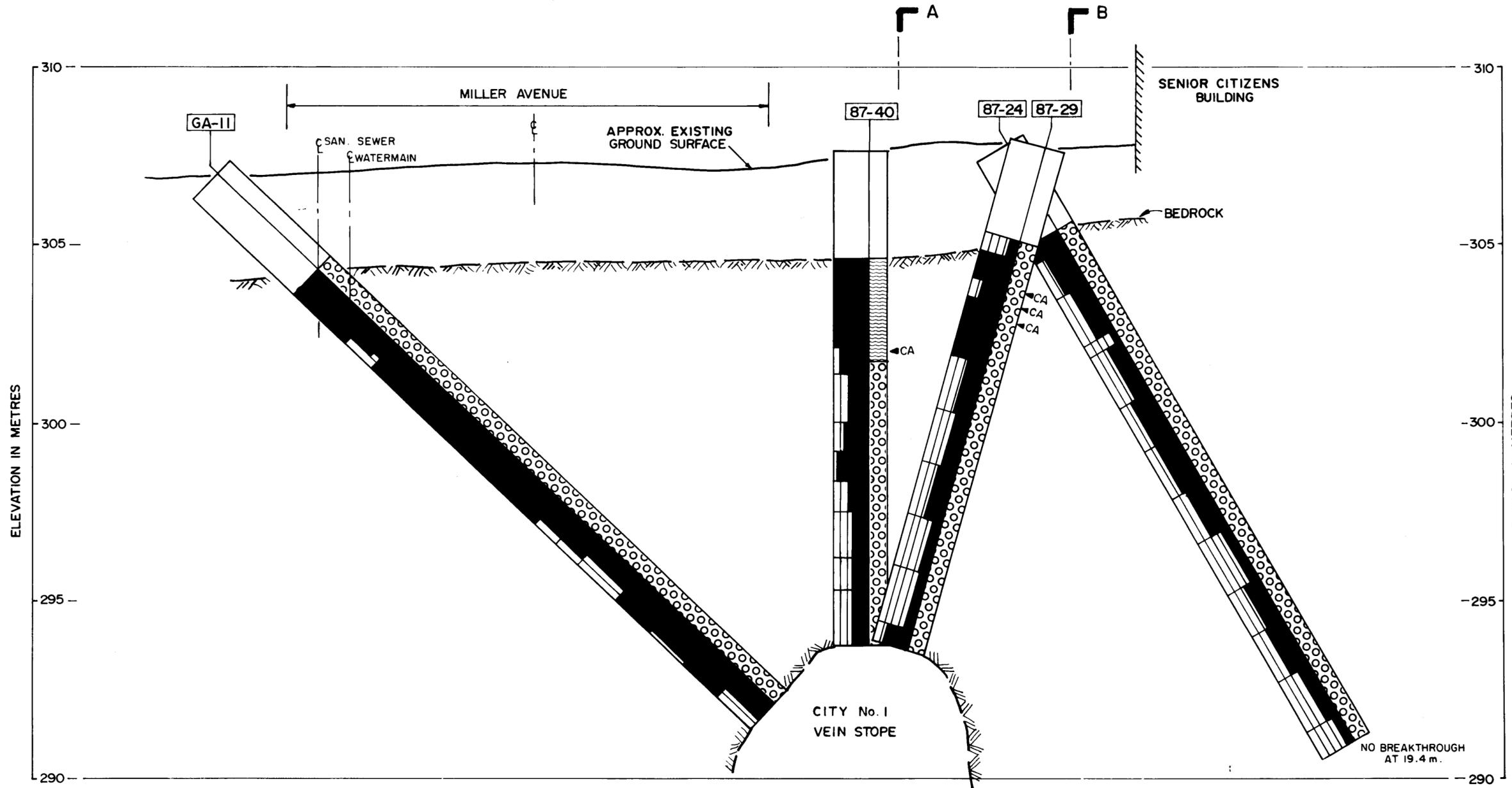
1. REFER TO FIGURE 2-1 FOR LOCATION OF SECTIONS.
2. REFER TO APPENDIX A FOR DETAILED LITHOLOGICAL DESCRIPTIONS AT HOLE LOCATIONS.
3. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT.

Date: DEC. 15, 1987  
Project: 871-1445

Golder Associates

Drawn: I.G.  
Chkd: Jbc

CROSS SECTION K-K  
ACROSS MILLER AVE., SOUTH OF  
SENIOR CITIZENS APARTMENT BUILDING



SECTION K-K  
SCALE 1:100

**LEGEND**

- EXISTING GROUND LEVEL
- OVERBURDEN / BEDROCK INTERFACE
- INTERPOLATED OUTLINE OF UNDERGROUND OPENINGS
- PI069 PROBEHOLE IN ELEVATION
- BH 87-1 BOREHOLE IN ELEVATION
- 87-29 DIAMOND DRILLHOLE IN ELEVATION
- SYMBOLIC LOG - LITHOLOGY SEE DESCRIPTIONS BELOW
- ROCK QUALITY DESIGNATION (RQD) - PERCENT

**STRUCTURAL SYMBOLS**

- BR BRECCIA
- SH SHEARED ZONE
- W WOOD ENCOUNTERED
- F FAULT
- CA CALCITE VEIN
- \* ZONE OF WATER LOSS

**LITHOLOGY**

**OVERBURDEN**

- BROWN SAND AND GRAVEL & RANDOM MINE WASTE ROCK - FILL
- BROWN SAND AND GRAVEL WITH MINOR CLAY AND SUBROUNDED BOULDERS UP TO 2m. - TILL
- SANDY SILT WITH MINOR CLAY AND BOULDERS
- UNDIFFERENTIATED OVERBURDEN

**BEDROCK**

- ARGILLITE - GREYISH GREEN, FINE GRAINED, MINOR CHLORITIC ALTERATION, OCCASIONAL CALCITE HEALED FRACTURES AND QUARTZ STRINGERS, TRACE PYRITE.
- CONGLOMERATE - PINKISH GREY TO GREENISH GREY, MASSIVE, FINE GRAINED, SUBROUNDED SAND TO GRAVEL SIZE CLASTS, OCCASIONAL CARBONATE FRACTURES, TRACE PYRITE

- NOTES**
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  - REFER TO APPENDIX A FOR DETAILED LITHOLOGICAL DESCRIPTIONS AT HOLE LOCATIONS.
  - THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT.

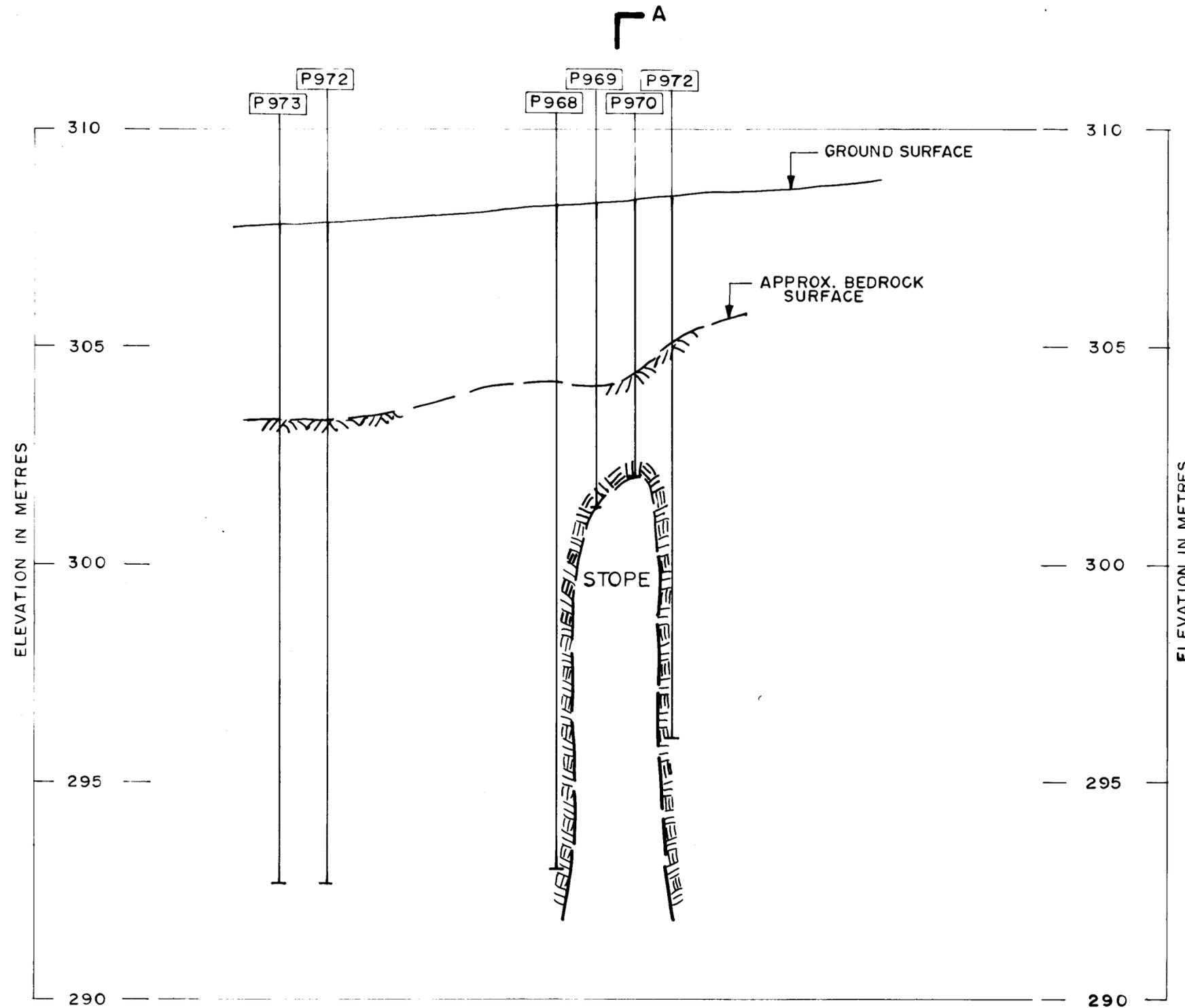
Date: DEC. 15, 1987  
Project: 871-1445

Golder Associates

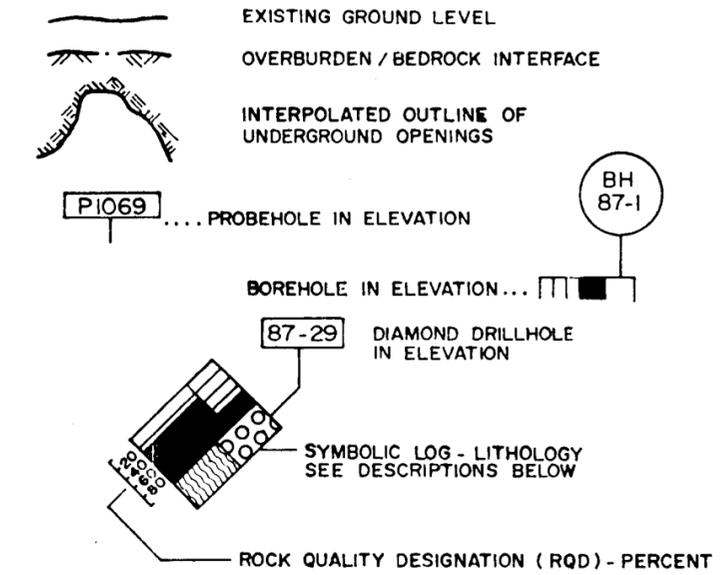
Drawn: I.G.  
Chkd: [Signature]

CROSS SECTION L-L  
ALONG GALENA ST., WEST OF  
SENIOR CITIZENS APARTMENT BUILDING

FIGURE 20



LEGEND



STRUCTURAL SYMBOLS

- BR ▶ BRECCIA      SH ▶ SHEARED ZONE      W ▶ WOOD ENCOUNTERED
- F ▶ FAULT      CA ▶ CALCITE VEIN      \* ZONE OF WATER LOSS

LITHOLOGY

- OVERBURDEN
- BROWN SAND AND GRAVEL & RANDOM MINE WASTE ROCK } FILL
  - BROWN SAND AND GRAVEL WITH MINOR CLAY AND SUBROUNDED BOULDERS UP TO 2m. - TILL
  - SANDY SILT WITH MINOR CLAY AND BOULDERS
  - UNDIFFERENTIATED OVERBURDEN
- BEDROCK
- ARGILLITE - GREYISH GREEN, FINE GRAINED, MINOR CHLORITIC ALTERATION, OCCASIONAL CALCITE HEALED FRACTURES AND QUARTZ STRINGERS, TRACE PYRITE.
  - CONGLOMERATE - PINKISH GREY TO GREENISH GREY, MASSIVE, FINE GRAINED, SUBROUNDED SAND TO GRAVEL SIZE CLASTS, OCCASIONAL CARBONATE FRACTURES, TRACE PYRITE

NOTES

1. REFER TO FIGURE 21 FOR LOCATION OF SECTIONS.
2. REFER TO APPENDIX A FOR DETAILED LITHOLOGICAL DESCRIPTIONS AT HOLE LOCATIONS.
3. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT.

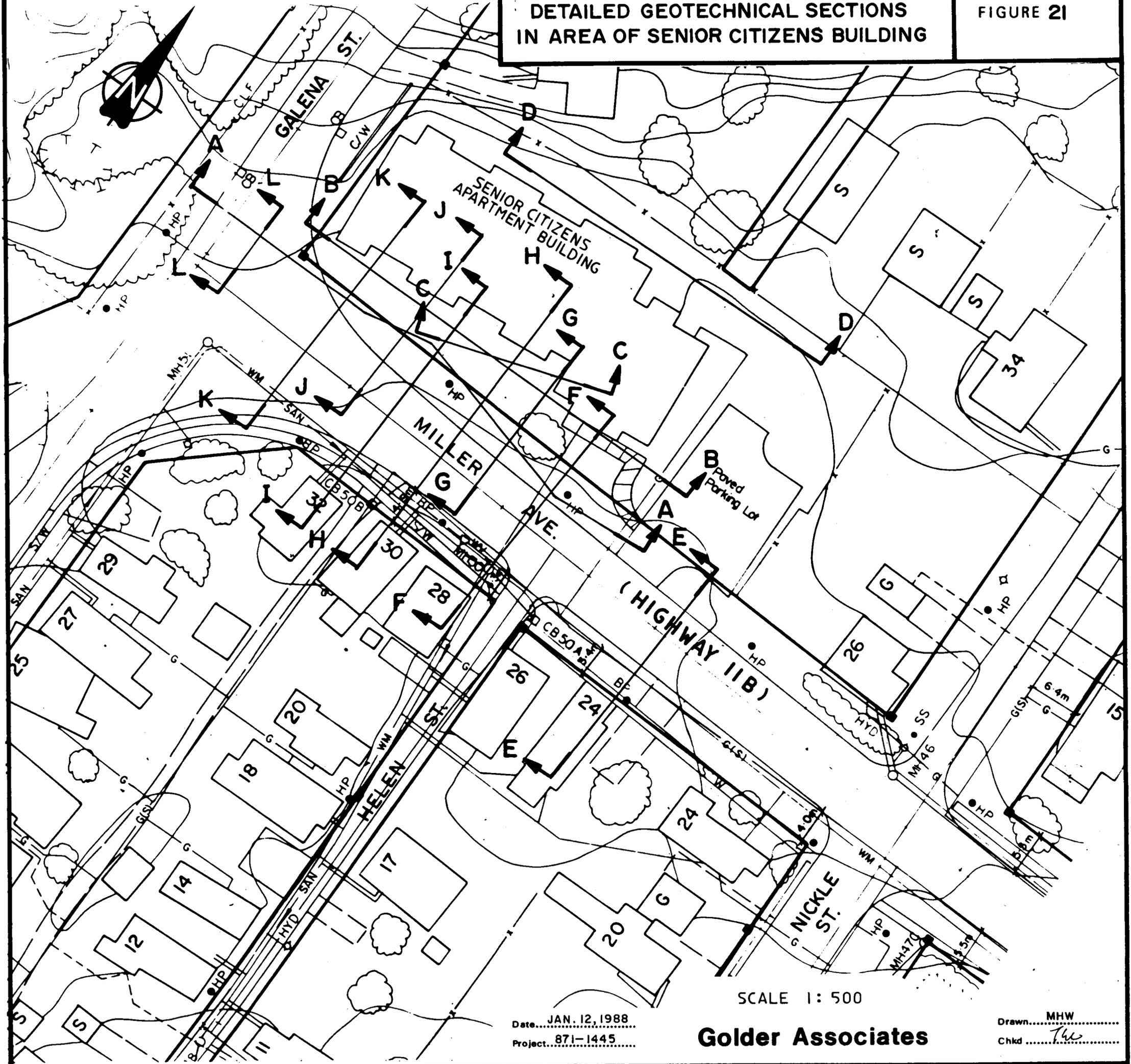
Date: DEC. 17, 1987.  
Project: 87-1-1445

