

Review of Geotechnical and Archaeological Conditions at the Money Pit (1967 – 2005) Oak Island, Nova Scotia



**Presentation By
Les MacPhie
August 13, 2005**

Outline of Presentation

- 1. Purpose of Review**
- 2. Geotechnical Investigations and Results**
- 3. Boulders in Glacial Till at Oak Island**
- 4. Selected Archaeological Findings at Money Pit Prior to 1967**
- 5. Archaeological Findings at Money Pit 1967 to 2005**
- 6. Options for Future Exploration**
- 7. Conclusions and Acknowledgements**

1. Purpose of Review

1. **Provide a summary of the geotechnical conditions at the Money Pit as they affect conceptual studies for a deep shaft.**
2. **Evaluate the archaeological findings at the Money Pit.**
3. **Discuss possible options for future exploration.**
4. **Share information and ideas with the ultimate objective of solving the Oak Island Mystery by the cooperative effort of researchers and interested parties.**

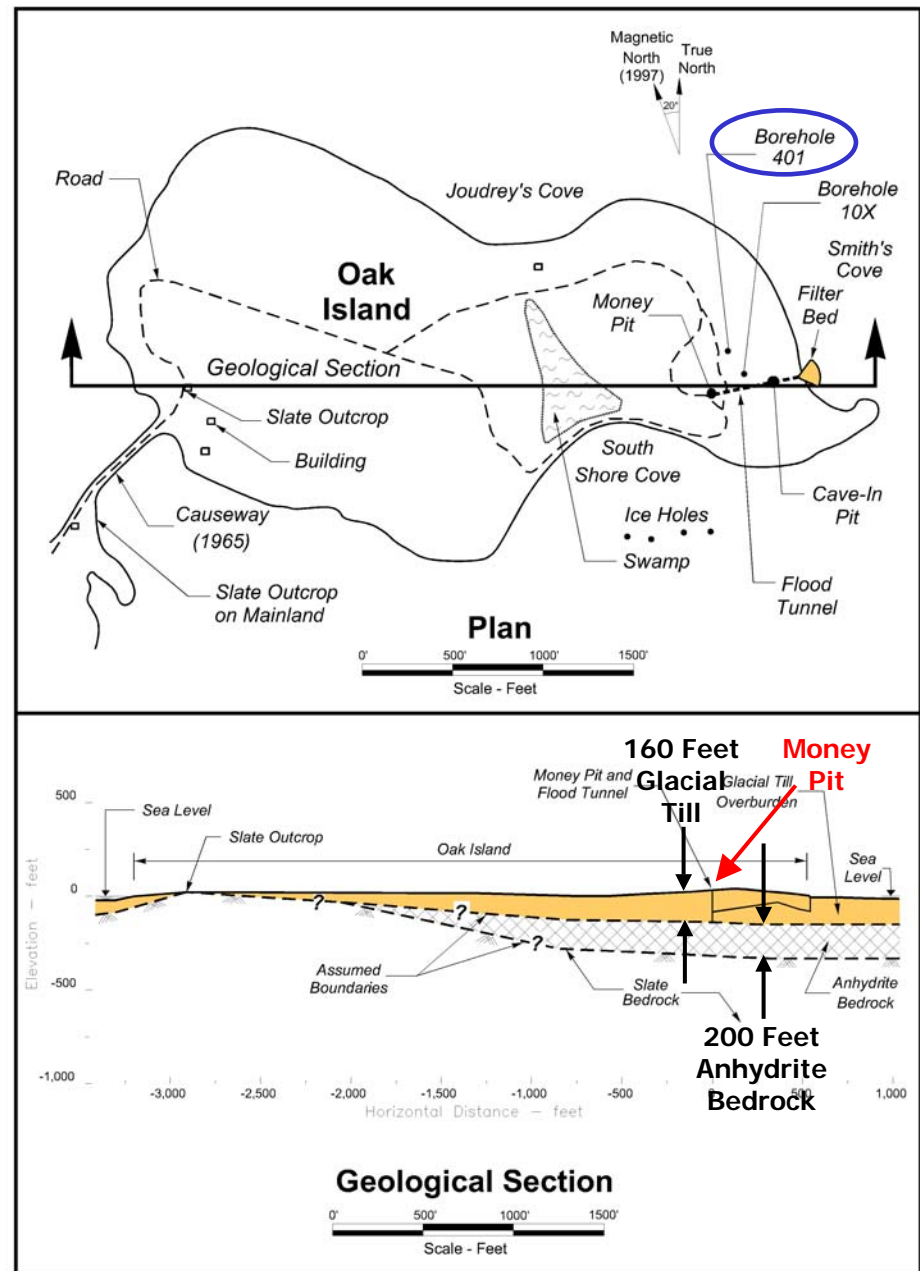
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2. Geotechnical Investigations and Results

- 1. Geological setting**
- 2. Geotechnical programs**
- 3. Geotechnical sections**
- 4. Tidal hydrogeology, anhydrite solubility, flow system in anhydrite**

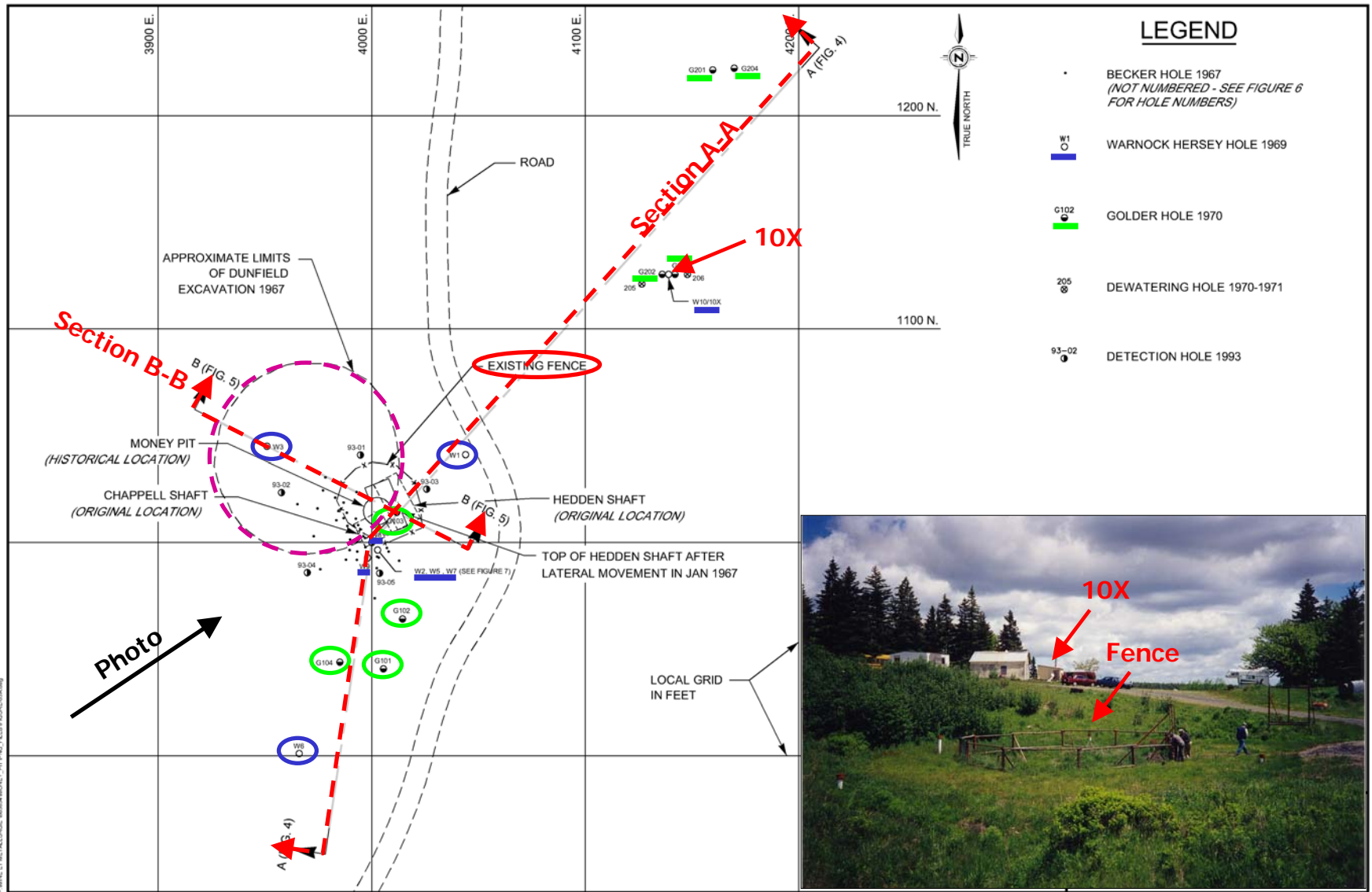
Geological Section of Oak Island



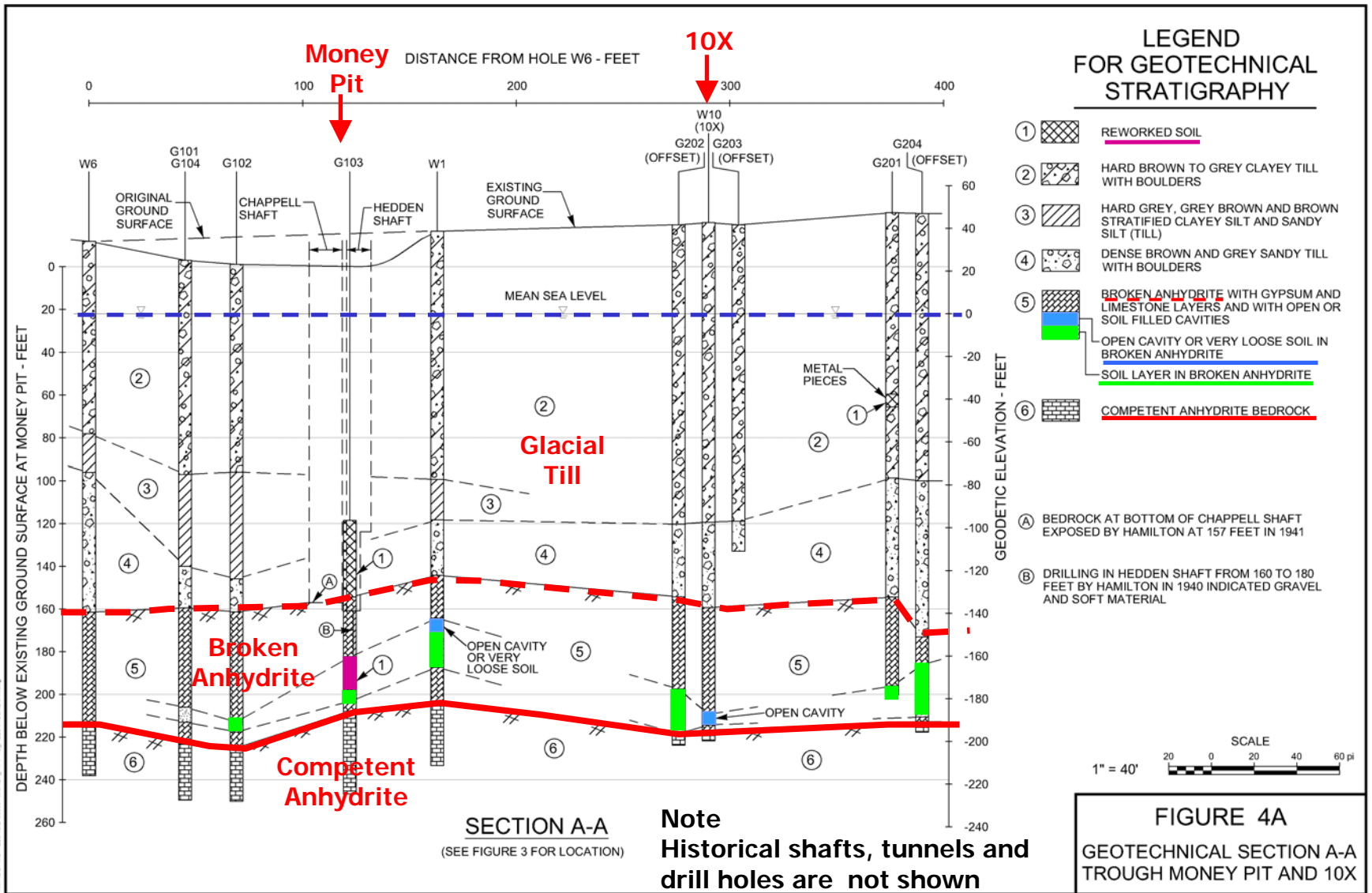
Geotechnical Programs

- 1. Based on the important archaeological findings in the Becker holes in 1967 (to be presented later), geotechnical and archaeological holes were drilled in the area of the Money Pit in 1969 and 1970.**
- 2. In 1969 Warnock Hersey put down 3 geotechnical holes in the Money Pit area and a number of archaeological holes.**
- 3. In 1970 Golder Associates put down 4 geotechnical holes in the Money Pit area and 4 archaeological holes northeast of the Money Pit.**
- 4. Archaeological holes were intended to investigate original workings and also provided geotechnical data.**
- 5. Borehole depths at the Money Pit will be with reference to existing ground surface which is about 10 feet lower than original ground surface.**

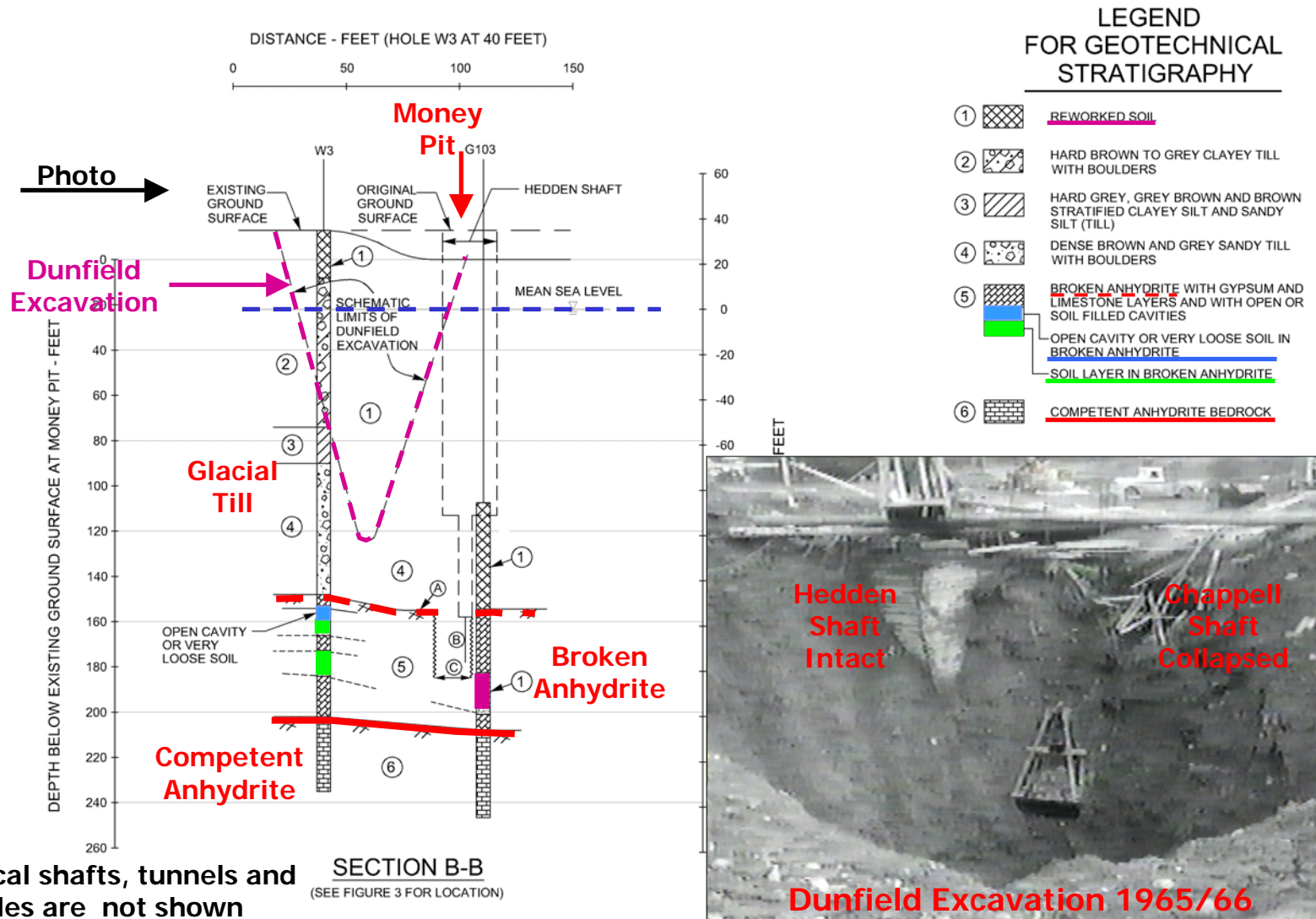
Plan of Geotechnical Boreholes



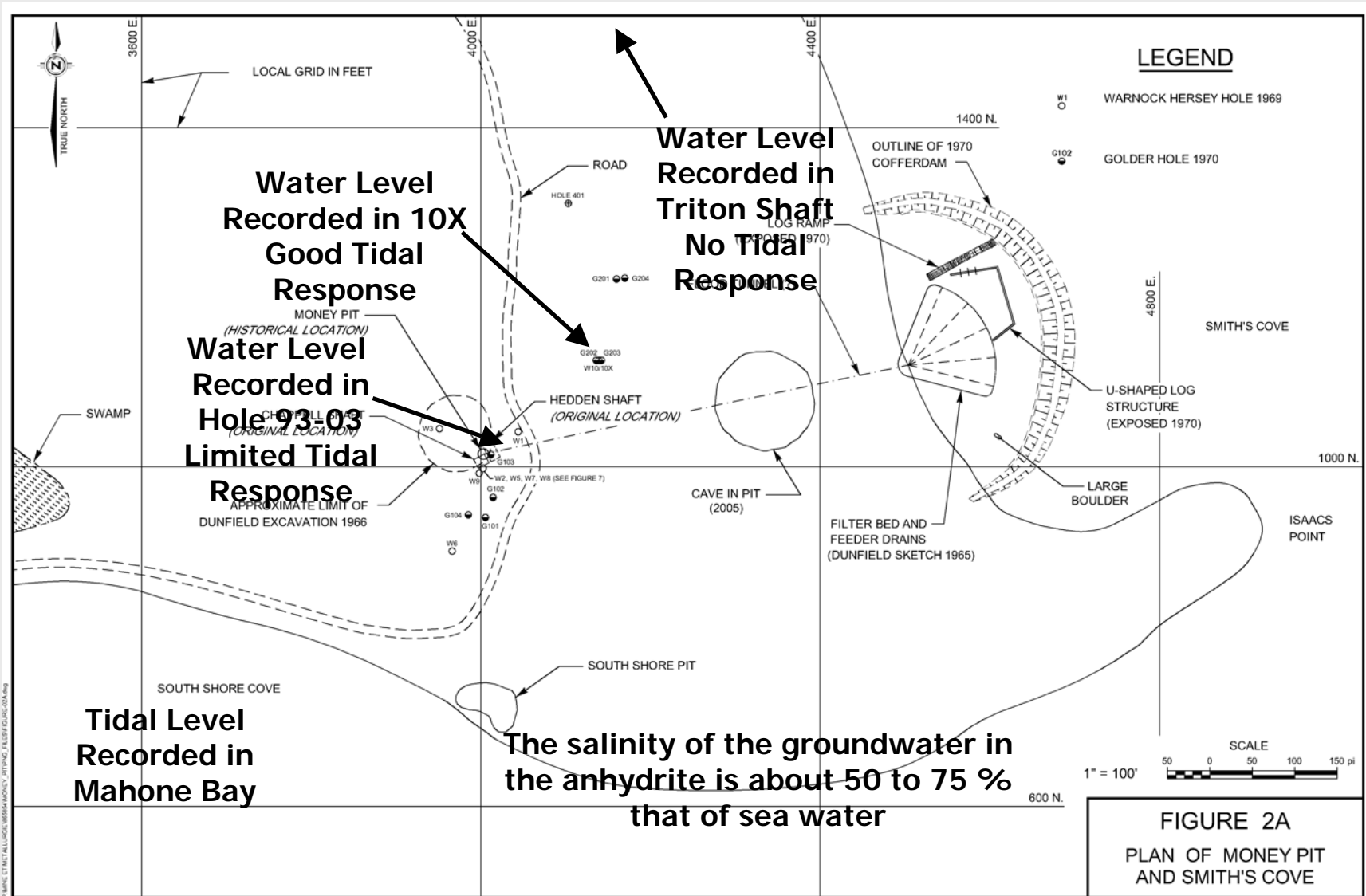
Geotechnical Section A-A at Money Pit and 10X



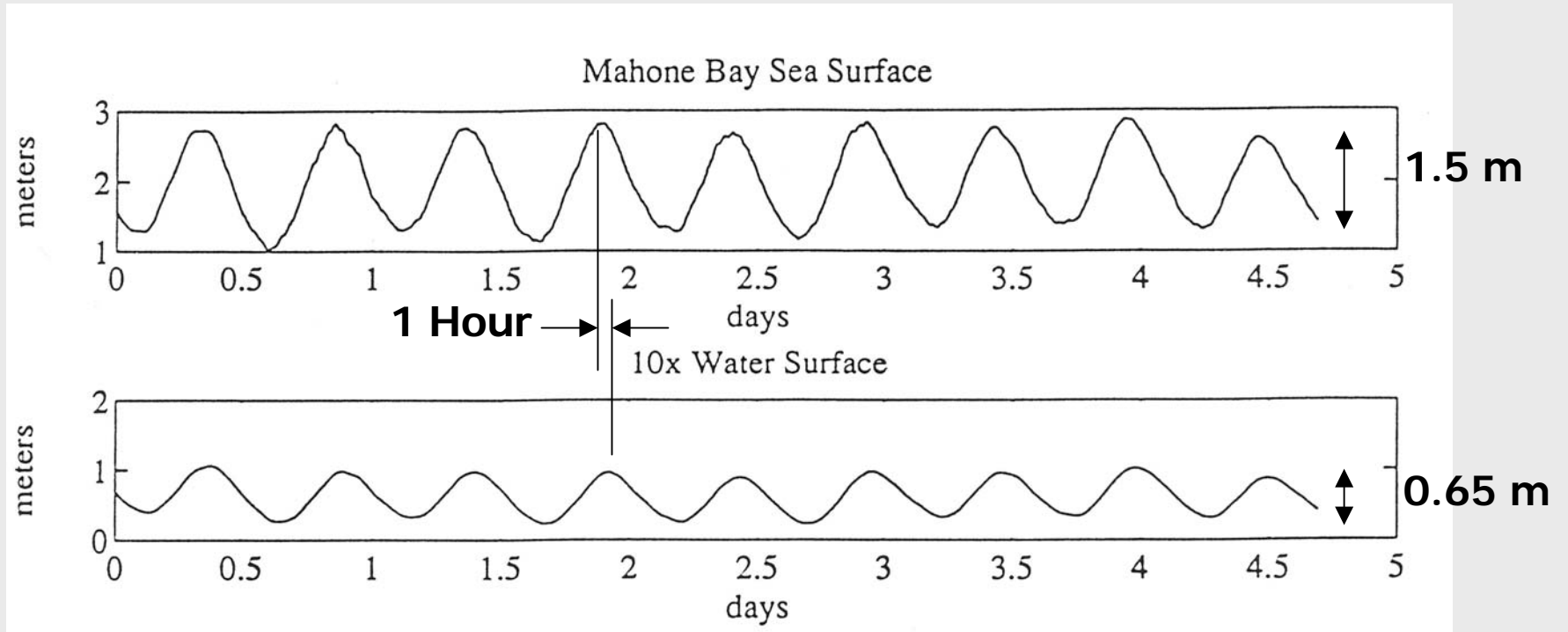
Geotechnical Section B-B at Money Pit and Dunfield Excavation



Plan of Woods Hole Tidal Hydrogeology Testing in July 1995



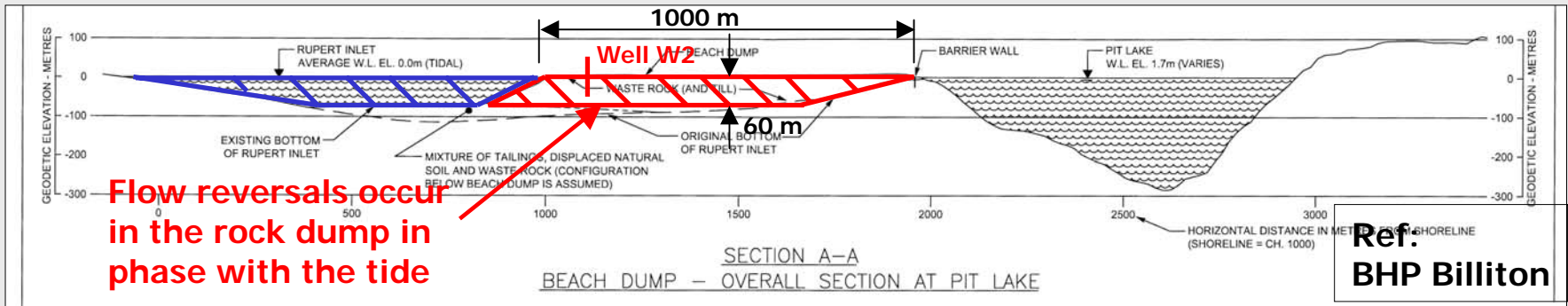
Water Level Variation in 10X from Tidal Variation in Mahone Bay



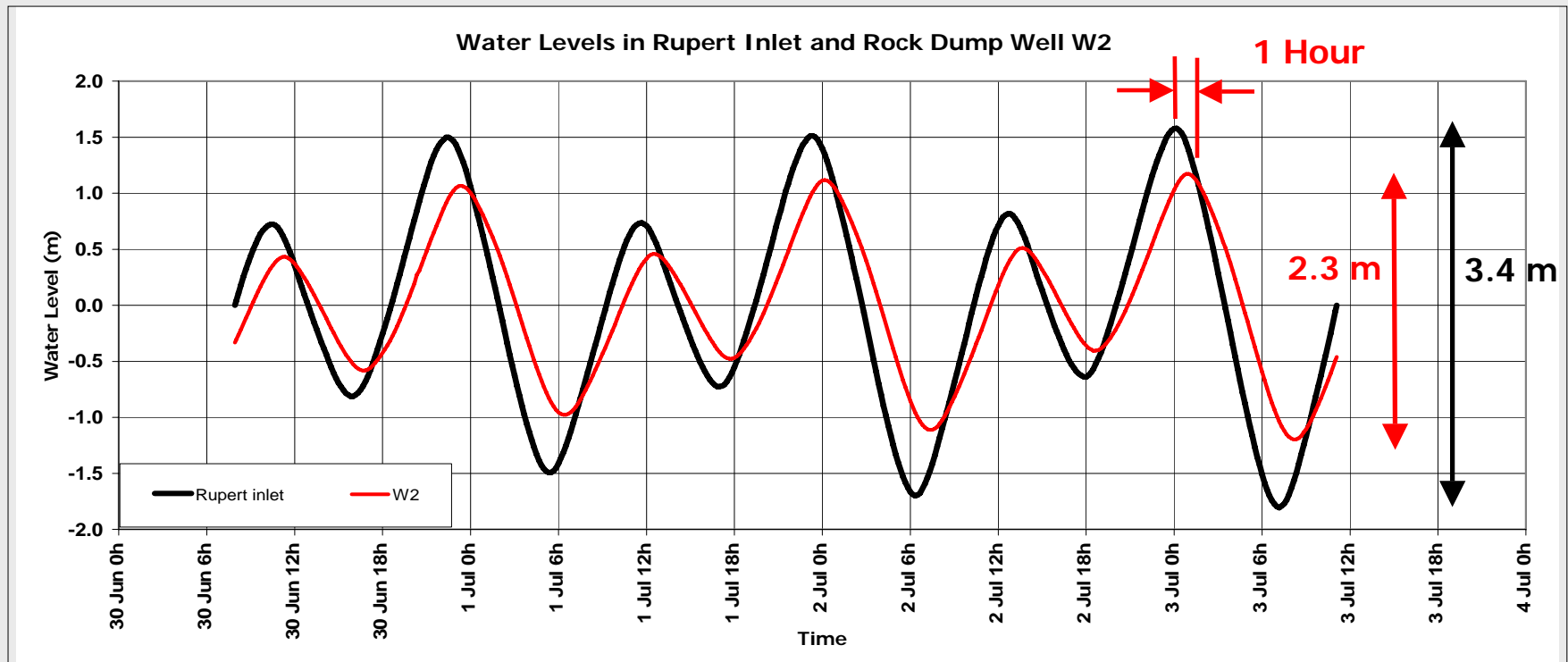
Time Lag 1 Hour (Between Peaks)
Ratio of Amplitudes = 0.43 (0.65/1.5)