Golder Associates

Drawn: MHW  
Chkd: Jhe

PLAN SHOWING LOCATIONS OF  
DETAILED GEOTECHNICAL SECTIONS  
IN AREA OF SENIOR CITIZENS BUILDING

FIGURE 21



SCALE 1: 500

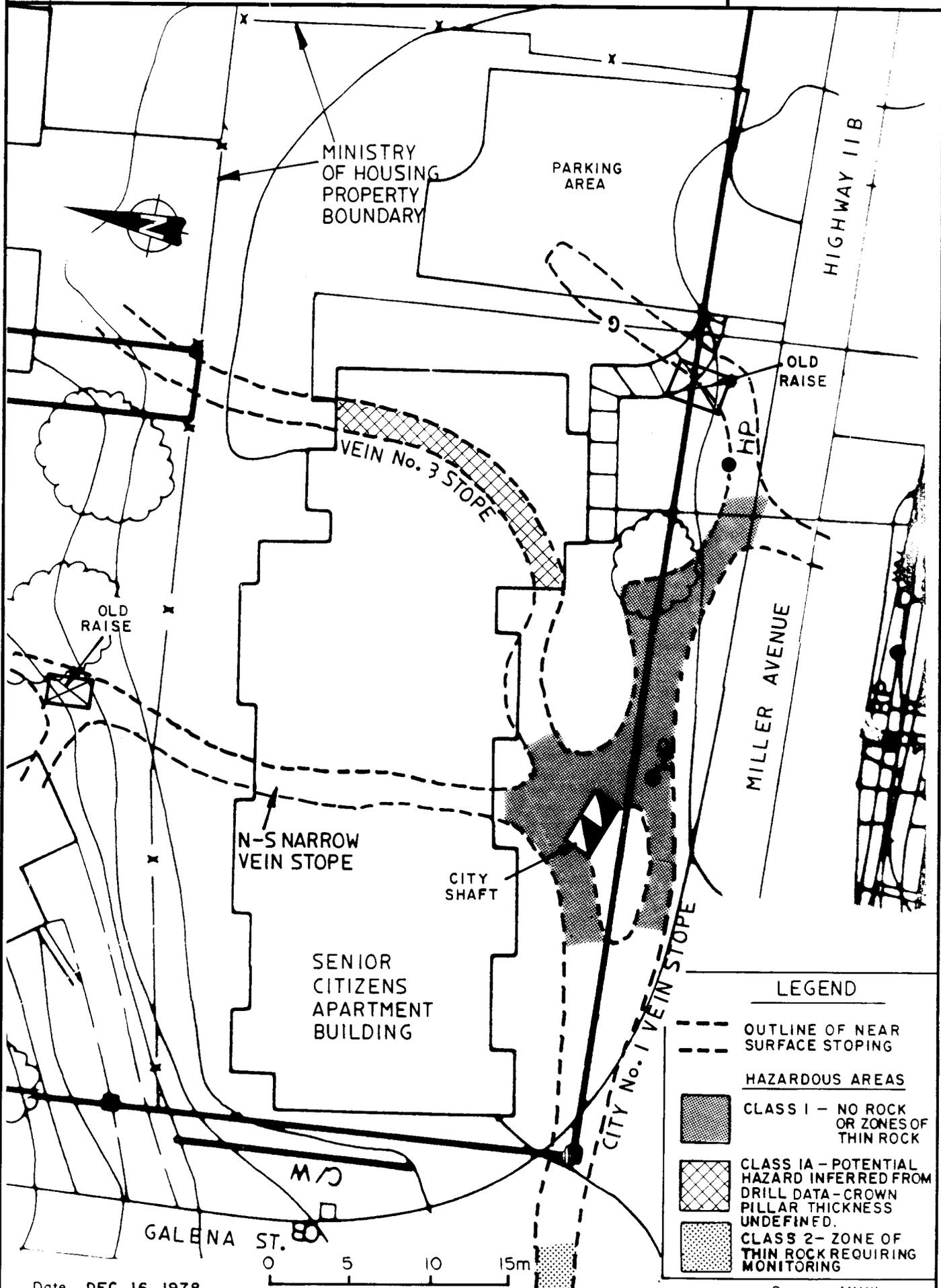
Date... JAN. 12, 1988  
Project... 871-1445

**Golder Associates**

Drawn... MHW  
Chkd... *the*

# HAZARD LOCATIONS SENIOR CITIZENS APARTMENT BUILDING

FIGURE 22



**LEGEND**

- OUTLINE OF NEAR SURFACE STOPPING
- HAZARDOUS AREAS
-  CLASS 1 - NO ROCK OR ZONES OF THIN ROCK
-  CLASS 1A - POTENTIAL HAZARD INFERRED FROM DRILL DATA - CROWN PILLAR THICKNESS UNDEFINED.
-  CLASS 2 - ZONE OF THIN ROCK REQUIRING MONITORING

Date DEC. 16, 1978  
Project 871-1445

**Golder Associates**

Drawn MHW  
Chkd Jw

COPY NO. 10 THE UNIVERSITY

APPENDIX A  
RECORD OF BOREHOLE LOGS  
LITHOLOGICAL AND GEOTECHNICAL ROCK  
DESCRIPTION TERMINOLOGY  
LIST OF ABBREVIATIONS  
BH87-29 TO BH87-31

January 1988

871-1445

# LITHOLOGICAL AND GEOTECHNICAL ROCK DESCRIPTION TERMINOLOGY

## WEATHERING STATE

**Fresh:** no visible sign of weathering.

**Faintly weathered:** weathering limited to the surface of major discontinuities.

**Slightly weathered:** penetrative weathering developed on open discontinuity surfaces but only slight weathering of rock material.

**Moderately weathered:** weathering extends throughout the rock mass but the rock material is not friable.

**Highly weathered:** weathering extends throughout rock mass and the rock material is partly friable.

**Completely weathered:** rock is wholly decomposed and in a friable condition but the rock texture and structure are preserved.

## BEDDING THICKNESS

Description	Bedding Plane Spacing
Very thickly bedded	> 2 m
Thickly bedded	0.6 m to 2m
Medium bedded	0.2 m to 0.6 m
Thinly bedded	60 mm to 0.2 m
Very thinly bedded	20 mm to 60 mm
Laminated	6 mm to 20 mm
Thinly laminated	< 6 mm

## JOINT OR FOLIATION SPACING

Description	Spacing
Very wide	> 3 m
Wide	1 - 3 m
Moderately close	0.3 - 1 m
Close	50 - 300 mm
Very close	< 50 mm

## GRAIN SIZE

Term	Size*
Very Coarse Grained	> 60 mm
Coarse Grained	2 - 60 mm
Medium Grained	60 microns - 2 mm
Fine Grained	2 - 60 microns
Very Fine Grained	< 2 microns

Note: \* Grains > 60 microns diameter are visible to the naked eye.

## CORE CONDITION

### Total Core Recovery

The percentage of solid drill core recovered regardless of quality or length, measured relative to the length of the total core run.

### Solid Core Recovery (SCR)

The percentage of solid drill core, regardless of length, recovered at full diameter, measured relative to the length of the total core run.

### Rock Quality Designation (RQD)

The percentage of solid drill core, greater than 100 mm length, recovered at full diameter, measured relative to the length of the total core run. RQD varies from 0% for completely broken core to 100% for core in solid sticks.

## DISCONTINUITY DATA

### Fracture Index

A count of the number of discontinuities (physical separations) in the rock core, including both naturally occurring fractures and mechanically induced breaks caused by drilling.

### Dip with Respect to (W.R.T.) Core Axis

The angle of the discontinuity relative to the axis (length) of the core. In a vertical borehole a discontinuity with a 90° angle is horizontal.

### Description and Notes

An abbreviated description of the discontinuities, whether naturally occurring separations such as fractures, bedding planes and foliation planes or mechanically induced features caused by drilling such as ground or shattered core and mechanically separated bedding or foliation surfaces. Additional information concerning the nature of fracture surfaces and infillings are also noted.

### Abbreviations

B - Bedding	P - Polished
FO - Foliation / Schistosity	S - Slickensided
CL - Cleavage	SM - Smooth
SH - Shear Plane Zone	R - Ridged / Rough
VN - Vein	ST - Stepped
F - Fault	PL - Planar
CO - Contact	FL - Flexured
J - Joint	UE - Uneven
FR - Fracture	W - Wavy
MF - Mechanical Fracture	C - Curved
- Parallel To	
⊥ - Perpendicular To	

## LIST OF ABBREVIATIONS

The abbreviation commonly employed on each "Record of Borehole," on the figures and in the text of the report, are as follows:

### I. SAMPLE TYPES

*AS* auger sample  
*CS* chunk sample  
*DO* drive open  
*DS* Denison type sample  
*FS* foil sample  
*RC* rock core  
*ST* slotted tube  
*TO* thin-walled, open  
*TP* thin-walled, piston  
*WS* wash sample

### II. PENETRATION RESISTANCES

#### Dynamic Penetration Resistance:

The number of blows by a 63.6 kg (140 lb) hammer dropped 760 mm (30 in.) to drive uncased a 50 mm (2 in.) diameter, 60° cone attached to "A" size drill rods for a distance of 0.3 m (12 in.).

#### Standard Penetration Resistance, *N*:

The number of blows by a 63.6 kg (140 lb) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) drive open sampler for a distance of 0.3 m (12 in.).

*WH* sampler advanced by static weight—weight, hammer  
*PH* sampler advanced by pressure—pressure, hydraulic  
*PM* sampler advanced by pressure—pressure, manual

### III. SOIL DESCRIPTION

(a) *Cohesionless Soils*      '*N*'  
Blows/0.30m  
or Blows/ft.

<i>Relative Density</i>	
Very loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very dense	over 50

(b) *Cohesive Soils*

<i>Consistency</i>	<u>kPa</u>	<u>'Cu'</u>	<u>psf.</u>
Very soft	0 to 12		0 to 250
Soft	12 to 25		250 to 500
Firm	25 to 50		500 to 1000
Stiff	50 to 100		1000 to 2000
Very stiff	100 to 200		2000 to 4000
Hard	over 200		over 4000

### IV. SOIL TESTS

*C* consolidation test  
*H* hydrometer analysis  
*M* sieve analysis  
*MH* combined analysis, sieve and hydrometer<sup>1</sup>  
*Q* undrained triaxial<sup>2</sup>  
*R* consolidated undrained triaxial<sup>2</sup>  
*S* drained triaxial  
*U* unconfined compression  
*V* field vane test

#### NOTES:

<sup>1</sup>Combined analyses when 5 to 95 per cent of the material passes the No. 200 sieve.

<sup>2</sup>Undrained triaxial tests in which pore pressures are measured are shown as  $\bar{Q}$  or  $\bar{R}$ .

# RECORD OF DRILLHOLE BH 87-29

SHEET 1 OF 2



LOCATION SEE FIGURE

DRILLING DATE SEPT.14-18,1987

DATUM GEODETIC

INCLINATION -90      AZIMUTH

DRILL RIG SKID MTD BBS-2

DRILLING CONTRACTOR McKNIGHT DRILLING CO.LTD.

PROJECT 87-1347

DEPTH SCALE METRES	DRILLING RECORD	SYMBOLIC LOG	ELEV. DEPTH (M)	RUN No.	PENETRATION RATE (M/MIN)	FR-FRACTURE		F-FAULT		SM-SMOOTH		FL-FLEXURED		DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
						CL-CLEAVAGE		J-JOINT		R -ROUGH		UE-UNEVEN			
						SH-SHEAR		P-POLISHED		ST-STEPPED		W -WAVY			
VN-VEN		S-SLICKENSIDED		PL-PLANAR		C -CURVED									
		RECOVERY		R.O.D. %	FRACT. INDEX PER 0.4M	DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY k <sub>v</sub> cm/sec							
		TOTAL CORE %	SOLID CORE %			TYPE AND SURFACE DESCRIPTION									
0	GROUND SURFACE		307.33												
0.08	BLACK SANDY TOPSOIL														
1	Loose to compact brown, crushed mine waste rock and sand. (FILL)				50 70 / DOO										
2			305.35												
1.98															
3	Compact brown SILTY SAND, with numerous boulders. (TILL)				50 50 / DO 50										
4															
5															
6															
7	ARGILLITE		301.14												
8.19	Weathered, highly fractured, green, fine grained with occ. quartzite clasts, Fe staining on fracture surfaces becoming less common with depth, Chlorite alteration spots.			1	NA	60%									R, UE
7				2	NA	60%									R, ST, UE
8				3	NA	0%									R, UE
9				4	NA	0%									R, UE, ST
10	CONGLOMERATE		298.98												
8.35	Fresh, light grey to grey, medium to coarse grained matrix with gravel to cobble size subangular clasts. (GOWGANDA FORMATION)			5	NA	0%									SM, PL
11				6	NA	0%									R, C, UE
12				7	NA	0%									R, ST, UE
13				8	NA	0%									R, PL, UE
14				9	NA	0%									R, ST, P, UE
15				10	NA	0%									R, ST, UE
16				11	NA	0%									R, UE
17				12	NA	0%									R, UE
18				13	NA	0%									R, UE
19				14	NA	0%									R, UE
20				15	NA	0%									R, UE
21				16	NA	0%									R, UE
22				17	NA	0%									R, UE
23				18	NA	0%									R, UE
24				19	NA	0%									R, UE
25				20	NA	0%									R, UE
26				21	NA	0%									R, UE
27				22	NA	0%									R, UE
28				23	NA	0%									R, UE
29				24	NA	0%									R, UE
30				25	NA	0%									R, UE
31				26	NA	0%									R, UE
32				27	NA	0%									R, UE
33				28	NA	0%									R, UE
34				29	NA	0%									R, UE
35				30	NA	0%									R, UE
36				31	NA	0%									R, UE
37				32	NA	0%									R, UE
38				33	NA	0%									R, UE
39				34	NA	0%									R, UE
40				35	NA	0%									R, UE
41				36	NA	0%									R, UE
42				37	NA	0%									R, UE
43				38	NA	0%									R, UE
44				39	NA	0%									R, UE
45				40	NA	0%									R, UE
46				41	NA	0%									R, UE
47				42	NA	0%									R, UE
48				43	NA	0%									R, UE
49				44	NA	0%									R, UE
50				45	NA	0%									R, UE
51				46	NA	0%									R, UE
52				47	NA	0%									R, UE
53				48	NA	0%									R, UE
54				49	NA	0%									R, UE
55				50	NA	0%									R, UE
56				51	NA	0%									R, UE
57				52	NA	0%									R, UE
58				53	NA	0%									R, UE
59				54	NA	0%									R, UE
60				55	NA	0%									R, UE
61				56	NA	0%									R, UE
62				57	NA	0%									R, UE
63				58	NA	0%									R, UE
64				59	NA	0%									R, UE
65				60	NA	0%									R, UE
66				61	NA	0%									R, UE
67				62	NA	0%									R, UE
68				63	NA	0%									R, UE
69				64	NA	0%									R, UE
70				65	NA	0%									R, UE
71				66	NA	0%									R, UE
72				67	NA	0%									R, UE
73				68	NA	0%									R, UE
74				69	NA	0%									R, UE
75				70	NA	0%									R, UE
76				71	NA	0%									R, UE
77				72	NA	0%									R, UE
78				73	NA	0%									R, UE
79				74	NA	0%									R, UE
80				75	NA	0%									R, UE
81				76	NA	0%									R, UE
82				77	NA	0%									R, UE
83				78	NA	0%									R, UE
84				79	NA	0%									R, UE
85				80	NA	0%									R, UE
86				81	NA	0%									R, UE
87				82	NA	0%									R, UE
88				83	NA	0%									R, UE
89				84	NA	0%									R, UE
90				85	NA	0%									R, UE
91				86	NA	0%									R, UE
92				87	NA	0%									R, UE
93				88	NA	0%									R, UE
94				89	NA	0%									R, UE
95				90	NA	0%									R, UE
96				91	NA	0%									R, UE
97				92	NA	0%									R, UE
98				93	NA	0%									R, UE
99				94	NA	0%									R, UE
100				95	NA	0%									R, UE
101				96	NA	0%									R, UE
102				97	NA	0%									R, UE
103				98	NA	0%									R, UE
104				99	NA	0%									R, UE
105				100	NA	0%									R, UE
106				101											