Ref:
Woods Hole Oceanographic Institution
Measurements made in July 1995

Water Level Variation in Coarse Rockfill Dump from Tidal Variation in Rupert Inlet



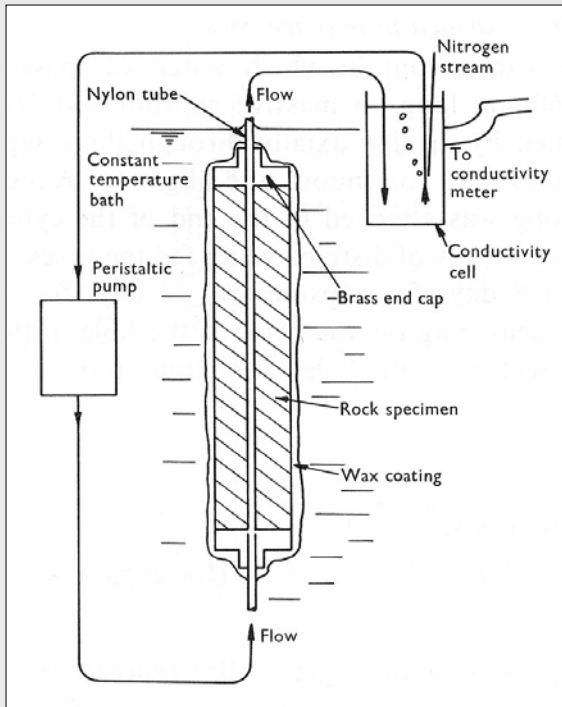
Water Level Variation in Coarse Rockfill Dump from Tidal Variation in Rupert Inlet



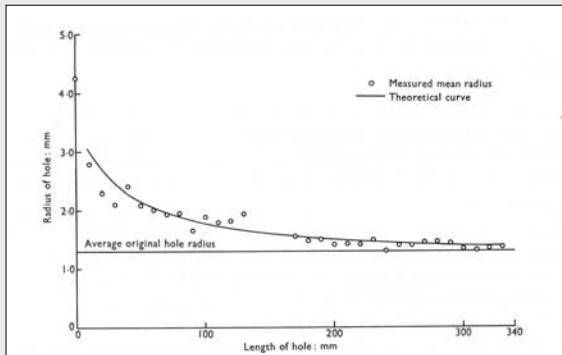
Time Lag 1 Hour (Between Peaks)
Ratio of Amplitudes = 0.68 (2.3/3.4)

Ref:
BHP Billiton

Lab Scale Testing of Anhydrite Solubility



Ref:
James
1978



36 mm
Diameter
(1.4 in)

36 mm
Diameter
(1.4 in)

360 mm
(14 in)

Distilled water
flow at
56 ml/day
(2 fluid oz/day)
for 44 days

2.5 mm
Diameter
Before
Test

6 mm
Diameter
After
Test

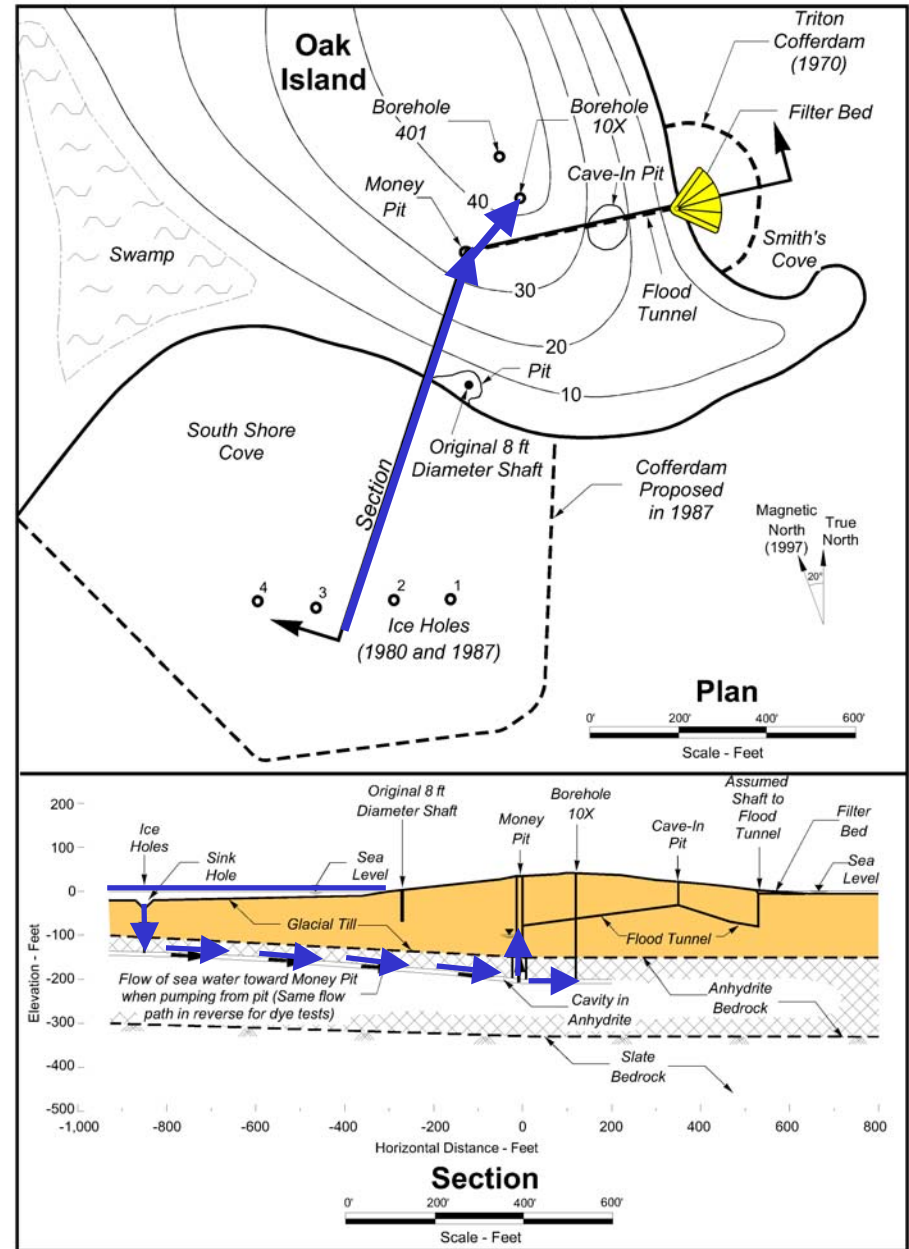
Sketch to
Scale

Example Flow System through Anhydrite from Mahone Bay to Money Pit and 10X

The flow system through anhydrite is activated by pumping at the Money Pit or 10X.

When there is no pumping the groundwater in the anhydrite is subject to flow reversals in phase with tidal variations.

Both of these water movement systems result in dissolution of anhydrite and increasing permeability with time.



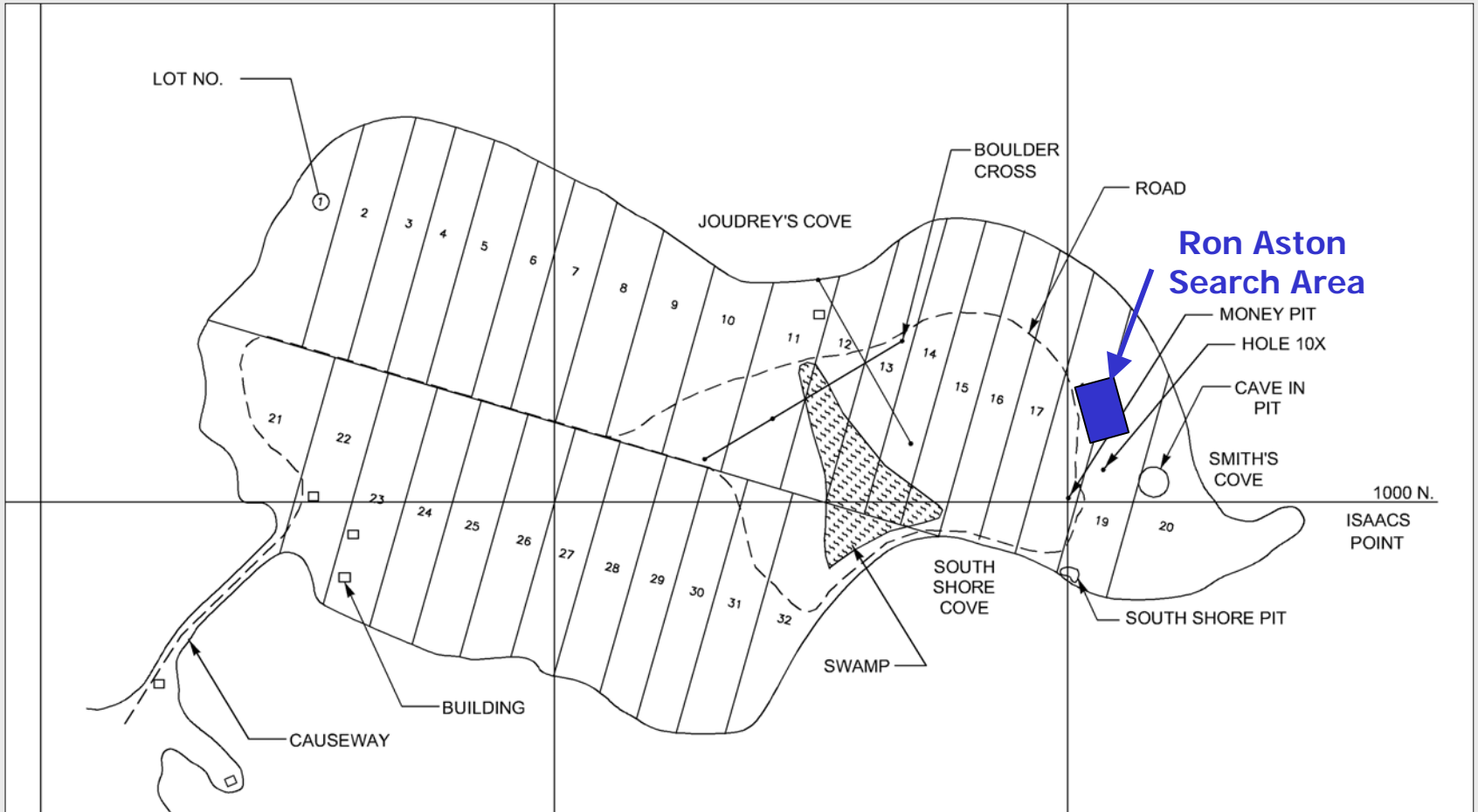
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3. Boulders in Glacial Till at Oak Island

- 1. Ron Aston from North Carolina 1999 and 2001**
- 2. Petter Amundsen from Norway 2003**
- 3. Drilled Boulder at Money Pit**

Plan of Ron Aston Search Area



Ron Aston and Others 2001



Murray
MacPhie

Jim
Harvey

David
Tobias

Ron
Aston



David
Tobias

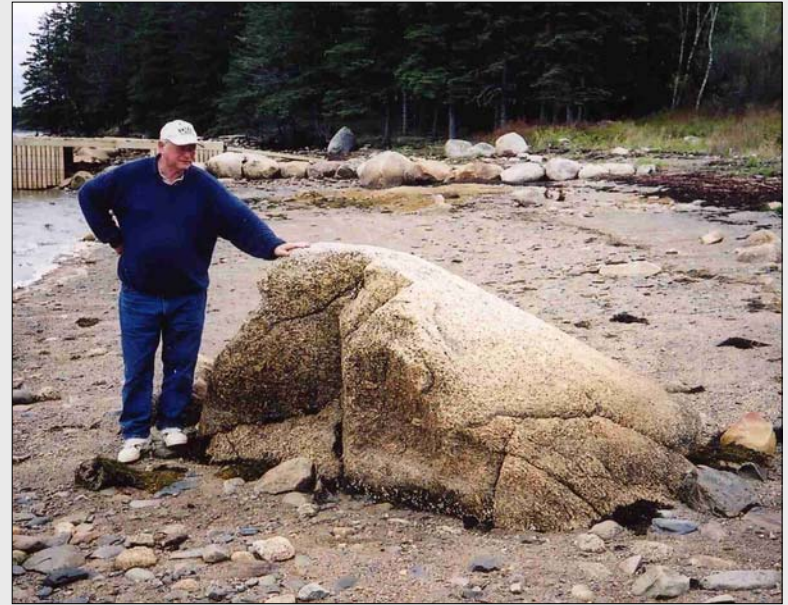
Ron Aston Drilling Program August 2001



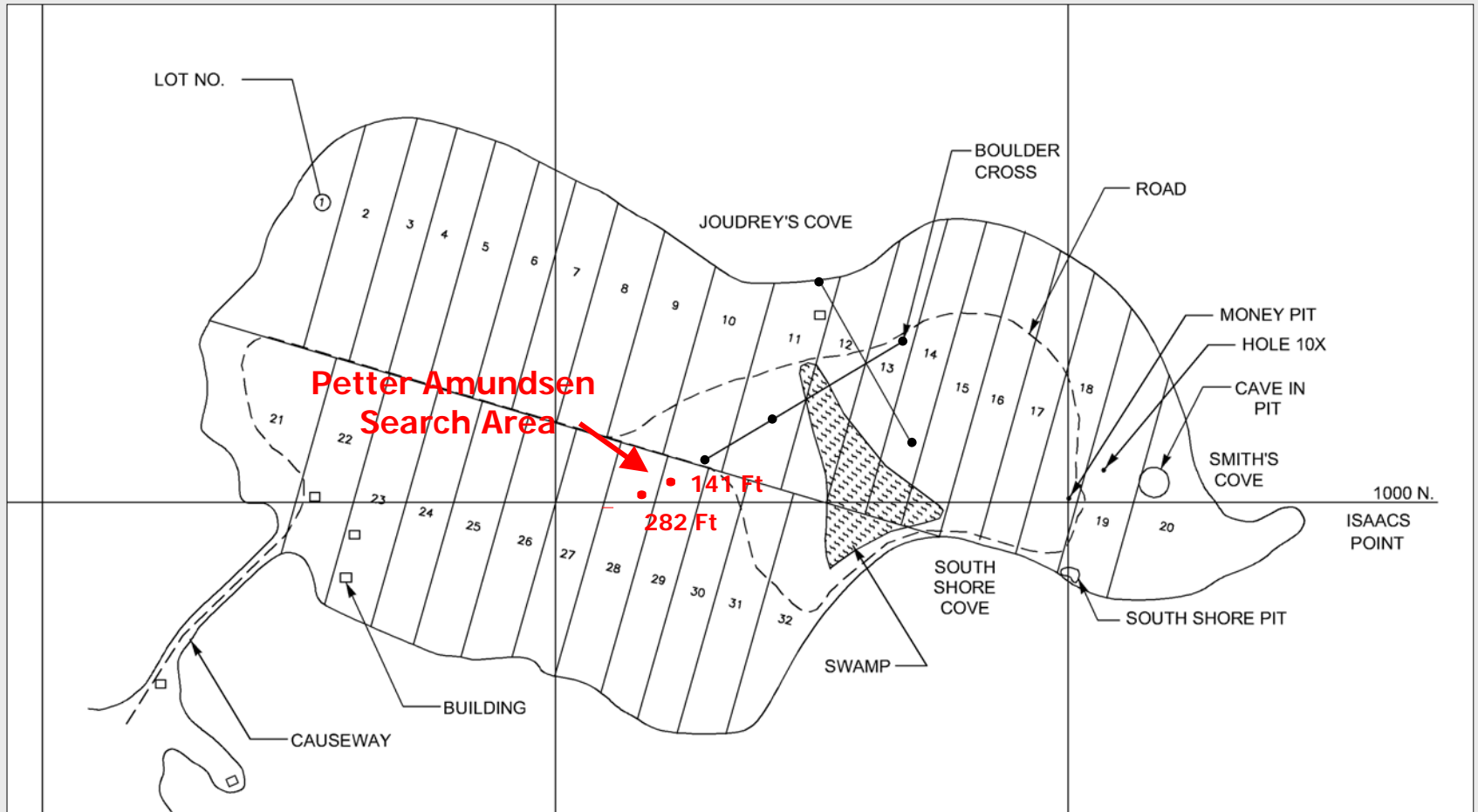
Boulder in Glacial Till Exposed by Aston 2001



Large Boulder at Shore



Plan of Petter Amundsen Search Area 2003



Happy Norwegians May 2003



Eric Hauan

Petter Amundsen

Tony Ronning

Sigbjorn Larsen

Boulder 282 Feet South of Cross



Boulders at Shore



Boulder 141 Feet South of Cross



Drilled Boulder at Money Pit



Summary of Geological, Geotechnical and Other Issues for Deep Excavation at Money Pit

- 1. Boulders in glacial till**
- 2. Open and soil filled cavities in broken anhydrite**
- 3. Saline groundwater in anhydrite**
- 4. Cyclic groundwater movement in anhydrite due to tides**
- 5. Reworked soil zones resulting from events such as collapse of the Money Pit in 1861 and the Dunfield excavation of 1965/66**
- 6. The presence of timbers and debris from numerous previous shafts and tunnels in the area of the Money Pit**
- 7. Steel casings and pipes from previous drilling operations**

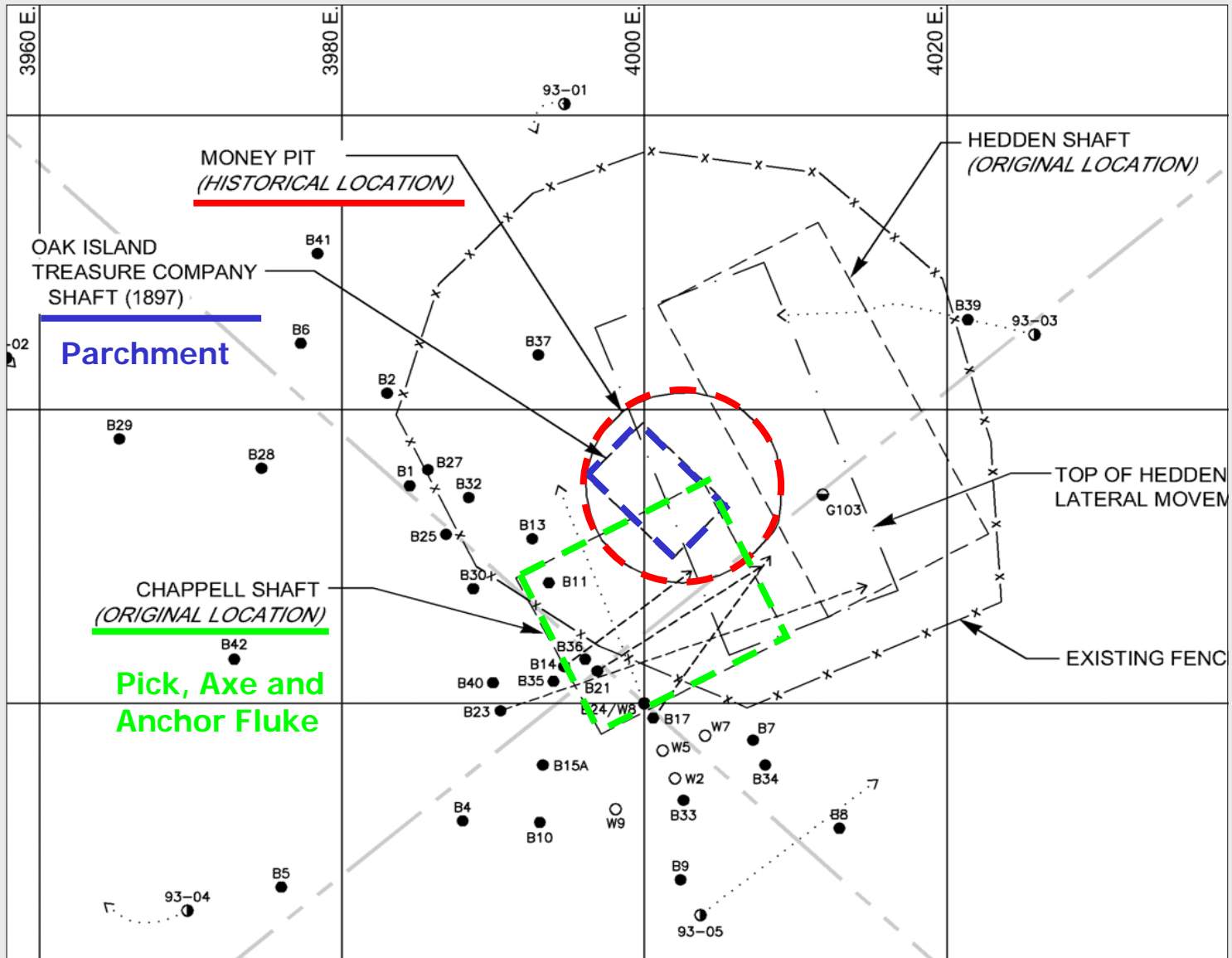
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4. Selected Archaeological Findings at Money Pit prior to 1967

- 1. Parchment in Oak Island Treasure Company Shaft 1897**
- 2. Poll Pick, Felling Axe and Anchor Fluke in Chappell Shaft 1937**

Plan of Shafts at Money Pit



Parchment Location from Drilling in Oak Island Treasure Company Shaft 1897

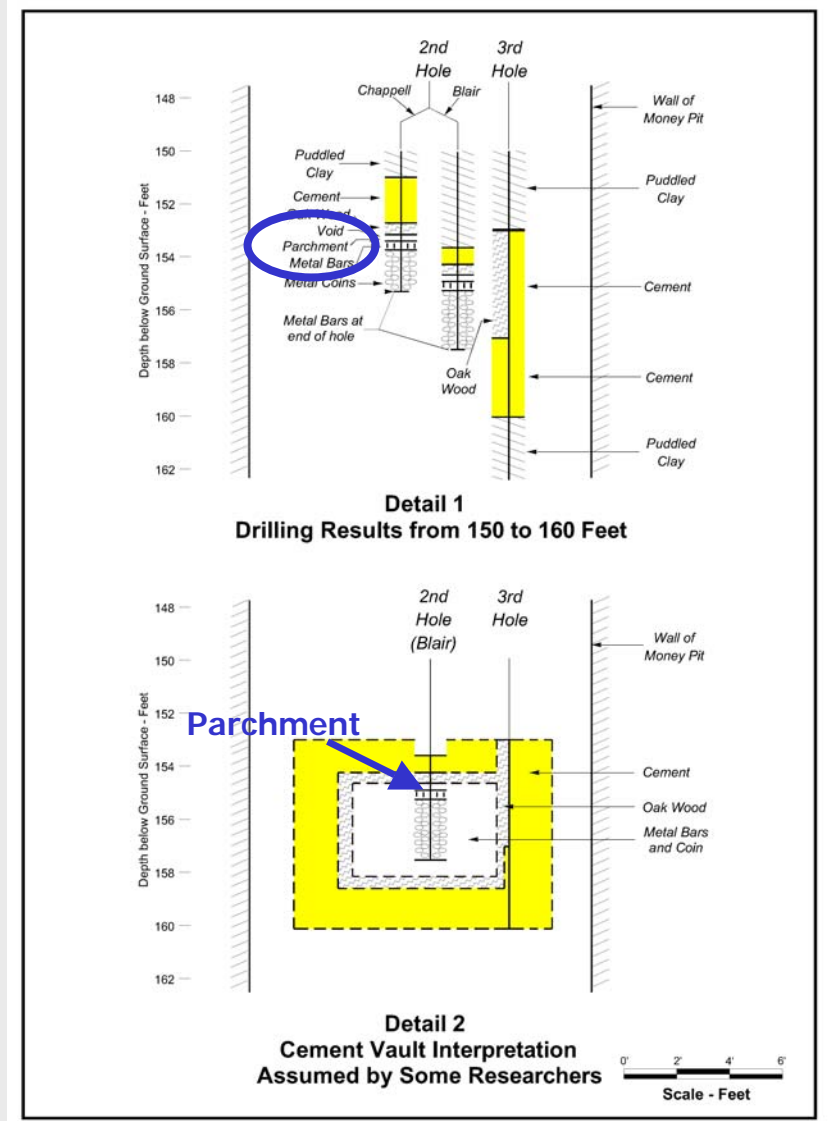
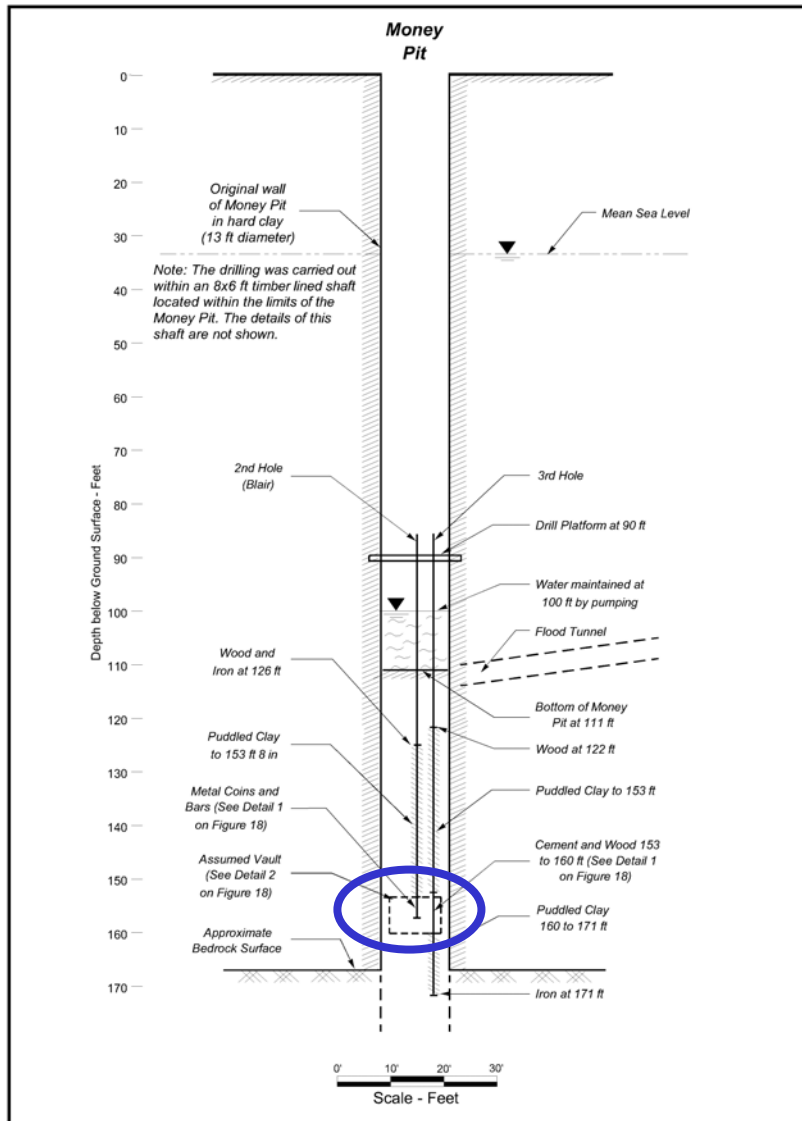