# RECORD OF DRILLHOLE BH 87-29

SHEET 2 OF 2



LOCATION SEE FIGURE

DRILLING DATE SEPT.14-18,1987

DATUM GEODETIC

INCLINATION -90 AZIMUTH

DRILL RIG SKID MTD BBS-2

DRILLING CONTRACTOR MCKNIGHT DRILLING CO.LTD.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (M)	RUN No.	PENETRATION RATE (M/MIN)	% RETURN FLUSH COLOUR	FR-FRACTURE		F-FAULT		SM-SMOOTH		FL-FLEXURED		DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION	
								CL-CLEAVAGE		J-JOINT		R -ROUGH		UE-UNEVEN				
								SH-SHEAR		P-POLISHED		ST-STEPPED		W -WAVY				
								VN-VEN		S-SLICKENSIDED		PL-PLANAR		C -CURVED				
RECOVERY		R.O.D.		FRACT. INDEX PER 0.3m		DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY										
TOTAL CORE %	SOLID CORE %	%	%	%	%	TYPE AND SURFACE DESCRIPTION												
15		CONTINUED FROM PREVIOUS PAGE		292.32														
		<b>CONGLOMERATE</b> Large granitic clasts 7 cm at 17.98m, core ground during drilling at 15.85m-16.15m		15.00														
				12	NA	0%												
				13	NA	0%												
				14	NA	0%												
				16	NA	0%												
16				289.03														
		END OF HOLE		18.29														
17																		
18																		
19																		
20																		
21																		
22																		
23																		
24																		
25																		
26																		
27																		
28																		
29																		
30																		

DEPTH SCALE

1 : 75

Golder Associates

LOGGED J.C.  
DATE OCT 7,1987  
CHECKED J.C./T.G.C.

# RECORD OF DRILLHOLE BH 87-30

SHEET 1 OF 1



LOCATION SEE FIGURE

DRILLING DATE SEPT 19-22, 1987

DATUM GEODETIC

INCLINATION -90 AZIMUTH

DRILL RIG SKID MTD. BBS-2

DRILLING CONTRACTOR McKNIGHT DRILLING Co. Ltd.

PROJECT 871-1347

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (M)	RUN No.	PENETRATION RATE (M/HR)	FR-FRACTURE				F-FAULT				SM-SMOOTH				FL-FLEXURED				DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION				
							CL-CLEAVAGE		SH-SHEAR		VN-VEN		J-JOINT		P-POLISHED		ST-STEPPED		PL-PLANAR		UE-UNEVEN				W-WAVY		C-CURVED	
							FLUSH	% RETURN	FLUSH	% RETURN	FLUSH	% RETURN	FLUSH	% RETURN	FLUSH	% RETURN	FLUSH	% RETURN	FLUSH	% RETURN	FLUSH	% RETURN			FLUSH	% RETURN	FLUSH	% RETURN
RECOVERY		R.O.D. %		FRACT. INDEX PER 0.3M CORE ABS		DISCONTINUITY DATA				HYDRAULIC CONDUCTIVITY (cm/sec)																		
TOTAL CORE #	SOLID CORE #	TOTAL CORE #	SOLID CORE #	TOTAL CORE #	SOLID CORE #	TYPE AND SURFACE DESCRIPTION																						
0		GROUND SURFACE		307.62																								
		BLACK SANDY TOPSOIL		0.09																								
1		Loose brown fine SAND with crushed stone, some gravel, traces of wood organics. (FILL)	X																									
2					1	50 DO	7																					
3						2	50 DO	9																				
4	BW CASING	Loose to dense brown SANDY SILT TO SILTY SAND, some gravel, trace of clay, occ. cobbles and boulders. (TILL)	X	304.51																								
6					3	50 DO	59																					
8						301.23																						
7	SEPT 19/87	-Mixture of conglomerate and argillite fragments -Slightly weathered, massive, argillaceous matrix. -Greenish grey	X	8.34																								
8		CONGLOMERATE -Slightly weathered, massive, fine grained matrix. -Large boulder size conglomerate clast at 8.1m-8.84m -Matrix argillaceous in places -Small amount of calcite infilling in fractures.	X	299.78																								
9					7.84																							
10	SEPT 20/87	CONGLOMERATE -Slightly weathered to fresh, massive, fine grained matrix, argillaceous between 12.7m to 13.01 -Greenish grey to light grey -Gravel size clasts, sub-rounded -Trace of pyrite throughout, with localized concentration at 14.63m & 15.7m -Calcite healed fractures appear below 14.78m -Calcite stringers near 15.24 m	X	297.35																								
11					10.27																							
12	BO RC.																											
13																												
14																												
15																												
16																												
		END OF HOLE		291.82																								
				18.00																								

DEPTH SCALE  
1 : 75

Golder Associates

LOGGED M.J.T.  
DATE OCT 7, 1987  
CHECKED J.C./T.G.C.



APPENDIX B

RECORD OF DIAMOND DRILLHOLE LOGS  
LITHOLOGICAL & GEOTECHNICAL ROCK  
DESCRIPTION TERMINOLOGY  
LIST OF ABBREVIATIONS

DDH87-16 TO DDH87-24

DDH87-26, DDH87-27

DDH87-30 TO DDH87-32, DDH87-50

DDH87-55, DDH87-57 TO DDH87-59

DDH87-62, DDH87-64 TO DDH87-66

January 1988

871-1445

# LITHOLOGICAL AND GEOTECHNICAL ROCK DESCRIPTION TERMINOLOGY

## WEATHERING STATE

**Fresh:** no visible sign of weathering.

**Faintly weathered:** weathering limited to the surface of major discontinuities.

**Slightly weathered:** penetrative weathering developed on open discontinuity surfaces but only slight weathering of rock material.

**Moderately weathered:** weathering extends throughout the rock mass but the rock material is not friable.

**Highly weathered:** weathering extends throughout rock mass and the rock material is partly friable.

**Completely weathered:** rock is wholly decomposed and in a friable condition but the rock texture and structure are preserved.

## BEDDING THICKNESS

<u>Description</u>	<u>Bedding Plane Spacing</u>
Very thickly bedded	> 2 m
Thickly bedded	0.6 m to 2m
Medium bedded	0.2 m to 0.6 m
Thinly bedded	60 mm to 0.2 m
Very thinly bedded	20 mm to 60 mm
Laminated	6 mm to 20 mm
Thinly laminated	< 6 mm

## JOINT OR FOLIATION SPACING

<u>Description</u>	<u>Spacing</u>
Very wide	> 3 m
Wide	1 - 3 m
Moderately close	0.3 - 1 m
Close	50 - 300 mm
Very close	< 50 mm

## GRAIN SIZE

<u>Term</u>	<u>Size*</u>
Very Coarse Grained	> 60 mm
Coarse Grained	2 - 60 mm
Medium Grained	60 microns - 2 mm
Fine Grained	2 - 60 microns
Very Fine Grained	< 2 microns

Note: \* Grains > 60 microns diameter are visible to the naked eye.

## CORE CONDITION

### Total Core Recovery

The percentage of solid drill core recovered regardless of quality or length, measured relative to the length of the total core run.

### Solid Core Recovery (SCR)

The percentage of solid drill core, regardless of length, recovered at full diameter, measured relative to the length of the total core run.

### Rock Quality Designation (RQD)

The percentage of solid drill core, greater than 100 mm length, recovered at full diameter, measured relative to the length of the total core run. RQD varies from 0% for completely broken core to 100% for core in solid sticks.

## DISCONTINUITY DATA

### Fracture Index

A count of the number of discontinuities (physical separations) in the rock core, including both naturally occurring fractures and mechanically induced breaks caused by drilling.

### Dip with Respect to (W.R.T.) Core Axis

The angle of the discontinuity relative to the axis (length) of the core. In a vertical borehole a discontinuity with a 90° angle is horizontal.

### Description and Notes

An abbreviated description of the discontinuities, whether naturally occurring separations such as fractures, bedding planes and foliation planes or mechanically induced features caused by drilling such as ground or shattered core and mechanically separated bedding or foliation surfaces. Additional information concerning the nature of fracture surfaces and infillings are also noted.

### Abbreviations

B - Bedding	P - Polished
FO - Foliation / Schistosity	S - Slickensided
CL - Cleavage	SM - Smooth
SH - Shear Plane / Zone	R - Ridged / Rough
VN - Vein	ST - Stepped
F - Fault	PL - Planar
CO - Contact	FL - Flexured
J - Joint	UE - Uneven
FR - Fracture	W - Wavy
MF - Mechanical Fracture	C - Curved
- Parallel To	
⊥ - Perpendicular To	

## LIST OF ABBREVIATIONS

The abbreviation commonly employed on each "Record of Borehole," on the figures and in the text of the report, are as follows:

### I. SAMPLE TYPES

*AS* auger sample  
*CS* chunk sample  
*DO* drive open  
*DS* Denison type sample  
*FS* foil sample  
*RC* rock core  
*ST* slotted tube  
*TO* thin-walled, open  
*TP* thin-walled, piston  
*WS* wash sample

### II. PENETRATION RESISTANCES

#### Dynamic Penetration Resistance:

The number of blows by a 63.6 kg (140 lb) hammer dropped 760 mm (30 in.) to drive uncased a 50 mm (2 in.) diameter, 60° cone attached to "A" size drill rods for a distance of 0.3 m (12 in.).

#### Standard Penetration Resistance, *N*:

The number of blows by a 63.6 kg (140 lb) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) drive open sampler for a distance of 0.3 m (12 in.).

*WH* sampler advanced by static weight—weight, hammer  
*PH* sampler advanced by pressure—pressure, hydraulic  
*PM* sampler advanced by pressure—pressure, manual

### III. SOIL DESCRIPTION

(a) *Cohesionless Soils*      '*N*'  
Blows/0.30m  
or Blows/ft.  
*Relative Density*  
 Very loose                      0 to 4  
 Loose                              4 to 10  
 Compact                         10 to 30  
 Dense                              30 to 50  
 Very dense                      over 50

#### (b) *Cohesive Soils*

<i>Consistency</i>	<u>kPa</u>	' <i>Cu</i> ' <u>psf.</u>
Very soft	0 to 12	0 to 250
Soft	12 to 25	250 to 500
Firm	25 to 50	500 to 1000
Stiff	50 to 100	1000 to 2000
Very stiff	100 to 200	2000 to 4000
Hard	over 200	over 4000

### IV. SOIL TESTS

*C* consolidation test  
*H* hydrometer analysis  
*M* sieve analysis  
*MH* combined analysis, sieve and hydrometer<sup>1</sup>  
*Q* undrained triaxial<sup>2</sup>  
*R* consolidated undrained triaxial<sup>2</sup>  
*S* drained triaxial  
*U* unconfined compression  
*V* field vane test

#### NOTES:

- <sup>1</sup>Combined analyses when 5 to 95 per cent of the material passes the No. 200 sieve.  
<sup>2</sup>Undrained triaxial tests in which pore pressures are measured are shown as  $\bar{Q}$  or  $\bar{R}$ .

# RECORD OF DRILLHOLE DDH 87-16

SHEET 1 OF 1



LOCATION SEE FIGURE

DRILLING DATE SEPT 10, 1987

DATUM GEODETIC

INCLINATION -90      AZIMUTH

DRILL RIG ROTARY DIAMOND BBS-2

DRILLING CONTRACTOR MCKNIGHT DRILLING Co. Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (M)	RUN No.	PENETRATION RATE (M/MIN)	FR-FRACTURE		F-FAULT		SM-SMOOTH		FL-FLEXURED		DIAMETRAL POINT LOAD INDEX (MPa)	NOTES
							CL-CLEAVAGE		J-JOINT		R-ROUGH		UE-UNEVEN			
							SH-SHEAR		P-POLISHED		ST-STEPPED		W-WAVY			
VN-VEIN		S-SLICKENSIDED		PL-PLANAR		C-CURVED		HYDRAULIC CONDUCTIVITY (cm/sec)		INSTRUMENTATION						
RECOVERY		R.Q.D. %		FRACT. INDEX PER 0.3M		DISCONTINUITY DATA		TYPE AND SURFACE DESCRIPTION								
TOTAL CORE %	SOLID CORE %															
0		GROUND SURFACE		307.82												
0		UNDIFFERENTIATED OVERBURDEN (mostly fill)		0.00												
1	BW CASING															
2		CONGLOMERATE		305.81	2.01	1	NA	NA	0%	0%						R. UE. PL.
2		Slightly to moderately weathered, massive, light greenish grey, fine grained matrix with sand and gravel size granite clasts, trace of pyrite throughout. Silt infilling and Fe staining on fracture surfaces common. (GOWGANDA FORMATION)				2	NA	NA	0%	0%						BC
3						3	NA	NA	0%	0%						BC. R. UE.
3						4	NA	NA	0%	0%						BC. R. UE.
4				303.89		5	.93	NA	0%	0%						BC. R. UE.
4				3.93		6	.061	0%	0%							BC.
5						7	.049	0%	0%							R. UE.
6						8	.082	0%	0%							BC.
6						9	.068	0%	0%							BC. R. UE.
7						10	.086	0%	0%							R. UE.
7	BQ RC.	CONGLOMERATE				11	.044	0%	0%							R. UE. PL.
8		Fresh massive, light greenish grey, fine grained matrix with gravel to cobble size sub-grounded granitic clasts, large granite clast (30cm) @ 4.8m. Calcite healed fractures throughout. Calcite veinlets 1-2 mm thick @ 70-80 CA. Trace of pyrite throughout. Fe staining common in top 4.57m. (GOWGANDA FORMATION)				12										BC.
9						13										R. UE. ST.
10						14										R. UE. C.
11						15										R. UE.
12				295.83												
12		END OF HOLE		12.19												

BACKFILLED TO SURFACE WITH SAND.