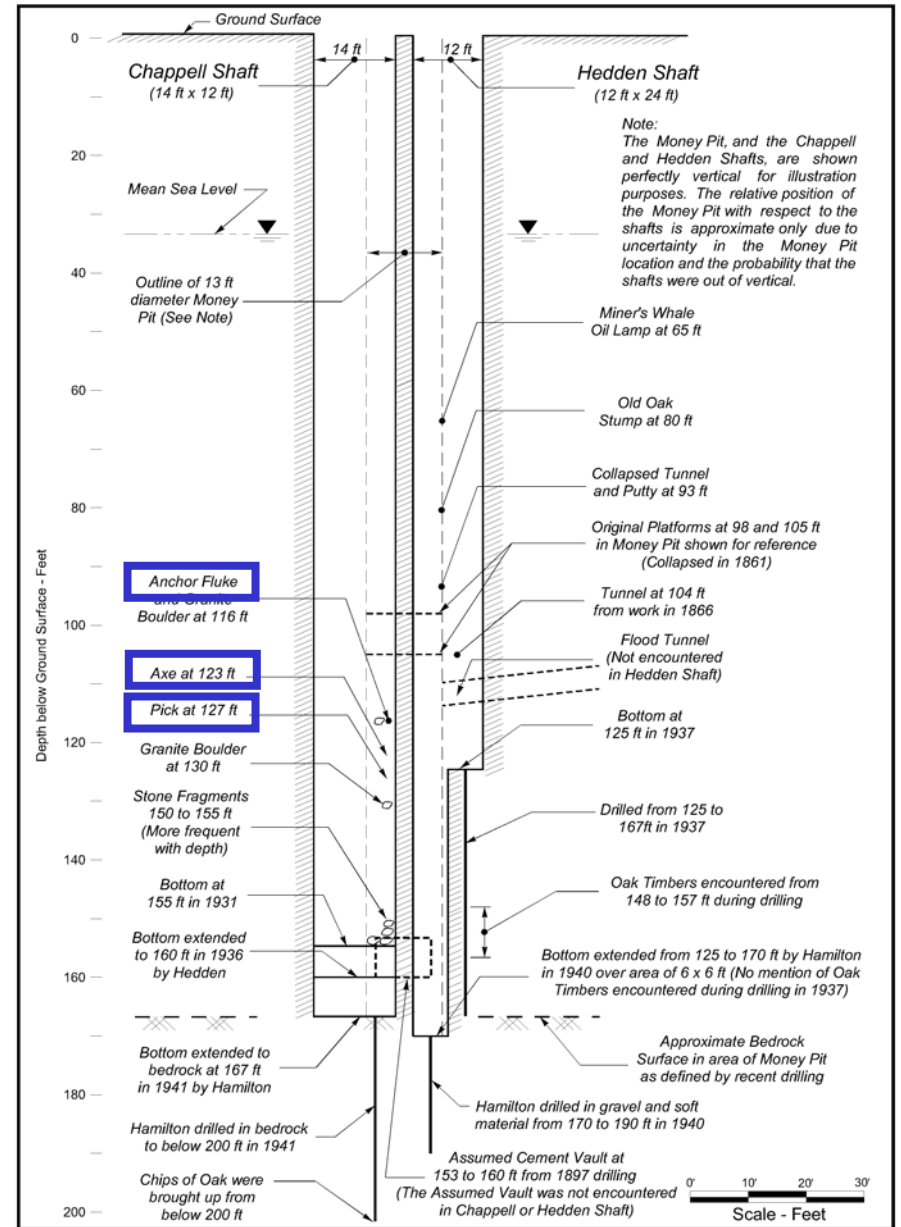
Photo of Parchment from Oak Island Treasure Company Shaft 1897



Parchment is $\frac{5}{16}$ inches long

Photo from Triton Alliance

Location of Pick, Axe and Anchor Fluke in Chappell Shaft 1931



Pick, Axe and Anchor Fluke Chappell Shaft 1931

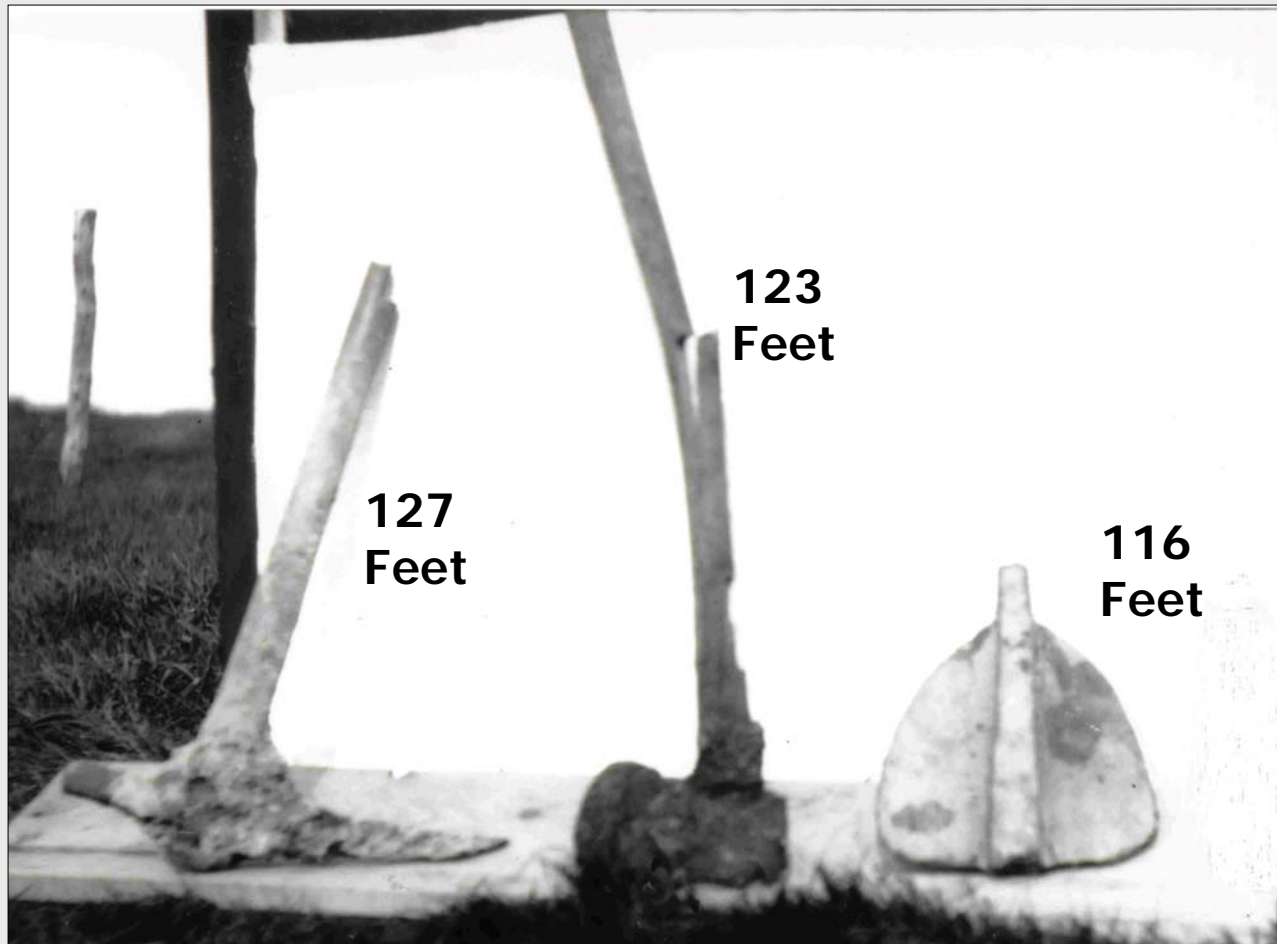


Photo from Triton Alliance

Poll Pick Chappell Shaft 1931



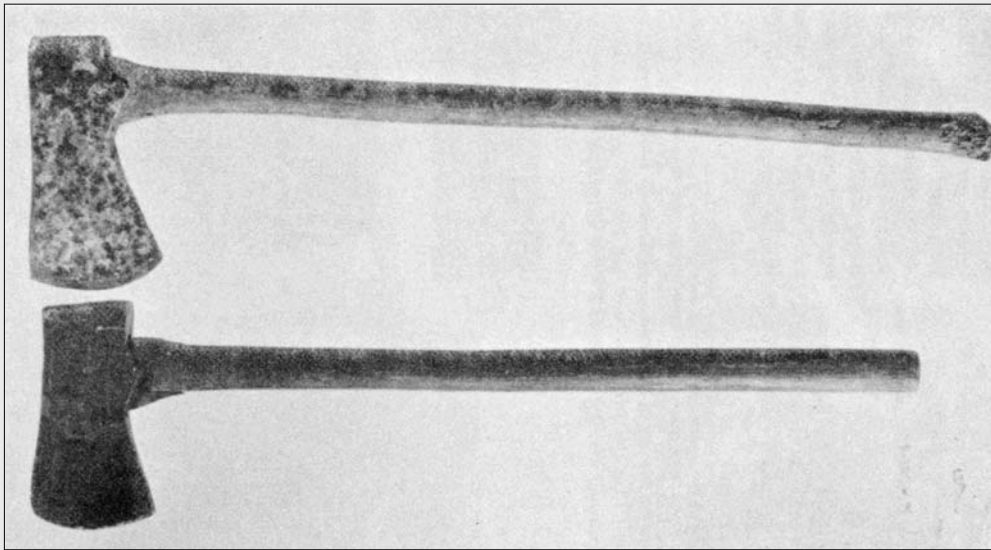
Photos from Triton Alliance

Anglo American Felling Axe Chappell Shaft 1931



Photos from Triton Alliance

Anglo American Axes (1725 – 1800)



Photos from Ancient Carpenters' Tools by Mercer

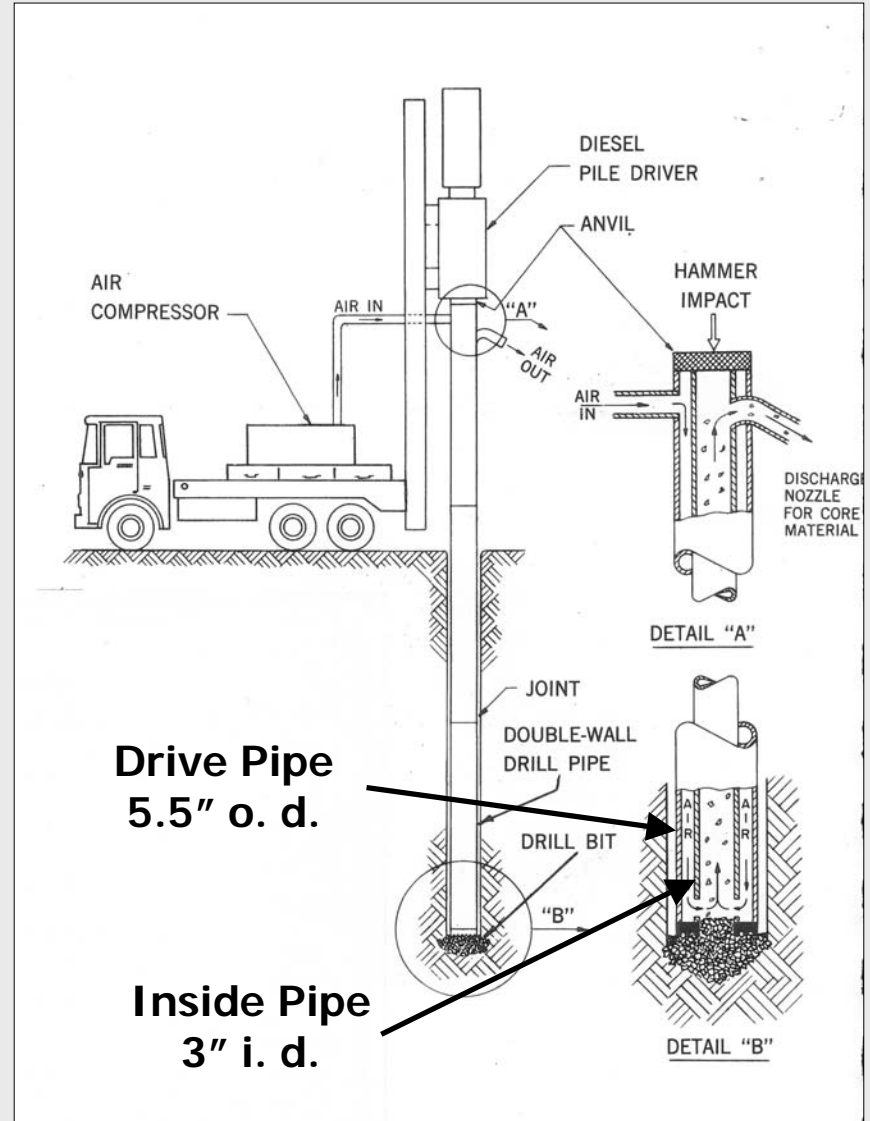
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5. Archaeological Findings at Money Pit 1967 to 2005

- 1. Becker Drilling Program 1967**
- 2. Pollen count results from Golder Holes 1970**
- 3. Five deep holes for detection program in 1993 provide lateral drift data**
- 4. Archaeological plan and sections**