# RECORD OF DRILLHOLE DDH 87-17

SHEET 1 OF 1



LOCATION SEE FIGURE  
INCLINATION -90 AZIMUTH

DRILLING DATE SEPT 11, 1987  
DRILL RIG SKID MTD BBS-2  
DRILLING CONTRACTOR MCKNIGHT DRILLING Co. Ltd.

DATUM GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	SYMBOLIC LOG	ELEV. DEPTH (M)	RUN No.	PENETRATION RATE (L/MIN)	FLUSH % RETURN COLOUR	RECOVERY		R.O.D. %	FRACT. INDEX PER 0.6M	DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY k <sub>v</sub> cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
							TOTAL CORE %	SOLID CORE %			TYPE AND SURFACE DESCRIPTION				
							FR-FRACTURE	F-FAULT			SM-SMOOTH	FL-FLEXURED			
0			307.80												
1	BW CASING		0.00												
2			305.38												
3		CONGLOMERATE Slightly weathered to fresh, massive, greenish grey. (GOWGANDA FORMATION)	2.44 304.81	1	NA	NA%					BC. R. UE. BC. R. UE.				
4		CONGLOMERATE Moderately to highly weathered, massive, greenish grey, highly broken, intervals @ 2.98m to 3.23m and 3.53m to 3.81m. (GOWGANDA FORMATION)	2.98 303.99	2	NA	NA%					R. UE. BC. R. UE. BC. R. UE.				
5			3.81	3	NA	NA%					BC. R. UE. BC. BC.				
6				4	NA	100%					R. UE.				
7	BQ R.C.	CONGLOMERATE Fresh massive, greenish grey, fine grained matrix with sand to gravel size granitic subrounded to subangular clasts, trace pyrite throughout. Calcite infilling, some silt infillings Fe staining throughout, calcite veinlets @ 80 to CA. at 7.55m to 7.95m, at 11.67m and 11.21m (GOWGANDA FORMATION)		6	NA	100%					R. UE. BC. R. UE. BC. R. UE. ST. R. UE. R. UE.				
8				7	.030	NA%					R. UE. C. R. UE. PL. R. UE.				
9				8	.059	NA%					R. PL. R. PL.				
10			295.81												
11			12.19												
12		END OF HOLE													
13															
14															
15															
16															

**BACKFILLED TO SURFACE WITH SAND.**

DEPTH SCALE

1 : 75

Golder Associates

LOGGED M.J.T.  
DATE OCT 8, 1987  
CHECKED J.C./T.G.C.

# RECORD OF DRILLHOLE DDH 87-18

SHEET 1 OF 1

LOCATION SEE FIGURE

DRILLING DATE SEPT 11/14/87

DATUM GEODETTIC

INCLINATION -90      AZIMUTH

DRILL RIG ROTARY DIAMOND BBS-2

DRILLING CONTRACTOR MCKNIGHT DRILLING Co. Ltd.



PROJECT 87-1837

DEPTH SCALE METRES	DRILLING RECORD	SYMBOLIC LOG	ELEV. DEPTH (M)	RUN No.	PENETRATION RATE (M/MIN)	FLUSH	% RETURN COLOUR	FR-FRACTURE CL-CLEAVAGE SH-SHEAR VN-VEIN			F-FAULT J-JOINT P-POLISHED S-SLICKENSIDED			SM-SMOOTH R-ROUGH ST-STEPPED PL-PLANAR			FL-FLEXURED UE-UNEVEN W-WAVY C-CURVED			DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION	
								RECOVERY		R.O.D. %	FRACT. INDEX PER 0.3m	DISCONTINUITY DATA			HYDRAULIC CONDUCTIVITY K <sub>v</sub> (m/s)							
								TOTAL CORE %	SOLID CORE %			TYPE AND SURFACE DESCRIPTION										
0	GROUND SURFACE		307.70																			
1	UNDIFFERENTIATED OVERBURDEN (mostly fill)		0.00																			
2																						
3	<b>CONGLOMERATE</b> Slightly weathered, massive, greenish grey, fine grained matrix, sand size clasts, Fe staining common, trace of pyrite throughout, broken core with gravel to cobble size angular to subangular pieces. (GOWGANDA FORMATION)		304.41	1	NA	0%																
4			303.52	2	NA	0%																
5			4.18	3	NA	0%																
6			4	NA	0%																	
7			5	NA	0%																	
8			6	NA	0%																	
9			7	NA	0%																	
10			8	NA	0%																	
11			9	NA	0%																	
12			END OF HOLE		295.23																	
13			12.47																			
14																						
15																						

**BACKFILLED TO SURFACE WITH SAND.**

DEPTH SCALE

1 : 75

Golder Associates

LOGGED M.J.T.  
DATE OCT 8, 1987  
CHECKED J.C./T.G.C.

# RECORD OF DRILLHOLE DDH 87-19

SHEET 1 OF 1

LOCATION SEE FIGURE  
INCLINATION -90 AZIMUTH

DRILLING DATE SEPT 14, 1987  
DRILL RIG ROTARY DIAMOND BBS-2  
DRILLING CONTRACTOR MCKNIGHT DRILLING Co. Ltd.

DATUM GEODETIC



DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (M)	RUN No.	PENETRATION RATE (M/MIN)	FLUSH % RETURN COLOUR	FR-FRACTURE		F-FAULT		SM-SMOOTH		FL-FLEXURED		DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
								CL-CLEAVAGE		J-JOINT		R -ROUGH		UE-UNEVEN			
								SH-SHEAR		P-POLISHED		ST-STEPPED		W -WAVY			
VN-VEIN		S-SLICKENSIDED		PL-PLANAR		C -CURVED		DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY (DVT/98C)							
TOTAL CORE %	SOLID CORE %	R.O.D. %	FRACT. INDEX PER 0.6M	DP W.L. CORE AXIS	TYPE AND SURFACE DESCRIPTION												
0		GROUND SURFACE		307.74													
1	BW CASING	UNDIFFERENTIATED OVERBURDEN (mostly fill)		0.00													
2																	
3																	
4		CONGLOMERATE Slightly to moderately weathered, massive, light green to greenish grey, slightly argillaceous matrix, sand to gravel size clasts, trace of pyrite throughout, iron staining common, calcite veinlet at 5.12m (2mm wide). Core broken from 3.85m-3.84m, 3.81m-4.11m 4.72m-4.82m, gravel to cobble size subangular pieces. (GOWGANDA FORMATION)		304.08 3.88	1 2	NA NA	100% 100%										BC. R.PL.Pyrite BC.PL.R. BC.PL.R. PL.R.UE. BC.PL.
5																	
6				302.82 5.12	3	NA	0%										R.UE.PL.BC. PL.S. PL.R.UE. PL.R.UE. PL.R.UE. PL.R.W.UE. R.UE. R.PL. BC.R.PL. PL.R.UE. R.PL. R.PL.
7					4	NA											
8	BQ R.C.				5	NA											
9		CONGLOMERATE Fresh, massive, greenish grey, fine grained matrix, with gravel to cobble size sub-rounded clasts, trace pyrite throughout, iron staining common to 8.7m, some pink calcite veinlet (approx 5mm) 80 to core axis, calcite healed fractures common throughout. (GOWGANDA FORMATION)			6	NA											R.PL. R.PL.UE. R.UE. PL.S. PL.R.UE. PL.R. PL.R.UE. PL.R.UE. R.UE.W. PL.R. PL.R.UE. R.UE.PL. R.PL. PL.R.UE. PL.UE.R. PL.R.UE. PL.R.UE. PL.R.UE. R.UE. R.PL.UE. PL.R. PL.R. PL.R.UE.
10					7	NA											
11					8	NA											
12	SEPT 14/87				9	NA											BACKFILLED TO SURFACE WITH SAND.
13		END OF HOLE		294.94 12.80	10	NA											
14																	
15																	

DEPTH SCALE

1: 75

Golder Associates

LOGGED R.J.W.  
DATE OCT 6, 1987  
CHECKED J.C./T.G.C.

# RECORD OF DRILLHOLE DDH 87-20

SHEET 1 OF 1



LOCATION: SEE FIGURE

DRILLING DATE: SEPT 16, 1987

DATUM: GEODETIC

INCLINATION: -90

AZIMUTH

DRILL RIG: SKID MTD BBS-2

DRILLING CONTRACTOR: MCKNIGHT DRILLING Co. Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (M)	RUN No.	PENETRATION RATE (M/MIN)	FLUSH % RETURN COLOUR	FR-FRACTURE		F-FAULT		SM-SMOOTH		FL-FLEXURED		DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
								CL-CLEAVAGE		J-JOINT		R-ROUGH		UE-UNEVEN			
								SH-SHEAR		P-POLISHED		ST-STEPPED		W-WAVY			
VN-VEIN		S-SLICKENSIDED		PL-PLANAR		C-CURVED		DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY (DVS)							
RECOVERY		R.O.D. %		FRACT. INDEX PER 0.3M		TYPE AND SURFACE DESCRIPTION											
TOTAL CORE %		SOLID CORE %		0 10 20 30 40 50		0 10 20 30 40 50		0 10 20 30 40 50		0 10 20 30 40 50							
0		GROUND SURFACE		307.70													
1	BW CASING	UNDIFFERENTIATED OVERBURDEN (mostly fill)		0.00													
2																	
3				304.50													
4		CONGLOMERATE -Fresh, massive, greenish grey, fine grained matrix. (GOWGANDA FORMATION)		3.20 303.80	1	NA											R.UE. ST PL.R.W. PL.R.ST. PL.R. fractured
5		CONGLOMERATE -Highly weathered, massive, greenish grey, fine grained matrix. (GOWGANDA FORMATION)		3.90	2	NA											fractured
6					3	NA											
7					4	NA											R.PL.UE.
8				302.09													
9				5.61	6	NA											PL.R.UE. PL.R.UE. PL.R.UE. PL.R.UE. PL.R. fractured PL.R. PL.R. PL.R.UE. PL.R.UE. PL.R.UE. PL.R.UE. PL.R. fractured
10	BQ R.C.	CONGLOMERATE -Fresh, massive, greenish grey, fine grained matrix. -Granite clasts, sand to gravel size, subrounded -calcite infilling common in fractures -White calcite veinlets scattered throughout @ 80 to core axis. -large, white, granite clast (10cm) at 12.49m -Trace of pyrite throughout (GOWGANDA FORMATION)			7	NA											PL.R. PL.R.UE.
11					8	NA											PL.R. PL.R.UE. PL.R. PL.R. PL.R.UE. PL.R.UE. PL.R.UE. PL.R.UE. PL.R. fractured
12	SEPT 16/87				9	NA											PL.R. R.PL.W. PL.R.UE. PL.R.UE. PL.R.UE.
13		END OF HOLE		295.20	11	NA											PL.R.UE.
14				12.50													
15																	

**BACKFILLED TO SURFACE WITH SAND.**



# RECORD OF DRILLHOLE DDH.87-22

SHEET 1 OF 2



LOCATION SEE FIGURE  
INCLINATION -80 AZIMUTH N 6 W

DRILLING DATE SEPT.17-18,1987  
DRILL RIG SKID MTD BBS-2  
DRILLING CONTRACTOR MCKNIGHT DRILLING CO.LTD.

DATUM GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (M)	RUN No.	PENETRATION RATE (M/HR)	FR-FRACTURE		F-FAULT		SM-SMOOTH		FL-FLEXURED		DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION	
							CL-CLEAVAGE		J-JOINT		R-ROUGH		UE-UNEVEN				
							SH-SHEAR		P-POLISHED		ST-STEPPED		W-WAVY				
VN-VEN		S-SLICKENSIDED		PL-PLANAR		C-CURVED		HYDRAULIC CONDUCTIVITY (cm/sec)									
		RECOVERY		R.O.D. %		FRACT. INDEX PER 0.3M		DISCONTINUITY DATA									
		TOTAL CORE %	SOLID CORE %					TYPE AND SURFACE DESCRIPTION									
		0000	0000														
0		GROUND SURFACE		307.70													
1	BW CASING	UNDIFFERENTIATED OVERBURDEN (mostly fill)		0.00													
2																	
3																	
4																	
5				CONGLOMERATE -Weathered, fractured, fine grained matrix, light grey- Clasts -Calcite filled fractures common -Trace of pyrite common -Iron staining on fracture faces		303.92											
6					4.38												
7					6												
8	BQ R.C.	CONGLOMERATE -Fresh, massive, fractured, light grey, fine grained. -Calcite healed fractures -Cobble size subrounded granite & quartzite clasts. -Trace of pyrite throughout -Vuggy, pink granite clast at 13.65m -Calcite infilling common in fractures -Slight iron staining throughout (GOWGANDA FORMATION)		301.53													
9				7.13													
10				8													
11				9													
12				10													
13				11													
14				12													
15		13		294.71													
15		CONTINUED ON NEXT SHEET		15.00													

DEPTH SCALE

1: 75

Golder Associates

LOGGED J.C.  
DATE OCT 6,1987  
CHECKED T.G.C.

# RECORD OF DRILLHOLE DDH.87-22

SHEET 2 OF 2



LOCATION SEE FIGURE

DRILLING DATE SEPT.18,1987

DATUM GEODETIC

INCLINATION -80

AZIMUTH N 5 W

DRILL RIG SKID MTD BBS-2

DRILLING CONTRACTOR MCKNIGHT DRILLING CO.LTD.

PROJECT 87-1347

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (M)	RUN NO.	PENETRATION RATE (M/MIN)	FLUSH & RETURN COLOUR	FR-FRACTURE		F-FAULT		SM-SMOOTH		FL-FLEXURED		DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
								CL-CLEAVAGE		J-JOINT		R-ROUGH		UE-UNEVEN			
								SH-SHEAR		P-POLISHED		ST-STEPPED		W-WAVY			
VN-VEIN		S-SLICKENSIDED		PL-PLANAR		C-CURVED		HYDRAULIC CONDUCTIVITY (L/m/sec)									
RECOVERY		R.O.D. %		DISCONTINUITY DATA		TYPE AND SURFACE DESCRIPTION											
TOTAL CORE %	SOLID CORE %																
CONTINUED FROM PREVIOUS SHEET				294.88													
15				15.00	13	NA											
16		CONGLOMERATE -Pink granite band @ 17.77m (GOWGANDA FORMATION)	●●●●●		14	NA											
17	SEPT 18 / 87 80 RC				16	NA											
18				292.06													
19		END OF HOLE		18.04													
20																	
21																	
22																	
23																	
24																	
25																	
26																	
27																	
28																	
29																	
30																	

BACKFILLED TO SURFACE WITH SAND.

DEPTH SCALE

1 : 75

Golder Associates

LOGGED J.C.  
DATE OCT 8,1987  
CHECKED T.G.C.

# RECORD OF DRILLHOLE DDH.87-23

SHEET 1 OF 2

LOCATION SEE FIGURE

DRILLING DATE SEPT.18-19,1987

DATUM GEODETTIC

INCLINATION -80

AZIMUTH N 6 W

DRILL RIG SKID MTD BBS-2

DRILLING CONTRACTOR MCKNIGHT DRILLING CO.LTD.



PROJECT 87P1347

DEPTH SCALE METRES	DRILLING RECORD	SYMBOLIC LOG	ELEV. DEPTH (M)	RUN No.	PENETRATION RATE (M/MIN)	FLUSH & RETURN COLOUR	RECOVERY		R.O.D. %	FRACT. INDEX PER 0.3M	DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY K <sub>v</sub> cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION	
							TOTAL CORE %	SOLID CORE %			TYPE AND SURFACE DESCRIPTION	OF 0.3M CORE AXES				
							FR-FRACTURE CL-CLEAVAGE SM-SHEAR VN-VEN	F-FAULT J-JOINT P-POLISHED S-SLICKENSIDED			SM-SMOOTH R-ROUGH ST-STEPPED PL-PLANAR	FL-FLEXURED UE-UNEVEN W-WAVY C-CURVED				
0	GROUND SURFACE		307.78													
1	UNDIFFERENTIATED OVERBURDEN (mostly fill)		0.00													
2																
3	<b>CONGLOMERATE</b> -Moderately weathered, massive light grey, fractured, fine grained -Sand size, subrounded clasts -Calcite healed fractures, pink calcite clast @ 4.88m -Trace of pyrite on fracture surfaces -Iron staining common -Small amount of silt infilling in upper 4.27m -Two highly broken up sections @ 4.57m-4.78m & 5.83m-5.76m. (GOWGANDA FORMATION)		304.25	4.08	1	NA	100%									
4			302.79	5.78	2	NA	80%									
5																
6																
7																
8																
9																
10																
11																
12			<b>CONGLOMERATE</b> -Fresh, massive, fractured, light grey, fine grained -Calcite lined & healed fractures throughout -Quartzite & granitic clasts sand to cobble size, subrounded to rounded. -Iron staining & trace of pyrite common. (GOWGANDA FORMATION)				6	NA	0%							
13																
14																
15	CONTINUED ON NEXT SHEET		294.79	15.00	9	NA										

DEPTH SCALE

1 : 75

Golder Associates

LOGGED J.C.  
DATE OCT 7,1987  
CHECKED T.G.C.

# RECORD OF DRILLHOLE DDH.87-23

SHEET 2 OF 2



LOCATION SEE FIGURE  
 INCLINATION -60      AZIMUTH N 6 W

DRILLING DATE SEPT 18-19, 1987  
 DRILL RIG SKID MTD BBS-2  
 DRILLING CONTRACTOR MCKNIGHT DRILLING COLTD.

DATUM GEODETIC

PROJECT 87-1347

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (M)	RUN NO.	PENETRATION RATE (M/HR)	FLUSH RETURN COLOUR	FR-FRACTURE		F-FAULT		SM-SMOOTH		FL-FLEXURED		DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION		
								CL-CLEAVAGE		J-JOINT		R-ROUGH		UE-UNEVEN					
								SH-SHEAR		P-POLISHED		ST-STEPPED		W-WAVY					
VN-VEN		S-SLICKENSIDED		PL-PLANAR		C-CURVED		HYDRAULIC CONDUCTIVITY (cm/sec)		DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION									
RECOVERY		R.O.D. %		FRACT. INDEX PER QJM		DISCONTINUITY DATA		DISCONTINUITY DATA		DISCONTINUITY DATA		DISCONTINUITY DATA							
TOTAL CORE %	SOLID CORE %																		
CONTINUED FROM PREVIOUS SHEET				294.79															
15		CONGLOMERATE (GOWGANDA FORMATION)	[Symbolic Log: Circles in a grid]	15.00	9	NA													
16				10	NA														
17	Bq RC			11	NA														
18	SEPT 19 / 87			18.99															
19		END OF HOLE		18.99															
20																			
21																			
22																			
23																			
24																			
25																			
26																			
27																			
28																			
29																			
30																			

BACKFILLED TO SURFACE WITH SAND.

DEPTH SCALE

1 : 75

Golder Associates

LOGGED J.C.  
 DATE OCT 8, 1987  
 CHECKED T.G.C.





# RECORD OF DRILLHOLE DDH 87-26

SHEET 1 OF 2



LOCATION SEE FIGURE

DRILLING DATE SEPT 23&24,1987

DATUM GEODETIC

INCLINATION -45 AZIMUTH N 85 E

DRILL RIG SKID MTD. BBS-2

DRILLING CONTRACTOR MCKNIGHT DRILLING Co. Ltd.

PROJECT 87-1947

DEPTH SCALE METRES	DRILLING RECORD	SYMBOLIC LOG	ELEV. DEPTH (M)	RUN NO.	PENETRATION RATE (M/MIN)	FLUSH % RETURN	% RETURN COLOUR	RECOVERY		R.O.D. %	FRACT. INDEX PER O.G.M	DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY k <sub>v</sub> cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION				
								TOTAL CORE %	SOLID CORE %			TYPE AND SURFACE DESCRIPTION	DP WALL CORE AXES							
								FR-FRACTURE	F-FAULT			SM-SMOOTH	FL-FLEXURED							
0	GROUND SURFACE		307.72																	
1	UNDIFFERENTIATED OVERBURDEN (mostly fill)		0.00																	
2																				
3																				
4					304.92															
5			<b>CONGLOMERATE</b> -Slightly weathered to weathered, massive, greenish grey, fine grained matrix. -Sand size, subrounded clasts -Silt intrusion -Iron staining on fracture surfaces. -Trace of pyrite throughout -Thin calcite healed fractures (0.5mm) between 5.95m-8.41m. (GOWGANDA FORMATION)		3.96	1	NA	100%												
6					2	NA	100%													
7					3	NA	100%													
8					4	NA														
9					5	NA														
10					6	NA														
11					7	NA														
12					8	NA														
13	9	NA																		
14	10	NA																		
15	11	NA																		
16	12	NA																		
15	CONTINUED ON NEXT PAGE		297.12																	
			15.00																	

DEPTH SCALE

1 : 75

Golder Associates

LOGGED R.J.W.  
DATE OCT 8,1987  
CHECKED J.C./T.G.C.

# RECORD OF DRILLHOLE DDH 87-26

SHEET 2 OF 2



LOCATION SEE FIGURE

DRILLING DATE SEPT 23&24,1987

DATUM GEODETIC

INCLINATION -45

AZIMUTH N 85 E

DRILL RIG SKID MTD. BBS-2

DRILLING CONTRACTOR McKNIGHT DRILLING Co. Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (M)	RIN No.	PENETRATION RATE (L/MIN)	FLUSH	% RETURN	COLOUR	FR-FRACTURE	F-FAULT	SM-SMOOTH	FL-FLEXURED	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES
										CL-CLEAVAGE	J-JOINT	R -ROUGH	UE-UNEVEN		
										SH-SHEAR	P-POLISHED	ST-STEPPED	W -WAVY		
										VN-VEIN	S-SLICKENSIDED	PL-PLANAR	C -CURVED		
RECOVERY		R.O.D. %	FRACT. INDEX PER 0.3M	DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY (mD/m)									
TOTAL CORE %	SOLID CORE %			DP W/L CORE AUB	TYPE AND SURFACE DESCRIPTION										
16		CONTINUED FROM PREVIOUS PAGE		297.12											
				15.00											
16					12	NA									R. UE. PL.
															R. UE. PL.
16															R. UE.
															R. UE. PL.
17															R. UE. PL.
															R. UE. PL.
17															R. UE. PL.
															R. UE. PL.
18		CONGLOMERATE CONTINUED													R. UE. PL.
															BC. R. UE.
18					14	NA									R. UE.
															R. UE. PL.
19															R. UE. C.
															R. UE. PL.
19															R. UE. PL.
															BC. R. UE. PL.
20															R. UE. PL.
															R. UE. PL.
20															R. UE. PL.
															BC. R. UE. PL.
21															R. UE. PL.
															R. UE. PL.
21															R. UE. PL.
															R. UE.
21				292.68											
				21.28											
22		BROKE THROUGH INTO UNDERGROUND OPENING													
22															
23															
23															
24															
24															
25															
25															
26															
26															
27															
27															
28															
28															
29															
29															
30															
30															

**BURLAP PLUG INSERTED AT 4.7m, BACKFILLED TO SURFACE WITH SAND.**

DEPTH SCALE

1 : 75

Golder Associates

LOGGED R.J.W.

DATE OCT 8, 1987

CHECKED J.C./T.G.C.

# RECORD OF DRILLHOLE DDH 87-27

SHEET 1 OF 2



LOCATION SEE FIGURE  
 INCLINATION -80      AZIMUTH N 85 E

DRILLING DATE SEPT 24&25,1987  
 DRILL RIG SKID MTD. BBS-2  
 DRILLING CONTRACTOR MCKNIGHT DRILLING Co. Ltd.

DATUM GEODETIC

PROJECT 87-1347

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (M)	RUN No.	PENETRATION RATE (M/MIN)	RECOVERY		R.Q.D. %	FRACT. INDEX PER 0.3M	DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY k <sub>v</sub> cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION				
							TOTAL CORE %	SOLID CORE %			TYPE AND SURFACE DESCRIPTION	OF W.J.L. CORE AXIS							
							FLUSH	% RETURN COLOUR											
0		GROUND SURFACE		307.74															
1	SEPT 25/87 BW CASING	UNDIFFERENTIATED OVERBURDEN (mostly fill)		0.00															
2																			
3						305.12	1	NA	100%									R.UE.C.	
4						3.02	2	NA	100%										R.UE.PL.
5							3	NA	100%										R.UE.PL.
6							4	NA	100%										R.UE.C.
7							5	NA	100%										BC.R.UE.PL.
8							6	NA	0%										BC.R.UE.
9						302.85	7	NA											BC.R.UE.PL.
10						5.64	8	NA											R.UE.
11							9	NA											BC.R.UE.
12							10	NA											R.UE.
13				11	NA											R.PL.			
14				12	NA											R.PL.			
15					12	NA										BC.R.UE.			
				294.28												R.PL.			
		CONTINUED ON NEXT PAGE		15.54															

DEPTH SCALE

1 : 75

Golder Associates

LOGGED M.J.T.  
 DATE OCT 6,1987  
 CHECKED J.C./T.G.C.

# RECORD OF DRILLHOLE DDH 87-27

SHEET 2 OF 2



LOCATION SEE FIGURE

DRILLING DATE SEPT 24&26,1987

DATUM GEODETIC

INCLINATION -80 AZIMUTH N 85 E

DRILL RIG SKID MTD. BBS-2

DRILLING CONTRACTOR MCKNIGHT DRILLING Co. Ltd.

PROJECT 87-1347

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (M)	RUN No.	PENETRATION RATE (M/HR)	FLUSH RETURN COLOUR	FR-FRACTURE		F-FAULT		SM-SMOOTH		FL-FLEXURED		DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
								CL-CLEAVAGE		J-JOINT		R -ROUGH		UE-UNEVEN			
								SH-SHEAR		P-POLISHED		ST-STEPPED		W -WAVY			
VN-VEIN		S-SLICKENSIDED		PL-PLANAR		C -CURVED		RECOVERY		R.O.D. %	FRACT. INDEX PER 0.6M	DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY k <sub>o</sub> /msec			
TOTAL CORE %	SOLID CORE %	TYPE AND SURFACE DESCRIPTION															
16		CONTINUED FROM PREVIOUS PAGE		294.28													
16				15.54	13	NA											R.UE.
17		CONGLOMERATE -Large granitic clast(8cm dia.) at approx. 21.3m. -Blue quartz grains (1-3mm) at approx. 18.59m.			14	NA											R.UE.
18					16	NA											R.UE.
19	BQ RC				16	NA											R.UE.
20	SEPT 28/87				16	NA											R.UE.
21				289.18	16	NA											R.UE.
22		BROKE THROUGH INTO UNDERGROUND OPENING		21.43													R.UE.
23																	
24																	
25																	
26																	
27																	
28																	
29																	
30																	

VANRUTH PLUG INSERTED AT 7.62 m, CEMENTED FOR 2.5m AND SAND BACKFILLED TO SURFACE.

DEPTH SCALE

1 : 75

Golder Associates

LOGGED M.J.T.

DATE OCT 8,1987

CHECKED J.C./T.G.C.

# RECORD OF DRILLHOLE DDH 87-30

SHEET 1 OF 1



LOCATION SEE FIGURE

DRILLING DATE OCT 14, 1987

DATUM GEODETIC

INCLINATION -90

AZIMUTH

DRILL RIG SKID MTD. BBS-2

DRILLING CONTRACTOR MCKNIGHT DRILLING Co. Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (M)	RUN No.	PENETRATION RATE (m/min)	FLUSH & RETURN COLOUR	FR-FRACTURE		F-FAULT		SM-SMOOTH		FL-FLEXURED		DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION				
								CL-CLEAVAGE		J-JOINT		R-ROUGH		UE-UNEVEN							
								SH-SHEAR		P-POLISHED		ST-STEPPED		W-WAVY							
0		GROUND SURFACE		307.78																	
1	BQ R.C.	UNDIFFERENTIATED OVERBURDEN (mostly fill)	○	0.00																	
2																					
3						304.58	1	NA												R. UE. PL.	
4						3.20	2	NA													BC.
5							3	NA													R. UE. BC.
6							4	NA													BC. R. UE.
7							5	NA													BC. R. UE.
8							6	NA													R. UE. BC.
9						302.02	7	NA													R. UE. BC.
10						5.78	8	NA													BC. R. UE.
11							9	NA													BC. R. UE.
12							10	NA													R. UE.
13							11	NA													BC. R. UE.
14				12	NA													BC. R. UE.			
15				13	NA													R. UE.			
16				14	NA													R. UE. PL.			
17				15	NA													R. ST. UE.			
18				16	NA													BC. R. UE.			
19				17	NA													BC. R. UE.			
20				18	NA													R. UE.			
21				19	NA													BC. R. UE. R			
22				20	NA													BC. R. UE. R			
23				21	NA													BC. R. UE.			
24				22	NA													R. UE.			
25				23	NA																
26				24	NA																
27				25	NA																
28				26	NA																
29				27	NA																
30				28	NA																
31				29	NA																
32				30	NA																
33				31	NA																
34				32	NA																
35				33	NA																
36				34	NA																
37				35	NA																
38				36	NA																
39				37	NA																
40				38	NA																
41				39	NA																
42				40	NA																
43				41	NA																
44				42	NA																
45				43	NA																
46				44	NA																
47				45	NA																
48				46	NA																
49				47	NA																
50				48	NA																
51				49	NA																
52				50	NA																
53				51	NA																
54				52	NA																
55				53	NA																
56				54	NA																
57				55	NA																
58				56	NA																
59				57	NA																
60				58	NA																
61				59	NA																
62				60	NA																
63				61	NA																
64				62	NA																
65				63	NA																
66				64	NA																
67				65	NA																
68				66	NA																
69				67	NA																
70				68	NA																
71				69	NA																
72				70	NA																
73				71	NA																
74				72	NA																
75				73	NA																
76				74	NA																
77				75	NA																
78				76	NA																
79				77	NA																
80				78	NA																
81				79	NA																
82				80	NA																
83				81	NA																
84				82	NA																
85				83	NA																
86				84	NA																
87				85	NA																
88				86	NA																
89				87	NA																
90				88	NA																
91				89	NA																
92				90	NA																
93				91	NA																
94				92	NA																
95				93	NA																
96				94	NA																
97				95	NA																
98				96	NA																
99				97	NA																
100				98	NA																
101				99	NA																
102				100	NA																
103																					



# RECORD OF DRILLHOLE DDH 87-31

SHEET 2 OF 2



LOCATION SEE FIGURE

DRILLING DATE OCT 28/87

DATUM GEODETIC

INCLINATION -90      AZIMUTH

DRILL RIG SKID MTD. BBS-2

DRILLING CONTRACTOR MCKNIGHT DRILLING Co. Ltd.