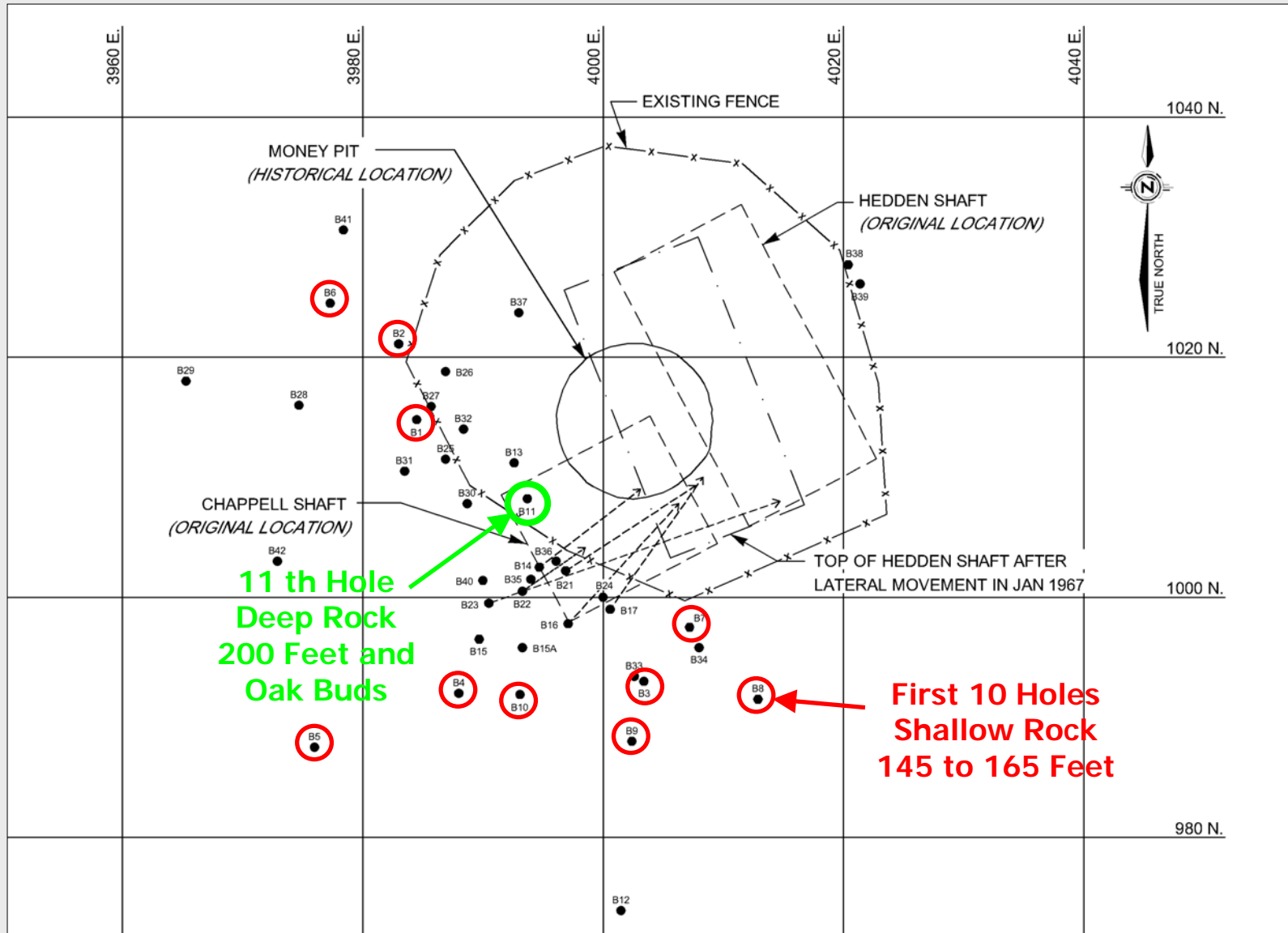
Becker Drill Setup 1967



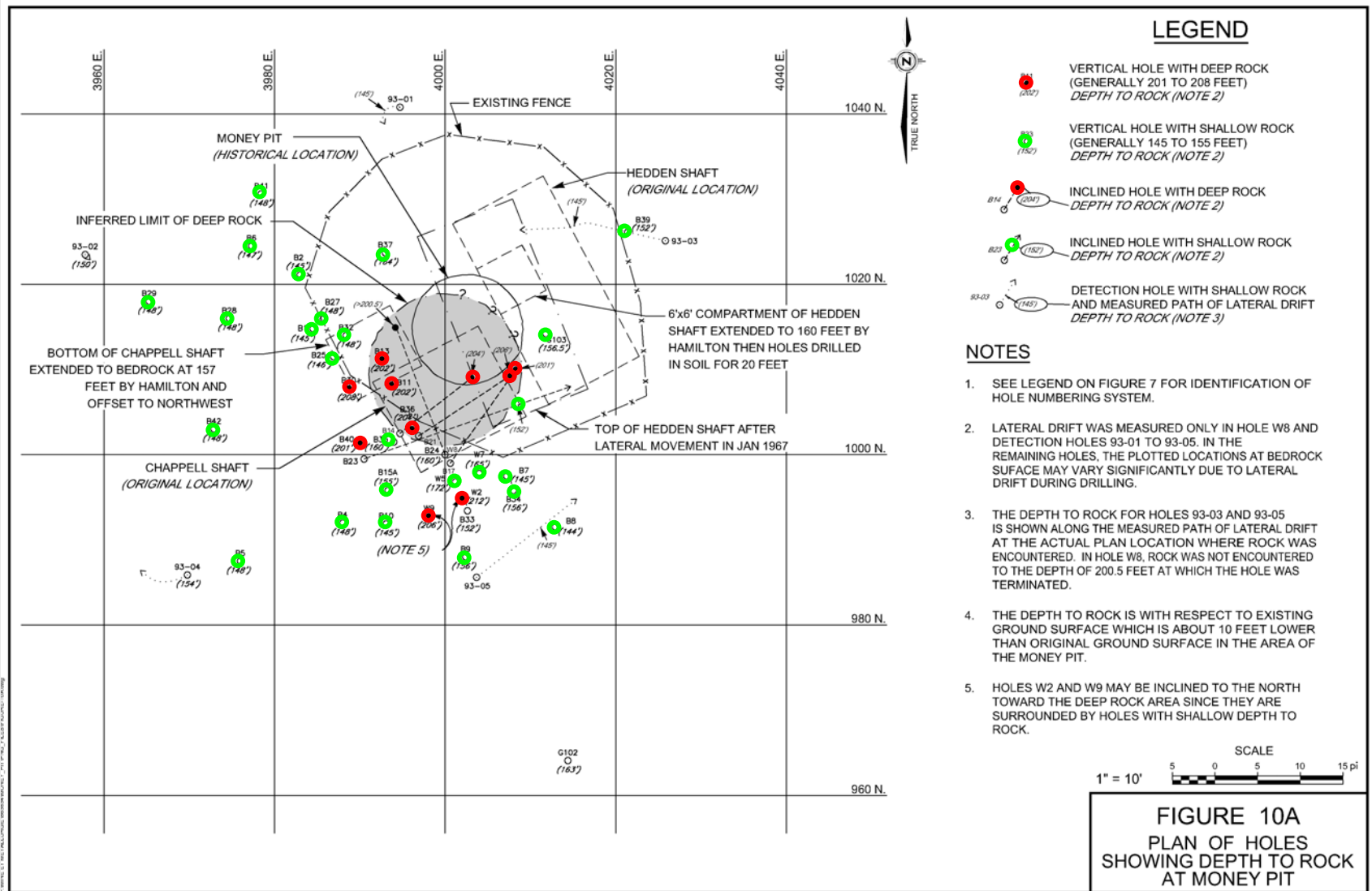
Becker Drilling Program in 1967

- The objective of the Becker drilling program was to drill through overburden to bedrock surface in search of the presumed treasure chests at 100 and 150 feet.
- The first 10 holes extended to bedrock surface at depths of 145 to 165 feet.
- The 11th hole (B11) extended to a depth of 200 feet before bedrock was encountered. Puddled clay was found from 184 to 200 feet and two oak buds were found embedded in the puddled clay at 196 feet.
- This singular finding initiated the extension of all holes to 200 feet with the use of tricone drilling in bedrock.
- 40 holes were drilled at the Money Pit from January to June 1967.
- The drilling resulted in the major milestone of finding man made cavities in the bedrock at 200 feet and this was completely unexpected.

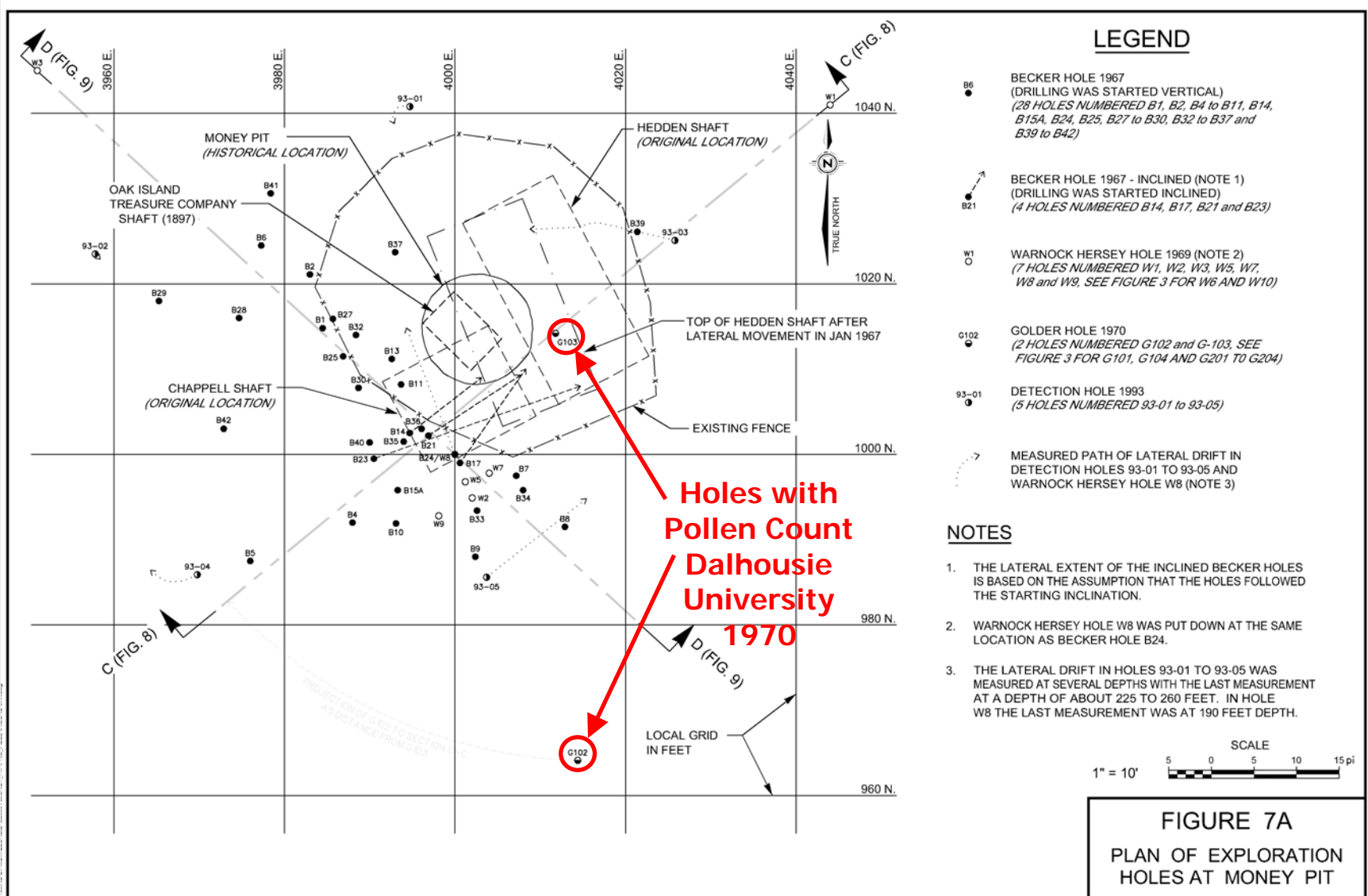
Plan of First 11 Becker Holes at Money Pit



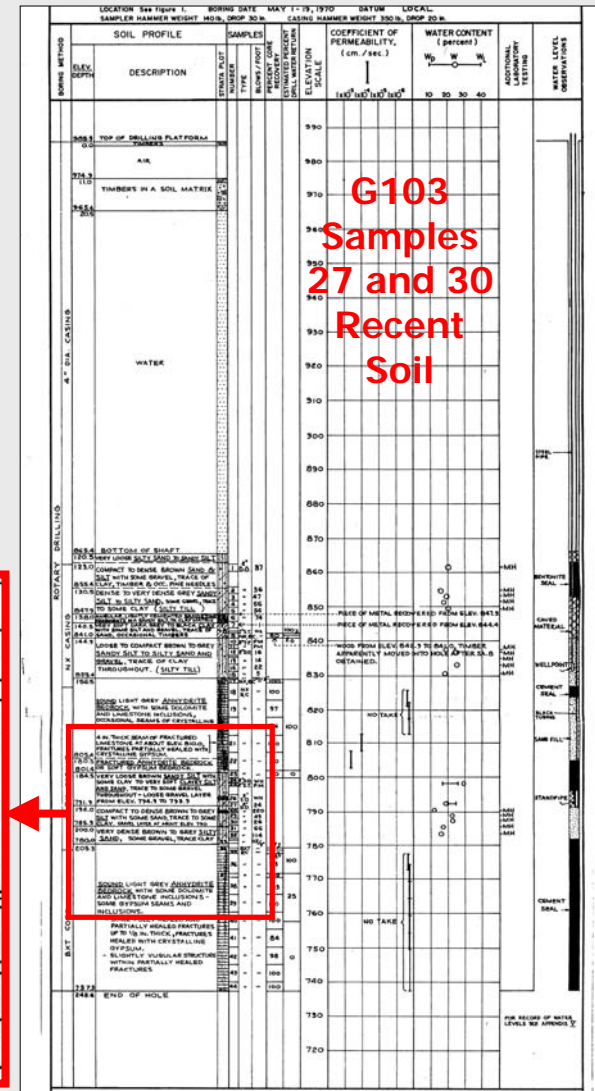
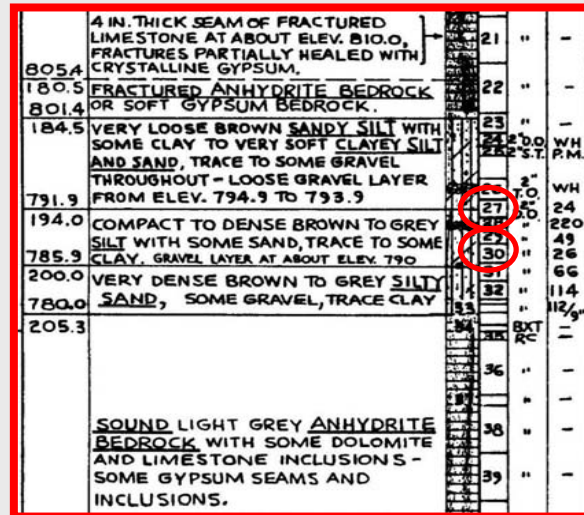
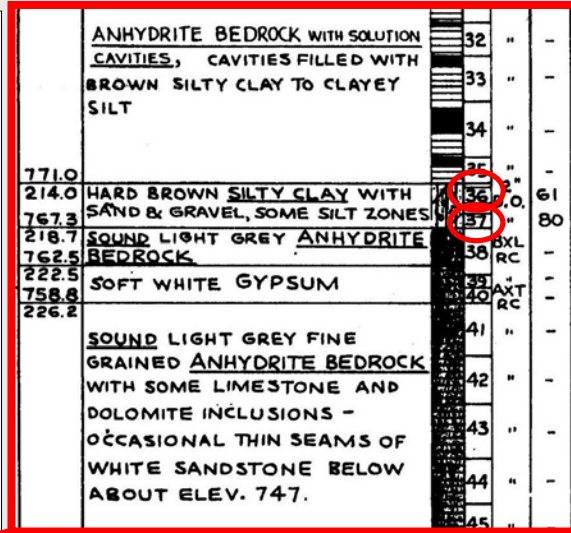
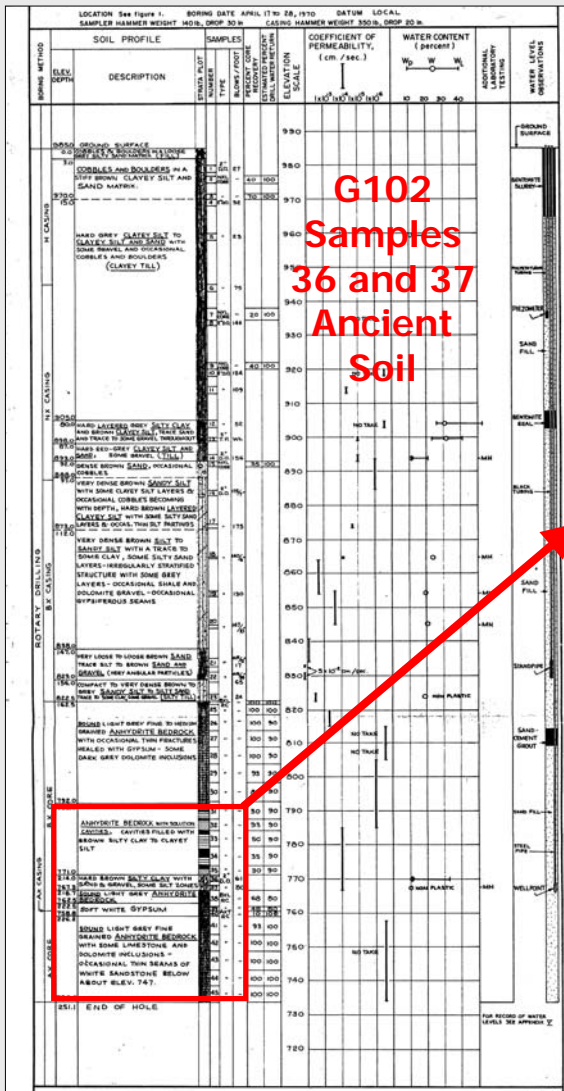
Plan of Deep Rock Area at Money Pit