PROJECT 87-1347

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (M)	RUN No.	PENETRATION RATE (m/min)	FLUSH COLOUR	% RETURN	FR-FRACTURE		F-FAULT		SM-SMOOTH		FL-FLEXURED		DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
									CL-CLEAVAGE		J-JOINT		R-ROUGH		UE-UNEVEN			
									SH-SHEAR		P-POLISHED		ST-STEPPED		W-WAVY			
VN-VEIN		S-SLICKENSIDED		PL-PLANAR		C-CURVED		HYDRAULIC CONDUCTIVITY k, cm/sec		DISCONTINUITY DATA		TYPE AND SURFACE DESCRIPTION						
RECOVERY		R.O.D. %		FRACT. INDEX PER 0.3M		OP. W. I.L. CORE AXIS												
TOTAL CORE %	SOLID CORE %																	
15		CONTINUED FROM PREVIOUS PAGE		292.71														
16		CONGLOMERATE (GOWGANDA FORMATION)	○○○○	15.00	13	NA												
16				291.40														
17		END OF HOLE		18.31														
18																		
19																		
20																		
21																		
22																		
23																		
24																		
25																		
26																		
27																		
28																		
29																		
30																		

**BACKFILLED TO SURFACE WITH SAND.**

- R. UE. ST.
- R. UE. ST.
- BC. R. UE.
- BC. R. UE.

DEPTH SCALE

1 : 75

Golder Associates

LOGGED M.J.T.

DATE OCT 28, 1987

CHECKED J.C./T.G.C.

# RECORD OF DRILLHOLE DDH 87-32

SHEET 1 OF 2



LOCATION SEE FIGURE

DRILLING DATE OCT 6&7, 1987

DATUM GEODETIC

INCLINATION -50

AZIMUTH N 84 E

DRILL RIG SKID MTD. BBS-2

DRILLING CONTRACTOR MCKNIGHT DRILLING Co. Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (M)	RUN No.	PENETRATION RATE (U/MIN)	FLUSH	% RETURN	COLOUR	FR-FRACTURE	F-FAULT	SM-SMOOTH	FL-FLEXURED	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
										CL-CLEAVAGE	J-JOINT	R-ROUGH	UE-UNEVEN		
										SH-SHEAR	P-POLISHED	ST-STEPPED	W-WAVY		
RECOVERY		R.O.D. %		FRACT. INDEX PER 0.3M		DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY % CIV/sec		DIA METRAL POINT LOAD INDEX (MPa)					
TOTAL CORE %	SOLID CORE %	80	40	10	20	DP	WLL	TYPE AND SURFACE DESCRIPTION							
0		GROUND SURFACE		307.64											
1		UNDIFFERENTIATED OVERBURDEN (mostly fill)		0.00											
2															
3															
4															
5															
6															
7															
8															
9		<b>CONGLOMERATE</b> -Fresh to slightly weathered massive, light grey, fine grained matrix, slightly argillitic at top 1.2m -Sand to gravel size clasts, subangular -Iron staining common -Trace of pyrite throughout -Coarse grained granitic section at 10.67m-11.28m -Calcite infilling common (GOWGANDA FORMATION)		301.17											
10				8.44	1	NA	100%								R. UE.
11					2	NA	60%								R. PL.
12					3	NA									R. PL.
13					4	NA									BC.
14					5	NA									BC. R. PL.
15					6	NA									R. UE.
16					7	NA									R. PL.
17					8	NA									R. UE.
18				9	NA									R. UE.	
19		<b>CONGLOMERATE</b> -Weathered to moderately weathered, massive, light grey, fine grained matrix. -Interval between 13.1-13.4m has been highly weathered, sand to gravel size pieces		297.72											
20				12.95	6	NA									BC. R. UE.
21					7	NA									R. UE.
22				8	NA									BC. R. UE. R. ST.	
23				9	NA									BC. R. UE.	
24				10	NA									BC. S.	
25				11	NA									BC. S.	
26				12	NA									BC. S.	
27		CONTINUED ON NEXT PAGE		298.08											
28				15.12											

DEPTH SCALE

1 : 75

Golder Associates

LOGGED M.J.T.  
DATE OCT 6&7, 1987  
CHECKED J.C.



# RECORD OF DRILLHOLE DDH 87-50

SHEET 1 OF 2

LOCATION SEE FIGURE

DRILLING DATE NOV 6, 1987

DATUM GEODETIC

INCLINATION -88      AZIMUTH N 4 E

DRILL RIG SKID MTD. BBS2

DRILLING CONTRACTOR MCKNIGHT DRILLING Co. LTD



PROJECT 87-1347

DEPTH SCALE METRES	DRILLING RECORD	SYMBOLIC LOG	ELEV. DEPTH (M)	RUN No.	PENETRATION RATE (M/MIN)	FR-FRACTURE			F-FAULT			SM-SMOOTH			FL-FLEXURED			DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION		
						CL-CLEAVAGE			J-JOINT			R-ROUGH			UE-UNEVEN						
						SH-SHEAR			P-POLISHED			ST-STEPPED			W-WAVY						
VN-VEIN			S-SLICKENSIDED			PL-PLANAR			C-CURVED												
						RECOVERY		R.O.D. %	FRACT. INDEX PER 0.3M	DISCONTINUITY DATA			HYDRAULIC CONDUCTIVITY (mD/ft)								
TOTAL CORE %		SOLID CORE %		TYPE AND SURFACE DESCRIPTION																	
0	GROUND SURFACE		308.45																		
1	UNDIFFERENTIATED OVERBURDEN (mostly fill)		0.00																		
4	<b>CONGLOMERATE</b> Slightly weathered to fresh massive greyish green, fine grained argillitic matrix with some quartzite and granitic clasts throughout sand to gravel size, trace pyrite throughout, calcite healed fractures common from 6.34-8.5m. Dark green chlorite alteration spots common from 8.5-10.2m (GOWGANDA FORMATION)		300.66	1	NA																
6.34			2	NA																	
			3	NA																	
			4	NA																	
			5	NA																	
			6	NA																	
			7	NA																	
8	<b>CONGLOMERATE</b> Fresh massive, grey to pinkish grey fine grained matrix becoming coarse at 11.28m sand to cobble size quartzite clasts trace pyrite throughout, Numerous pinkish calcite veinlets (1-5 mm thick) from 11.7-12.01m. (GOWGANDA FORMATION)		296.49	4	NA	0%															
10.91			5	NA	0%																
			6	NA																	
			7	NA																	
			8	NA																	
			9	NA																	
			10	NA																	
11	<b>CONGLOMERATE</b> Fresh, massive, greyish green, fine grained argillitic matrix with granitic and quartzite clasts throughout, trace pyrite throughout, calcite healed fractures common. (GOWGANDA FORMATION)		295.09	6	NA	0%															
12.44			7	NA	0%																
			8	NA																	
			9	NA																	
			10	NA																	
			11	NA																	
			12	NA																	
13	<b>ARGILLITE</b> Fresh, massive, dark greyish green to greenish grey, fine grained, trace pyrite throughout, some calcite healed fractures		293.83	7	NA	0%															
13.71			8	NA	0%																
			9	NA	0%																
14			292.75	9	NA	0%															
15			15.00																		
	CONTINUED ON NEXT PAGE																				

DEPTH SCALE

1: 75

Golder Associates

LOGGED M.T.  
DATE NOV 6, 1987  
CHECKED JW.MT.

# RECORD OF DRILLHOLE DDH 87-50

SHEET 2 OF 2



LOCATION SEE FIGURE

DRILLING DATE NOV 8, 1987

DATUM GEODETIC

INCLINATION -88      AZIMUTH N 4 E

DRILL RIG SKID MTD. BBS2

DRILLING CONTRACTOR MCKNIGHT DRILLING Co. LTD

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (M)	RUN No.	PENETRATION RATE (m/min)	FLUSH % RETURN COLOUR	FR-FRACTURE			F-FAULT			SM-SMOOTH			FL-FLEXURED			DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
								CL-CLEAVAGE			J-JOINT			R-ROUGH			UE-UNEVEN				
								SH-SHEAR			P-POLISHED			ST-STEPPED			W-WAVY				
								VN-VEIN			S-SLICKENSIDED			PL-PLANAR			C-CURVED				
		RECOVERY		R.O.D.		FRACT. INDEX PER QJM		DISCONTINUITY DATA				HYDRAULIC CONDUCTIVITY									
		TOTAL CORE %	SOLID CORE %	%		%		TYPE AND SURFACE DESCRIPTION				k <sub>ov</sub> /sec									
		30 40 50	30 40 50	30 40 50	30 40 50	30 40 50	30 40 50														
15		CONTINUED FROM PREVIOUS PAGE		292.78																	
		ARGILLITE		14.99	10	NA	0%														
		CONGLOMERATE		15.30																	
16		Fresh, massive, greenish grey fine grained matrix, sand to cobble size granitic and quartzite clasts, calcite healed fractures, scattered throughout, pinkish calcite veinlet 2mm wide at 17.2 m at 80 to CA. trace pyrite throughout badly broken up section of core from 18.4-18.7m gravel size pieces angular to subangular (GOWGANDA FORMATION)			11	NA	0%														
17					12	NA	0%														
18					13	NA	0%														
19					14	NA	0%														
20					288.47																
20		BROKE INTO MINE OPENING		19.89																	
21																					
22																					
23																					
24																					
25																					
26																					
27																					
28																					
29																					
30																					

RUBBER PLUG (0.1m) INSTALLED AT 12.95 m, 0.4m OF BENTONITE, CEMENTED FOR 3.0 m, BACKFILLED TO SURFACE WITH SAND

DEPTH SCALE

1 : 75

Golder Associates

LOGGED M.T.  
DATE NOV 8, 1987  
CHECKED JW.MT.

# RECORD OF DRILLHOLE DDH 87-55

SHEET 1 OF 3

LOCATION SEE FIGURE

DRILLING DATE NOV 13-18, 1987

DATUM GEODETIC

INCLINATION -55      AZIMUTH S 84 W

DRILL RIG SKID MTD. BBS2

DRILLING CONTRACTOR MCKNIGHT DRILLING Co. LTD



PROJECT 87-1446

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (M)	RUN No.	PENETRATION RATE (M/HR)	% RETURN FLUSH COLOUR	FR-FRACTURE		F-FAULT		SM-SMOOTH		FL-FLEXURED		DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
								CL-CLEAVAGE	SH-SHEAR	J-JOINT	P-POLISHED	R-ROUGH	ST-STEPPED	UE-UNEVEN	W-WAVY		
								SH-SHEAR	VN-VEIN	S-SLICKENSIDED	PL-PLANAR	C-CURVED					
0	GROUND SURFACE			307.64													
	TOPSOIL			0.34													
1	CONCRETE				1	NA											R. UE.
	CONGLOMERATE	Slightly weathered to fresh, massive, fine grained matrix, greenish grey, sand to cobble size clasts, Fe staining throughout, trace of pyrite throughout, void from 1.6-2.1m possibly filled with some sand and silt, occasional calcite healed fractures (GOWGANDA FORMATION)			2	NA											R. UE.
2																	R. UE.
3																	R. UE.
4				304.52													R. UE.
5				3.81													R. UE.
6																	R. UE.
7																	R. UE.
8																	R. UE.
9																	R. UE.
10				302.90													R. UE.
11				5.79													R. UE.
12																	R. UE.
13																	R. UE.
14																	R. UE.
15																	R. UE.
16																	R. UE.
17																	R. UE.
18				295.21													R. UE.
19				15.18													R. UE.
		CONTINUED ON NEXT PAGE															

DEPTH SCALE

1 : 75

Golder Associates

LOGGED M.T.  
DATE NOV 18/87  
CHECKED JW.MT.

# RECORD OF DRILLHOLE DDH87-55con't

SHEET 2 OF 3

LOCATION SEE FIGURE

DRILLING DATE NOV 13-18, 1987

DATUM GEODETIC

INCLINATION -55      AZIMUTH S 84 W

DRILL RIG SKID MTD. BBS2

DRILLING CONTRACTOR McKNIGHT DRILLING Co. LTD



PROJECT 87-1446

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (M)	RUN No.	PENETRATION RATE (M/MIN)	FLUSH % RETURN COLOUR	RECOVERY		R.O.D. %	FRACT. INDEX PER 0.3M	DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY $k_{ov/sec}$	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION	
								TOTAL CORE %	SOLID CORE %			TYPE AND SURFACE DESCRIPTION	DP W/L CORE AXIS				
								FR-FRACTURE CL-CLEAVAGE SH-SHEAR VN-VEIN	F-FAULT J-JOINT P-POLISHED S-SLICKENSIDED			SM-SMOOTH R-ROUGH ST-STEPED PL-PLANAR	FL-FLEXURED UE-UNEVEN W-WAVY C-CURVED				
15		CONTINUED FROM PREVIOUS PAGE		295.21													
16		CONGLOMERATE (GOWGANDA FORMATION) continued	[Symbolic Log: Circles]	16.18													
17				19	NA	0%											
18				20	NA	0%											
19				21	NA	0%											
20				22	NA	0%											
21				23	NA	0%											
22				24	NA	0%											
23				25	NA	0%											
24				26	NA	0%											
25				27	NA	0%											
26		28	NA	0%													
27		28.04		285.52													
28		28.04		27.01													
29		29	NA	0%													
30		30	NA	0%													
		CONTINUED ON NEXT PAGE		284.87													
				28.04													
				282.73													
				30.42													

DEPTH SCALE

1 : 75

Golder Associates

LOGGED M.T.  
DATE NOV 18/87  
CHECKED JW.MT.

# RECORD OF DRILLHOLE DDH87-55con't

SHEET 3 OF 3

LOCATION SEE FIGURE

DRILLING DATE NOV 13-18, 1987

DATUM GEODETIC

INCLINATION -56

AZIMUTH S 84 W

DRILL RIG SKID MTD. BBS2

DRILLING CONTRACTOR MCKNIGHT DRILLING Co. LTD



PROJECT 87-1440

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (M)	RUN No.	PENETRATION RATE (M/MIN)	FLUSH % RETURN COLOUR	FR-FRACTURE		F-FAULT		SM-SMOOTH		FL-FLEXURED		DIAMETRAL POINT LOAD INDEX (MPa)	NOTES		
								CL-CLEAVAGE		J-JOINT		R-ROUGH		UE-UNEVEN					
								SH-SHEAR		P-POLISHED		ST-STEPPED		W-WAVY					
VN-VEIN		S-SLICKENSIDED		PL-PLANAR		C-CURVED		HYDRAULIC CONDUCTIVITY % @ 100		WATER LEVELS INSTRUMENTATION									
RECOVERY		R.O.D. %		FRACT. INDEX PER 0.3M		DISCONTINUITY DATA		TYPE AND SURFACE DESCRIPTION											
TOTAL CORE %	SOLID CORE %																		
30		CONTINUED FROM PREVIOUS PAGE		282.73															
31		CONGLOMERATE (GOWGANDA FORMATION) continued		30.42	31	NA	0%										R.UE.		
32				32	NA	0%													R.UE.
33				33	NA	0%													R.UE.
34				34	NA	0%													R.UE.
35				35	NA	0%													R.UE.
36	BQ-3 RC			36	NA	0%													BC.R.UE.
37				37	NA	0%													BC.R.UE.
38				38	NA	0%													BC.R.UE.
39	NOV 18/87	BROKE THROUGH INTO UNDERGROUND OPENING WITH MUCK BACKFILL		277.38	37	NA	0%												
				36.94	38	NA	0%												
39		END OF HOLE		275.81															
40				38.88															

RUBBER PLUG INSTALLED AT APPROX. 9.75 m, 0.4 m OF BENTONITE, CEMENTED FOR 3.5 m, BACKFILLED TO SURFACE WITH SAND

DEPTH SCALE

1 : 75

Golder Associates

LOGGED M.T.  
DATE NOV 18/87  
CHECKED JW.MT.