Plan of Pollen Count Holes 1970



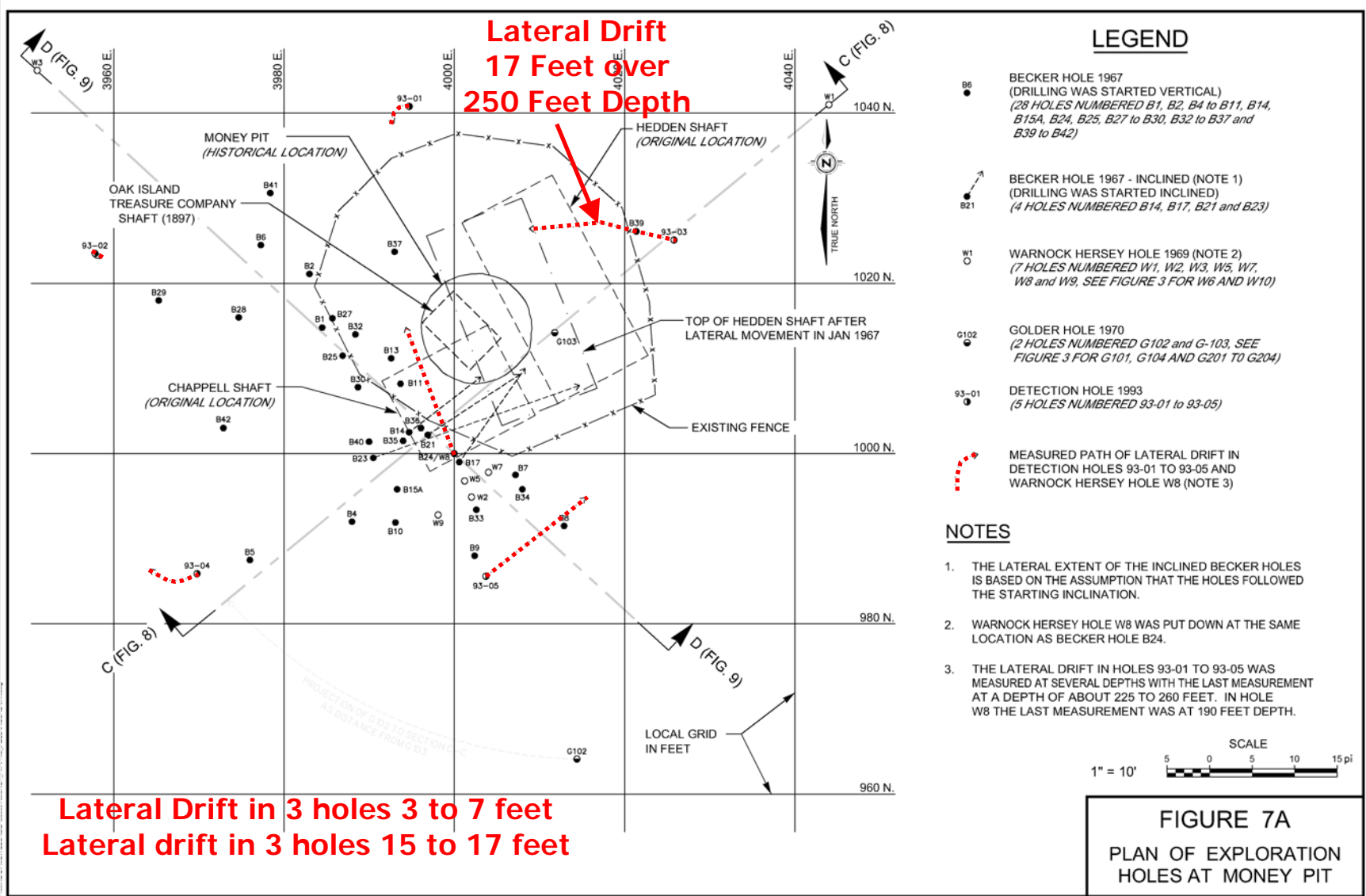
Pollen Count Samples from G102 and G103



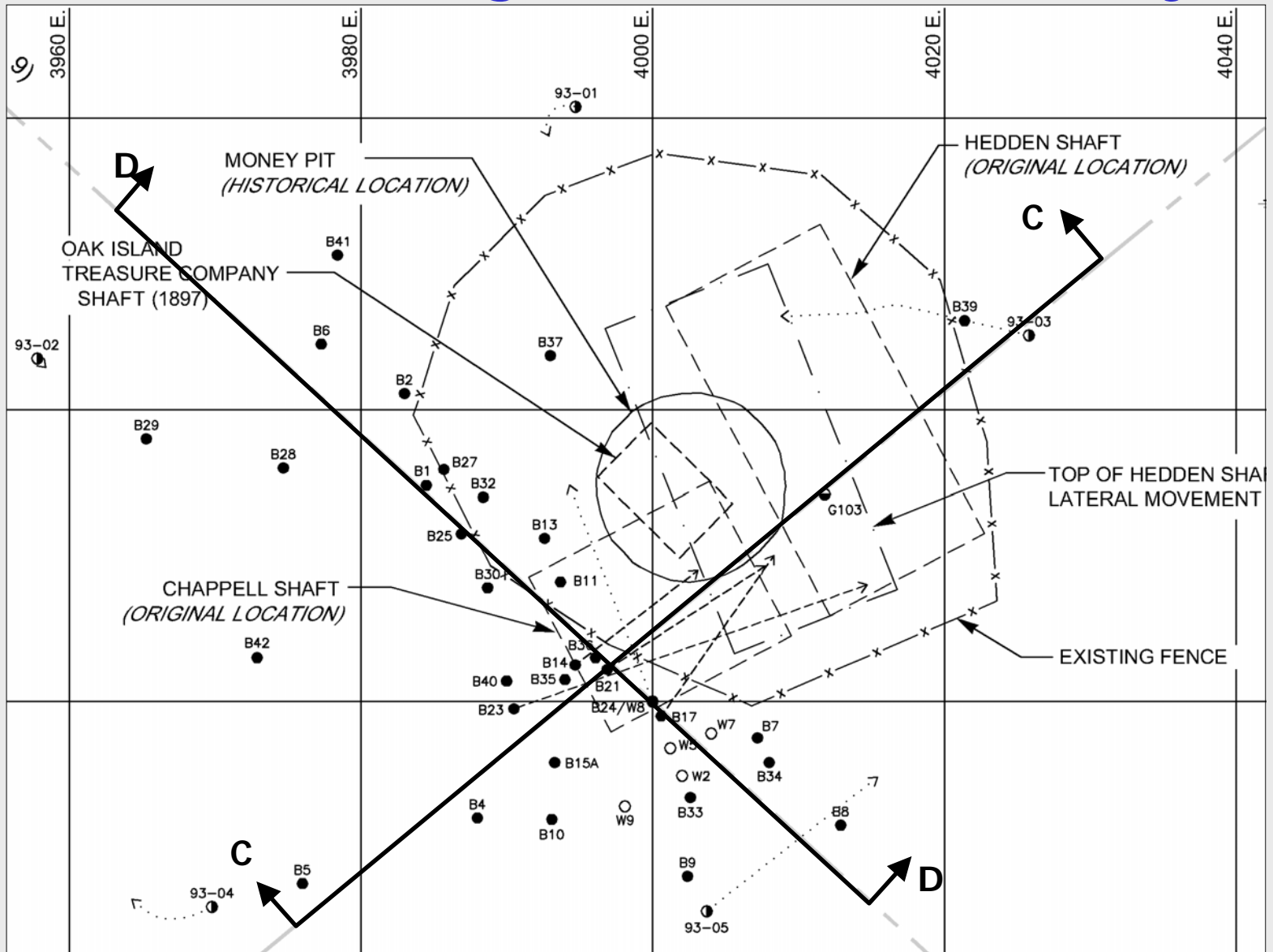
Lateral Drift in Five Deep Detection Holes 1993

- **Five deep holes to about 250 feet were put down in 1993 for a geophysical detection program.**
- **Lateral drift was measured in the 5 detection holes and in Hole W8.**
- **This provided an understanding of the importance of lateral drift which was not measured in the previous Becker Holes.**