# RECORD OF DRILLHOLE DDH 87-57

SHEET 1 OF 3



LOCATION SEE FIGURE

DRILLING DATE NOV 18-24, 1987

DATUM GEODETIC

INCLINATION -76

AZIMUTH S 83 E

DRILL RIG SKID MTD. BBS2

DRILLING CONTRACTOR McKNIGHT DRILLING Co. LTD

PROJECT 87-1446

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (M)	RUN NO.	PENETRATION RATE (M/MIN)	FLUSH & RETURN COLOUR	RECOVERY			R.O.D. %	FRACT. INDEX PER 0.3M	DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY k <sub>ov</sub> /sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION	
								TOTAL CORE %	SOLID CORE %				TYPE AND SURFACE DESCRIPTION					
								00 00 00	00 00 00	00 00 00								
0		GROUND SURFACE		307.49														
1	NOV. 19/87	UNDIFFERENTIATED OVERBURDEN (mostly fill)		0.00														
2																		
3																		
4	BW CASING																	
5																		
6																		
7				ARGILLITE		300.93	1	NA										BC. R. UE.
8		-Fresh to slightly weathered -Massive -Greenish grey -Argillaceous matrix -Very few clasts -Mottled limonite staining -Calcite infilling common -Minor silt intrusion		8.79	2	NA										BC. R. UE. PL. W.		
9					3	NA										R. UE. PL.		
10		CONGLOMERATE		298.13	4	NA	0%									R. UE. PL.		
11	NOV 20/87	-Fresh, massive, light pinkish grey -Fine grained matrix -Sand to gravel size granitic clasts, subrounded -Trace of pyrite throughout -Calcite stringers near 10.4m (GOWGANDA FORMATION)		9.89	5	NA										BC. R. UE. PL.		
12					6	NA										R. UE.		
13	BQ-3 RC	ARGILLITE		296.22	7	NA										R. UE.		
14		-Fresh to slightly weathered -Massive -Dark grey -Argillaceous matrix -Very few clasts -Trace of pyrite -Iron and limonite staining common		11.87	8	NA	0%									BC. R. UE. PL.		
15					9	NA										BC. R. UE.		
16		CONGLOMERATE		293.36	10	NA										BC. PL. R. UE.		
				14.83	11	NA										BC. R. UE.		
				292.82	12	NA										BC. R. UE. S.		
				15.39	13	NA										BC. R. UE. PL.		
		CONTINUED ON NEXT PAGE														R. UE.		
																BC. R. UE. PL.		

DEPTH SCALE

1 : 75

Golder Associates

LOGGED J.W.  
DATE NOV 24/87  
CHECKED JW.MT.

# RECORD OF DRILLHOLE DDH87-57con't

SHEET 2 OF 3

LOCATION SEE FIGURE

DRILLING DATE NOV 18-24, 1987

DATUM GEODETIC

INCLINATION -75      AZIMUTH S 83 E

DRILL RIG SKID MTD. BBS2

DRILLING CONTRACTOR McKNIGHT DRILLING Co. LTD



DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (M)	RUN NO.	PENETRATION RATE (M/HR)	FLUSH & RETURN COLOUR	FR-FRACTURE		F-FAULT		SM-SMOOTH		FL-FLEXURED		DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K <sub>v</sub> cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION				
								CL-CLEAVAGE		J-JOINT		R-ROUGH		UE-UNEVEN									
								SH-SHEAR		P-POLISHED		ST-STEPED		W-WAVY									
VN-VEIN		S-SLICKENSIDED		PL-PLANAR		C-CURVED																	
		RECOVERY		R.Q.D. %		FRACT. INDEX PER 0.3M		DP W/L CORE AXIS															
		TOTAL CORE %		SOLID CORE %																			
16	NOV 23/87	CONTINUED FROM PREVIOUS PAGE		292.62																			
		CONGLOMERATE		15.39	14	NA																	
16			-Fresh to slightly weathered			15	NA	0%															
			-Sand to gravel size clasts, subrounded			16	NA																
			-occasional rounded cobble pieces		291.39	16	NA																
17					16.67	17	NA																
						18	NA																
						19	NA																
18			ARGILLITE			20	NA																
			-Fresh to slightly weathered			21	NA																
			-Massive			22	NA																
			-Greenish grey			23	NA																
			-Argillaceous matrix, banding common 40-80 to CA. alternating light and dark, < 5mm wide with some upto 2 cm at 20.8 m			24	NA																
			-Very fractured above 18.0m		288.29	24	NA																
22		BO -3 RC			21.95	24	NA																
				CONGLOMERATE			25	NA															
				-Greenish grey, fresh, massive			26	NA															
				-Fine grained matrix, slightly argillaceous			27	NA	0%														
				-Quartzite clasts, gravel size with occasional cobbles, rounded.			28	NA															
				-Thin strings of pyrite <1mm wide and upto 2-3 cm long scattered throughout			29	NA															
				-Pyrite on fracture surfaces.			30	NA															
				-Calcite infilling common			31	NA															
			-Calcite stringers common																				
			-Occasional calcite healed																				
		fractures at 80-70 to CA. <2mm wide, some at 30 to CA.																					
		-Concentration of calcite and/or quartz stringers at 38.0-38.2m																					
		(GOWGANDA FORMATION)																					
29																							
30																							
		CONTINUED ON NEXT PAGE		277.78																			
				30.78																			

DEPTH SCALE

1: 75

Golder Associates

LOGGED J.W.

DATE NOV 24/87

CHECKED JW.MT.

# RECORD OF DRILLHOLE DDH87-57con't

SHEET 3 OF 3



LOCATION SEE FIGURE

DRILLING DATE NOV 18-24, 1987

DATUM GEODETIC

INCLINATION -76

AZIMUTH S 63 E

DRILL RIG SKID MTD. BBS2

DRILLING CONTRACTOR MCKNIGHT DRILLING Co. LTD

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (M)	RUN No.	PENETRATION RATE (M/MIN)	FLUSH	RETURN COLOUR	FR-FRACTURE		F-FAULT		SM-SMOOTH		FL-FLEXURED		DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION	
									CL-CLEAVAGE		J-JOINT		R -ROUGH		UE-UNEVEN				
									SH-SHEAR		P-POLISHED		ST-STEPPED		W -WAVY				
									VN-VEIN		S-SLICKENSIDED		PL-PLANAR		C -CURVED				
RECOVERY		R.O.D. %	FRACT. INDEX PER 0.3M	DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY (mD/ft)													
TOTAL CORE %	SOLID CORE %			TYPE AND SURFACE DESCRIPTION															
30		CONTINUED FROM PREVIOUS PAGE		277.76															
31		CONGLOMERATE (GOWGANDA FORMATION) continued	[Symbolic Log: Circles in a grid]	30.78	32	NA													
32				33	NA														
33				34	NA														
34				35	NA														
35				36	NA														
36				37	NA														
36				38	NA	0%													
37				END OF HOLE		272.19													
38				38.55															
39																			
40																			
41																			
42																			
43																			
44																			
45																			

**BACKFILLED TO SURFACE WITH SAND.**

PROJECT 871-1416

NOV 24/87

BO-3 RC

DEPTH SCALE

1 : 75

Golder Associates

LOGGED J.W.  
DATE NOV 24/87  
CHECKED JW.MT.

# RECORD OF DRILLHOLE DDH 87-58

SHEET 1 OF 2

LOCATION SEE FIGURE

DRILLING DATE NOV 19-23, 1987

DATUM GEODETIC

INCLINATION -45

AZIMUTH N 89 E

DRILL RIG SKID MTD. BBS2

DRILLING CONTRACTOR McKNIGHT DRILLING Co. LTD.



PROJECT 87-1436

DEPTH SCALE METRES	DRILLING RECORD	SYMBOLIC LOG	ELEV. DEPTH (M)	RUN No.	PENETRATION RATE (M/HR)	FLUSH % RETURN COLOUR	FR-FRACTURE		F-FAULT		SM-SMOOTH		FL-FLEXURED		DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION	
							CL-CLEAVAGE		J-JOINT		R -ROUGH		UE-UNEVEN				
							SH-SHEAR		P-POLISHED		ST-STEPPED		W -WAVY				
VN-VEIN		S-SLICKENSIDED		PL-PLANAR		C -CURVED		HYDRAULIC CONDUCTIVITY (mD/ft)		DISCONTINUITY DATA		TYPE AND SURFACE DESCRIPTION					
RECOVERY		R.O.D. %		FRACT. INDEX PER 0.3M		DISCONTINUITY DATA		TYPE AND SURFACE DESCRIPTION		TYPE AND SURFACE DESCRIPTION		TYPE AND SURFACE DESCRIPTION					
TOTAL CORE %		SOLD CORE %		DISCONTINUITY DATA		TYPE AND SURFACE DESCRIPTION		TYPE AND SURFACE DESCRIPTION		TYPE AND SURFACE DESCRIPTION		TYPE AND SURFACE DESCRIPTION					
0	GROUND SURFACE		307.99														
1	UNDIFFERENTIATED OVERBURDEN (mostly fill)		0.00														
2																	
3	CONGLOMERATE Slightly weathered to fresh, massive, greenish grey, fine grained matrix with sand to boulder size clasts, large granitic clast .81 m at 3.88 m, trace pyrite throughout, numerous calcite healed fractures throughout, clasts becoming more abundant from 4.9-6.1m, calcite veinlets common from 7.8-8.1m, occasional Fe staining of fractures surfaces throughout (GOWGANDA FORMATION)		308.38	1	NA	100%										BC.R.UE.	
4			2.30	2	NA	100%											BC.R.UE.
5					3	NA	100%										BC.R.UE.
6					4	NA	100%										BC.R.UE.
7					5	NA	100%										BC.R.UE.
8					6	NA	100%										BC.R.UE.
9					7	NA	100%										BC.R.UE.
10					8	NA	100%										R.UE.
11					9	NA	100%										R.UE.
12					10	NA	100%										R.UE.
13					11	NA	100%										R.UE.
14					12	NA	100%										R.UE.
15					13	NA	100%										R.UE.
15	CONTINUED ON NEXT PAGE		297.34														
			15.08														

DEPTH SCALE

1: 75

Golder Associates

LOGGED J.W.  
DATE NOV 25/87  
CHECKED J.W.MT.

# RECORD OF DRILLHOLE DDH87-58con't

SHEET 2 OF 2



LOCATION SEE FIGURE 2

DRILLING DATE NOV 19-23, 1987

DATUM GEODETC

INCLINATION -45 AZIMUTH N 89 E

DRILL RIG SKID MTD. BBS2

DRILLING CONTRACTOR MCKNIGHT DRILLING Co. LTD

PROJECT 87-1436

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (M)	RUN NO.	PENETRATION RATE (m/min)	FLUSH & RETURN COLOUR	RECOVERY		R.Q.D. %	FRACT. INDEX PER 0.3M	DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY k, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION		
								TOTAL CORE %	SOLID CORE %			TYPE AND SURFACE DESCRIPTION						
								FR-FRACTURE	F-FAULT			SM-SMOOTH	FL-FLEXURED					
		CONTINUED FROM PREVIOUS PAGE		297.34														
16	NOV 23/87 BQ-3 RC	CONGLOMERATE (GOWGANDA FORMATION) continued	(Symbolic Log: Circles)	15.08	14	NA	100%											
16				15	NA	100%												
17				1718	NA	100%												
		END OF HOLE		295.79														
				17.25														
18																		
19																		
20																		
21																		
22																		
23																		
24																		
25																		
26																		
27																		
28																		
29																		
30																		

**BACKFILLED TO SURFACE WITH SAND.**

DEPTH SCALE

1 : 75

Golder Associates

LOGGED J.W.  
DATE NOV 23/87  
CHECKED JW.MT.



# RECORD OF DRILLHOLE DDH87-59con't

SHEET 2 OF 2



LOCATION SEE FIGURE  
 INCLINATION -88 AZIMUTH N 46 W

DRILLING DATE NOV 24-26,1987  
 DRILL RIG SKID MTD. BBS2  
 DRILLING CONTRACTOR MCKNIGHT DRILLING Co. LTD

DATUM GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (M)	RUN No.	PENETRATION RATE (M/Min)	RECOVERY		R.O.D. %	FRACT. INDEX PER 0.3M	DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY k <sub>v</sub> cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION		
							TOTAL CORE %	SOLID CORE %			TYPE AND SURFACE DESCRIPTION	TYPE AND SURFACE DESCRIPTION					
							FR-FRACTURE CL-CLEAVAGE SH-SHEAR VN-VEIN	F-FAULT J-JOINT P-POLISHED S-SLICKENSIDED			SM-SMOOTH R-ROUGH ST-STEPPED PL-PLANAR	FL-FLEXURED UE-UNEVEN W-WAVY C-CURVED					
15		CONTINUED FROM PREVIOUS PAGE		293.28													
16	BQ-3 RC	-Few calcite veinlets at 80- to CA. scattered -Pink calcite infilling into irregular fractures at 18.2 m -Minor calcite infilling in upon fractures (GOWGANDA FORMATION)	(Symbolic Log: Circles with dots)	15.51	18	NA									• BC.R.UE. • BC.R.UE. • R.UE. • R.UE.		
17				19	NA											• R.UE.BC. • R.UE. • R.UE. • R.UE.	
18				20	NA												• BC.R.UE. • R.UE. • BC.R.UE. • R.UE.ST.W. • R.UE.
19				21	NA												• R.UE.
20							288.81										
21					BROKE THROUGH INTO UNDERGROUND OPENING VOID		20.83										
22	NOV 26/87			288.84													
23		MADE CONTACT WITH SOLID SURFACE (north face of stope ?)		22.58													
24																	
25																	
26																	
27																	
28																	
29																	
30																	

RUBBER PLUG (0.1m) INSTALLED AT 15.39m, 0.2 m OF BENTONITE, CEMENTED FOR 3.5 m, BACKFILLED TO SURFACE WITH SAND

DEPTH SCALE

1 : 75

Golder Associates

LOGGED J.W.  
 DATE NOV 26/87  
 CHECKED JW.MT.

# RECORD OF DRILLHOLE DDH 87-62

SHEET 1 OF 2



LOCATION SEE FIGURE

DRILLING DATE NOV30-DEC2,1987

DATUM GEODETIC

INCLINATION -50      AZIMUTH N 51 W

DRILL RIG SKID MTD. BBS2

DRILLING CONTRACTOR MCKNIGHT DRILLING Co. LTD

PROJECT 87-144B

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (M)	RUN No.	PENETRATION RATE (M/HR)	FLUSH RETURN COLOUR	RECOVERY		R.Q.D. %	FRACT. INDEX PER 0.3M	DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY $k_{ov}/sec$	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION	
								TOTAL CORE %	SOLID CORE %			TYPE AND SURFACE DESCRIPTION	DP W/L CORE AXES				
								FR-FRACTURE CL-CLEAVAGE SH-SHEAR VN-VEIN	F-FAULT J-JOINT P-POLISHED S-SLICKENSIDED			SM-SMOOTH R-ROUGH ST-STEPPED PL-PLANAR	FL-FLEXURED UE-UNEVEN W-WAVY C-CURVED				
0		GROUND SURFACE		307.14													
1		UNDIFFERENTIATED OVERBURDEN (mostly fill)		0.00													
2																	
3																	
4																	
5																	
6	BW CASING																
7																	
8			ARGILLITE		301.18	1	NA	0%									BC.R.UE.
9		CONGLOMERATE -Fresh to slightly weathered -Trace of pyrite throughout -fine grained matrix -light grey to greenish grey		7.98	2	NA											BC.R.UE.
10					3	NA											R.UE.
11					4	NA											BC.R.UE.PL.
12					5	NA											BC.R.UE.
13					6	NA											BC.R.UE.
14					7	NA											BC.R.UE.PL.
15		ARGILLITE Slightly weathered, massive fractured, dark grey, trace of pyrite throughout, small amount of calcite infilling, argillaceous matrix, no clasts		299.43	8	NA											BC.R.UE.PL.
16					9	NA											S.BC.R.UE.
17					10	NA											BC.R.UE.PL.
18					11	NA											BC.R.UE.
19					12	NA											BC.R.UE.PL.
20					13	NA											BC.R.UE.
21					14	NA	0%										BC.R.UE.
22		CONGLOMERATE -Fresh massive light greenish grey -Fine grained matrix -Sand to cobble size granitic clasts, rounded to subrounded -Trace of pyrite throughout with occasional concentration of sand size specs -Calcite infilling common -Calcite veinlets are common.		298.61	15	NA											R.PL.
23					16	NA											R.PL.
24					17	NA											R.UE.
25					18	NA											BC.R.UE.
26					19	NA											R.UE.PL.
27					20	NA											ST.R.UE.
28					21	NA											BC.R.UE.
29					22	NA											R.UE.
30					23	NA											BC.R.UE.PL.
31					24	NA											BC.R.UE.PL.
32					25	NA											R.UE.PL.
33					26	NA											
34					27	NA											
35					28	NA											
36					29	NA											
37					30	NA											
38					31	NA											
39					32	NA											
40					33	NA											
41					34	NA											
42					35	NA											
43					36	NA											
44					37	NA											
45					38	NA											
46					39	NA											
47					40	NA											
48					41	NA											
49					42	NA											
50					43	NA											
51					44	NA											
52					45	NA											
53					46	NA											
54					47	NA											
55					48	NA											
56					49	NA											
57					50	NA											
58					51	NA											
59					52	NA											
60					53	NA											
61					54	NA											
62					55	NA											
63					56	NA											
64					57	NA											
65					58	NA											
66					59	NA											
67					60	NA											
68					61	NA											
69					62	NA											
70					63	NA											
71					64	NA											
72					65	NA											
73					66	NA											
74					67	NA											
75					68	NA											
76					69	NA											
77					70	NA											
78					71	NA											
79					72	NA											
80					73	NA											
81					74	NA											
82					75	NA											
83					76	NA											
84					77	NA											
85					78	NA											
86					79	NA											
87					80	NA											
88					81	NA											
89					82	NA											
90					83	NA											
91					84	NA											
92					85	NA											
93					86	NA											
94					87	NA											
95					88	NA											
96					89	NA											
97					90	NA											
98					91	NA											
99					92	NA											
100					93	NA											
101					94	NA											
102					95	NA											
103					96	NA											
104					97	NA											
105					98	NA											
106					99	NA		</									

# RECORD OF DRILLHOLE DDH87-62con't

SHEET 2 OF 2

LOCATION SEE FIGURE

DRILLING DATE NOV30-DEC2,1987

DATUM GEODETIC

INCLINATION -50

AZIMUTH N 51° W

DRILL RIG SKID MTD. BBS2

DRILLING CONTRACTOR MCKNIGHT DRILLING Co. LTD.



PROJECT 87-1446

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (M)	RUN No.	PENETRATION RATE (M/MIN)	FLUSH RETURN COLOUR	RECOVERY		R.O.D. %	FRACT. INDEX PER 0.3M	DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY k <sub>v</sub> cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION		
								TOTAL CORE %	SOLID CORE %			TYPE AND SURFACE DESCRIPTION						
								80	80			00	00					
15		CONTINUED FROM PREVIOUS PAGE		295.30														
16		<b>CONGLOMERATE</b> -Fresh massive, light greenish grey -Fine grained matrix -Sand to cobble size granitic clasts, rounded to subrounded -Trace of pyrite throughout with occasional concentration of sand size specs -Calcite infilling common -Calcite veinlets are common, 10 to 70 to CA. (GOWGANDA FORMATION)		15.45	20	NA	0%					BC.R.UE.PL.						
17				21	NA							R.UE.PL.						
18														R.UE.				
19														R.UE.				
20														BC.R.UE.				
21														BC.R.UE.PL.				
22				290.05	23	NA	0%					R.UE.C.						
23	DEC 2/87	BROKE THROUGH INTO UNDERGROUND OPENING VOID		22.31	24	NA	0%					BC.R.UE.						
24		MADE CONTACT WITH SOLID SURFACE (the other side of slope)		288.93	25	NA	0%					ST.BC.						
25				23.77	26	NA						R.UE.PL.						
26					27	NA						BC.R.UE.PL.						
27					28	NA						R.UE.						
28					29	NA						BC.SM.PL.R.UE.						
29					30	NA						BC.PL.C.R.UE.						
30												R.UE.PL.						
												BC.R.UE.						

UNABLE TO RE-ENTER HOLE AFTER BREAKTHROUGH, RUBBER PLUG INSTALLED AT 6.53m, CEMENTED FOR 2.0m, BACKFILLED TO SURFACE WITH SAND.

DEPTH SCALE

1: 75

Golder Associates

LOGGED J.W.  
DATE DEC 2/87  
CHECKED JW.MT.





# RECORD OF DRILLHOLE DDH 87-65

SHEET 1 OF 2



LOCATION SEE FIGURE

DRILLING DATE DEC 3-11, 1987

DATUM GEODETIC

INCLINATION -65

AZIMUTH N 80 E

DRILL RIG SKID MTD. BBS2

DRILLING CONTRACTOR MCKNIGHT DRILLING Co. LTD

PROJECT 87-11445

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (M)	RUN No.	PENETRATION RATE (M/MIN)	RECOVERY		R.O.D. %	FRACT. INDEX PER 0.3M	DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY k <sub>v</sub> cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION	
							TOTAL CORE %	SOLID CORE %			TYPE AND SURFACE DESCRIPTION	OP WLL CORE AXIS				
							FLUSH % RETURN	FLUSH COLOUR								
0		GROUND SURFACE		307.73												
1	DEC 4/87	UNDIFFERENTIATED OVERBURDEN (mostly fill)		0.00												
2	DEC 7/87 BW CASING															
3																
4																
5																
6																
6		CONGLOMERATE Moderately to highly weathered, massive, light greyish green, fine grained matrix with sand to gravel size clasts, largely granitic, trace pyrite throughout, heavy staining common throughout. (GOWGANDA FORMATION)	O	302.66	1	NA	100%								BC. R. UE.	
7				2	NA	100%										BC. R. UE.
8				3	NA	0%										BC. R. UE.
9				4	NA	0%										R. UE.
10				6	NA	0%										R. UE.
11				7	NA	0%										R. UE.
10	DEC 8/87	CONGLOMERATE Fresh, massive, light greenish grey, fine grained matrix with sand to gravel size clasts, trace of pyrite throughout, pinkish calcite veinlets at 15.4 and 15.7m 10mm and 20mm thick respectively, some calcite healed fractures throughout. (GOWGANDA FORMATION)	O	298.92	8	NA	0%								R. UE. BC.	
11	DEC 9/87 BQ - 3 RC			9	NA	0%										R. UE.
12				10	NA	0%										R. UE.
13				11	NA	0%										R. UE.
14				12	NA	0%										BC. R. UE.
15				13	NA	0%										R. UE.
16				14	NA	0%										R. UE.
17				15	NA	0%										R. UE.
18				16	NA	0%										R. UE.
19				17	NA	0%										R. UE.
20		18	NA	0%										R. UE.		
15	DEC 10/87			293.77												
15		CONTINUED ON NEXT PAGE		15.40												

DEPTH SCALE

1: 75

Golder Associates

LOGGED M.T.  
DATE DEC 15/87  
CHECKED J.W.M.T.

# RECORD OF DRILLHOLE DDH87-65con't

SHEET 2 OF 2



LOCATION SEE FIGURE  
 INCLINATION -65 AZIMUTH N 80 E

DRILLING DATE DEC 3-11,1987  
 DRILL RIG SKID MTD. BBS2  
 DRILLING CONTRACTOR MCKNIGHT DRILLING Co. LTD

DATUM GEODETC

PROJECT 871-1446

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (M)	RUN NO.	PENETRATION RATE (m/min)	FLUSH RETURN %	COLOUR	FR-FRACTURE			F-FAULT			SM-SMOOTH			FL-FLEXURED			DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION		
									CL-CLEAVAGE			J-JOINT			R-ROUGH			UE-UNEVEN						
									SH-SHEAR			P-POLISHED			ST-STEPPED			W-WAVY						
VN-VEIN			S-SLICKENSIDED			PL-PLANAR			C-CURVED															
				RECOVERY		R.O.D. %		FRACT. INDEX PER 0.3M		DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY $k_{ov}/sec$												
				TOTAL CORE %	SOLID CORE %			TYPE AND SURFACE DESCRIPTION																
16		CONTINUED FROM PREVIOUS PAGE		293.77																				
16	DEC 11/87	CONGLOMERATE GOWGANDA FORMATION (mostly fill)		15.40	21	NA	0%																	
17																								
18	BQ-3 RC						22	NA	0%															
19							23	NA	0%															
20							24	NA	0%															
21		BROKE THROUGH INTO UNDERGROUND OPENING		289.12																				
22				20.64																				
23																								
24																								
26																								
28																								
27																								
28																								
29																								
30																								

CANNOT RE-ENTER HOLE AFTER BREAKTHROUGH, RUBBER PLUG INSTALLED AT 5.64m, 0.4m OF BENTONITE, 2.0m OF CEMENT, BACKFILLED TO SURFACE WITH SAND.

DEPTH SCALE

1 : 75

Golder Associates

LOGGED M.T.  
 DATE DEC 15/87  
 CHECKED JW.MT.

# RECORD OF DRILLHOLE DDH 87-66

SHEET 1 OF 2



LOCATION SEE FIGURE  
 INCLINATION -85      AZIMUTH N 59 W

DRILLING DATE DEC 7-9, 1987  
 DRILL RIG SKID MTD. BBS2  
 DRILLING CONTRACTOR MCKNIGHT DRILLING Co. LTD

DATUM GEODETC

PROJECT 871-1445

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (M)	RUN No.	PENETRATION RATE (M/HR)	FLUSH % RETURN COLOUR	FR-FRACTURE		F-FAULT		SM-SMOOTH		FL-FLEXURED		DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION		
								CL-CLEAVAGE		J-JOINT		R -ROUGH		UE-UNEVEN					
								SH-SHEAR		P-POLISHED		ST-STEPPED		W -WAVY					
VN-VEIN		S-SLICKENSIDED		PL-PLANAR		C -CURVED		HYDRAULIC CONDUCTIVITY (cm/sec)											
RECOVERY		R.O.D. %		DISCONTINUITY DATA		TYPE AND SURFACE DESCRIPTION													
TOTAL CORE %	SOLID CORE %	FRACT. INDEX PER 0.3M	DP w.r.t. CORE AXIS																
00	00	00	00																
20	20	20	20																
40	40	40	40																
60	60	60	60																
80	80	80	80																
100	100	100	100																
0		GROUND SURFACE		307.34															
0.00																			
1	DEC 8/87  BW CASING	UNDIFFERENTIATED OVERBURDEN (mostly fill)																	
2																			
3																			
4																			
5																			
6						301.93													
6	BO-3 RC	CONGLOMERATE -Light greenish grey -Fresh, massive -Fine grained matrix -Sand to cobble size granite and quartzite clasts rounded to subrounded -Trace of pyrite throughout -Calcite veinlets at 70-80 to CA. common, <3 cm thick -Calcite infilling on open fractures common -Minor amount of chlorite infilling between 14.9-16.8m -Limonite staining common throughout with minor amount of iron staining (GOWGANDA FORMATION)	(Symbolic Log)	5.97	1	NA	100%											BC.R.UE.	
7			2	NA															R.UE.
8			3	NA															R.UE.
9			4	NA															PL.R.UE.
10			5	NA															R.UE.
11			6	NA															R.UE.
12			7	NA															PL.
13			8	NA															R.UE.
14			9	NA															R.UE.
15			10	NA															
15				293.70														BC.R.UE.PL.	
15				15.08														R.UE.PL.	
		CONTINUED ON NEXT PAGE																R.UE.	

DEPTH SCALE

1: 75

Golder Associates

LOGGED J.W.  
 DATE NOV 18/87  
 CHECKED JW.MT.

# RECORD OF DRILLHOLE DDH87-66con't

SHEET 2 of 2



LOCATION SEE FIGURE

DRILLING DATE DEC 7-9, 1987

DATUM GEODETIC

INCLINATION -85      AZIMUTH N 59 W

DRILL RIG SKID MTD. BB62

DRILLING CONTRACTOR MCKNIGHT DRILLING Co. LTD

PROJECT 871-1446

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (M)	RUN No.	PENETRATION RATE (M/MIN)	FLUSH & RETURN COLOUR	FR-FRACTURE		F-FAULT		SM-SMOOTH		FL-FLEXURED		DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION	
								CL-CLEAVAGE		J-JOINT		R -ROUGH		UE-UNEVEN				
								SM-SHEAR		P-POLISHED		ST-STEPPED		W -WAVY				
VN-VEIN		S-SLICKENSIDED		PL-PLANAR		C -CURVED		HYDRAULIC CONDUCTIVITY $k_{eff}$		DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION								
RECOVERY		R.O.D. %		FRACT. INDEX PER 0.3M		DISCONTINUITY DATA		HYDRAULIC CONDUCTIVITY		DISCONTINUITY DATA								
TOTAL CORE %	SOLID CORE %	%	INDEX	TYPE AND SURFACE DESCRIPTION	TYPE AND SURFACE DESCRIPTION	TYPE AND SURFACE DESCRIPTION	TYPE AND SURFACE DESCRIPTION											
CONTINUED FROM PREVIOUS PAGE		293.70																
16				15.08														
16					10	NA											R.UE.ST. R.UE. BC.S.R.UE. BC.R.UE.ST.PL. R.UE. R.UE. BC.R.UE. R.UE. BC.R.UE. BC.R.UE. BC.R.UE. R.UE. R.UE.BC. ST.R.UE. R.UE. R.UE. R.UE. R.UE.BC. R.UE. BC.R.UE. BC.R.UE. R.UE.PL. R.UE. BC.R.UE.PL. R.UE. R.UE. R.UE.PL.	
17					11	NA												
18	DEC 9/87	CONGLOMERATE (GOWGANDA FORMATION) continued			12	NA	100%											
19					13	NA												
20					14	NA												
21					15	NA												
22	BQ-3 RC				16	NA												
23					17	NA												
24					18	NA												
26		CONGLOMERATE -Light greenish grey -Slightly weathered, fractured, sand to gravel size clasts rounded to subrounded -Iron staining common (GOWGANDA FORMATION)		284.28 25.46	19	NA	100%											
27		END OF HOLE		282.86 27.01	20	NA												
28					21	NA												
29					22	NA												
30					23	NA												

**BACKFILLED TO SURFACE WITH SAND.**