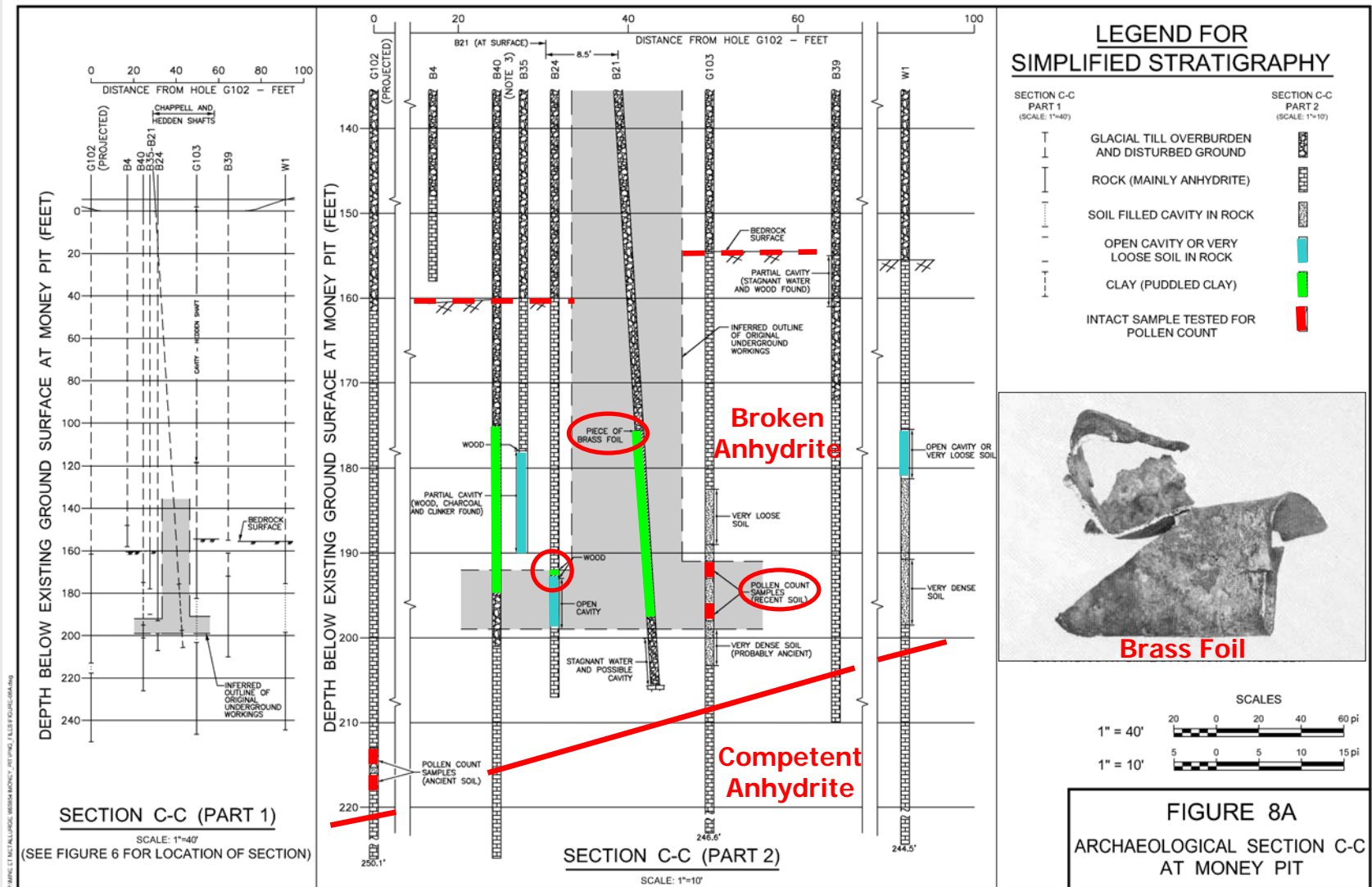
Plan of Lateral Drift Measurements



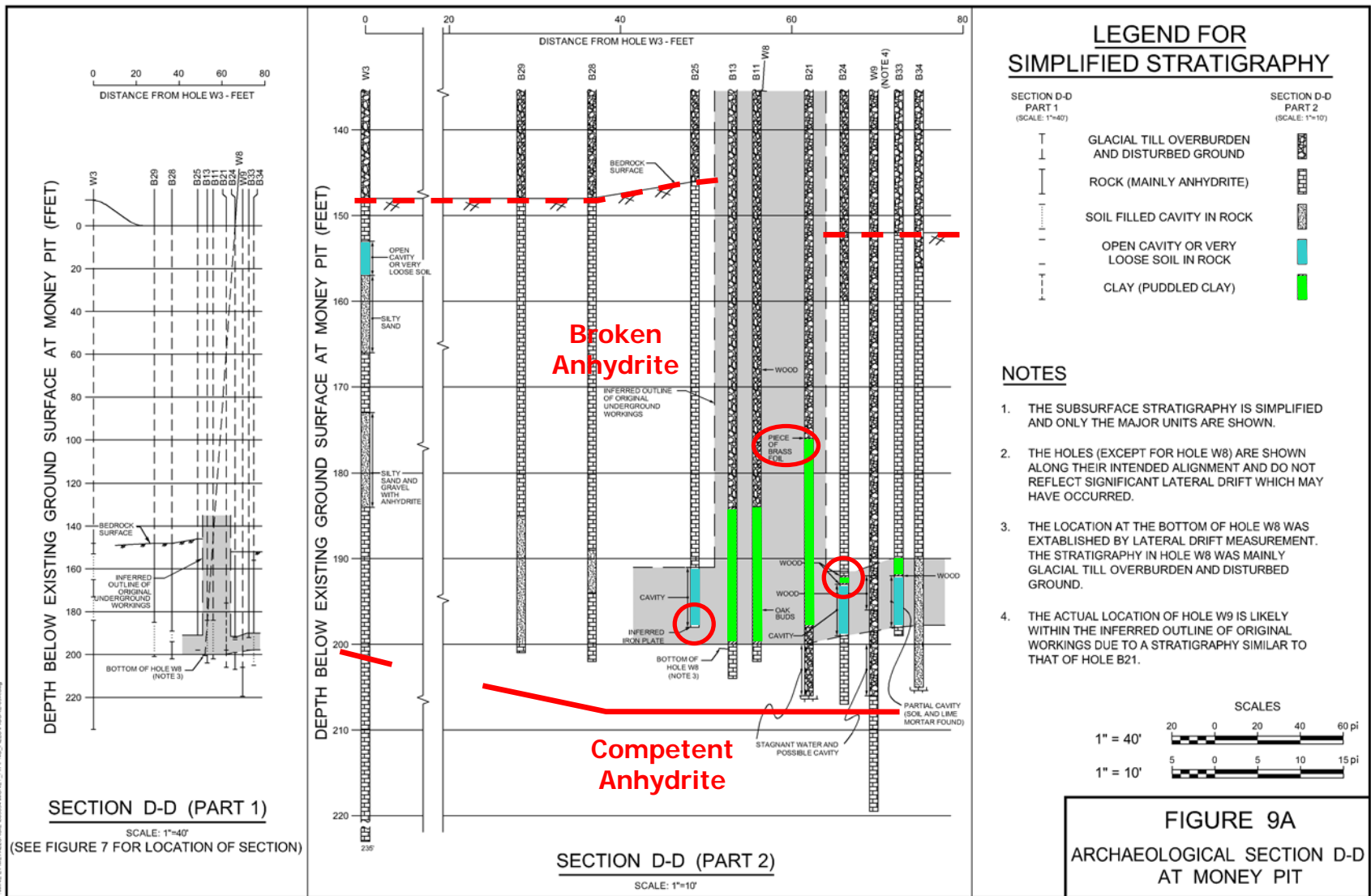
Plan of Archaeological Sections at Money Pit



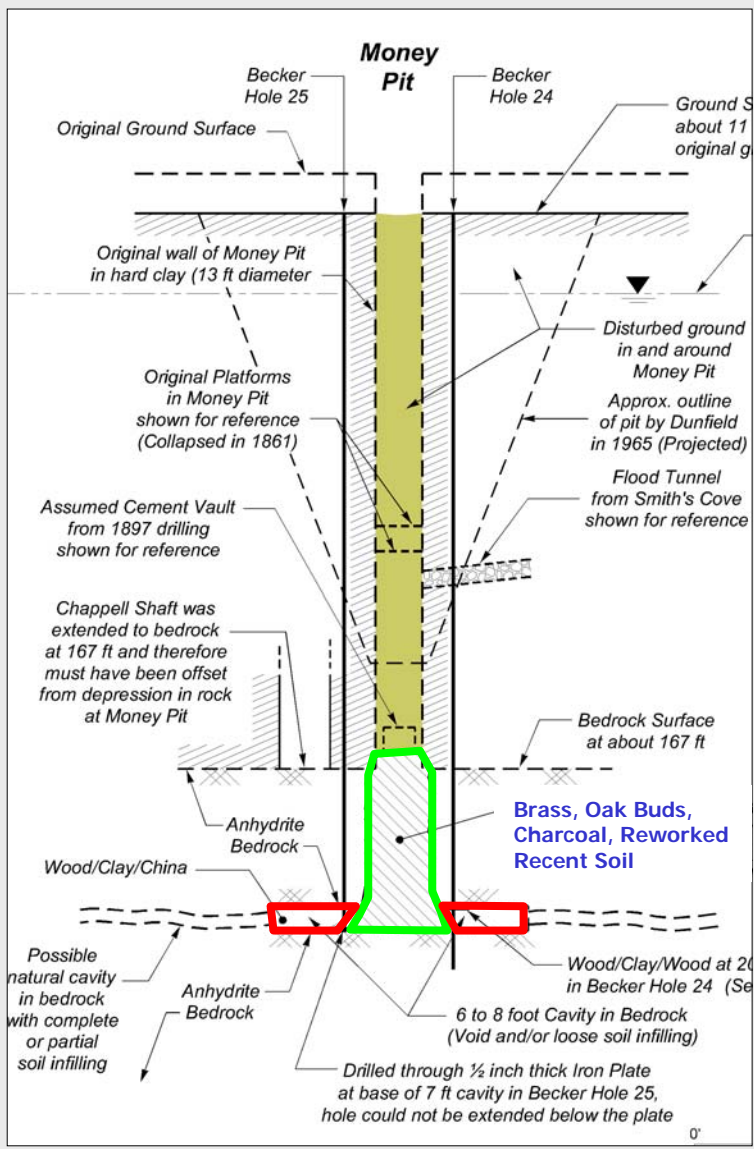
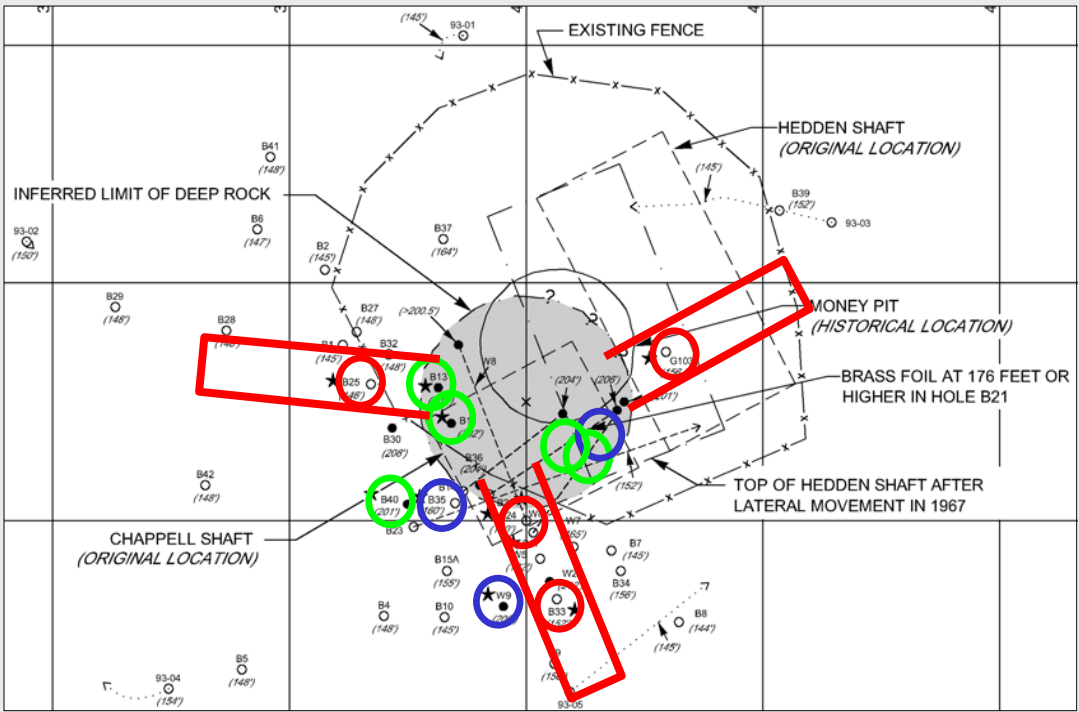
Archaeological Section C-C at Money Pit



Archaeological Section D-D at Money Pit



Summary of Archaeological Features at Money Pit



★ HOLES WITH ARCHAEOLOGICAL FEATURES (NOTE 2)

HOLE	FEATURES	DEPTH
B11	<u>PUDDLED CLAY</u> , OAK BUDS	184-200
B13	<u>PUDDLED CLAY</u>	184-200
B17	<u>PUDDLED CLAY</u>	176-198
B21	<u>BRASS FOIL</u> , <u>PUDDLED CLAY</u> , STAGNANT WATER	176-205
B24	<u>INFERRED CHAMBER</u> , CHINA FRAGMENT, WOOD	192-199
B25	<u>INFERRED CHAMBER</u> , IRON PLATE	191-198
B33	<u>INFERRED CHAMBER</u> , WOOD, LIME MORTAR	190-198
B35	<u>WOOD</u> , <u>CHARCOAL</u> , <u>CLINKER</u>	178-190
B40	<u>PUDDLED CLAY</u>	175-195
W9	<u>WOOD</u> , <u>STAGNANT WATER</u>	192-206
G103	<u>REWORKED RECENT SOIL (INFERRED CHAMBER)</u>	191-198

Geotechnical and Archaeological Conditions at Money Pit

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6. Options for Future Exploration

1. Option 1

Exploration boreholes with lateral drift measurements and downhole camera inspection to define the nature of man made workings and possibly to verify the presence of treasure and artifacts. If successful, this could lead to specific targets which could be accessed by a small diameter shaft.

2. Option 2

Excavation of a deep shaft of sufficient diameter to enclose the zone of man made workings at 200 feet depth.

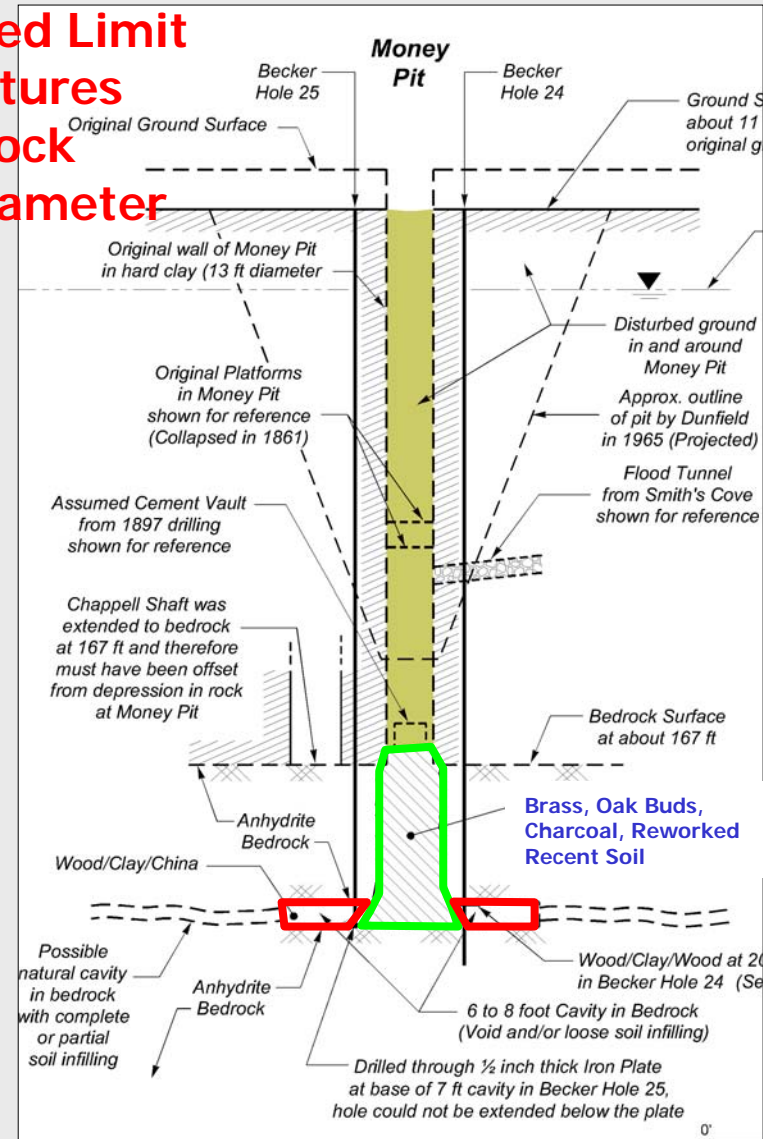
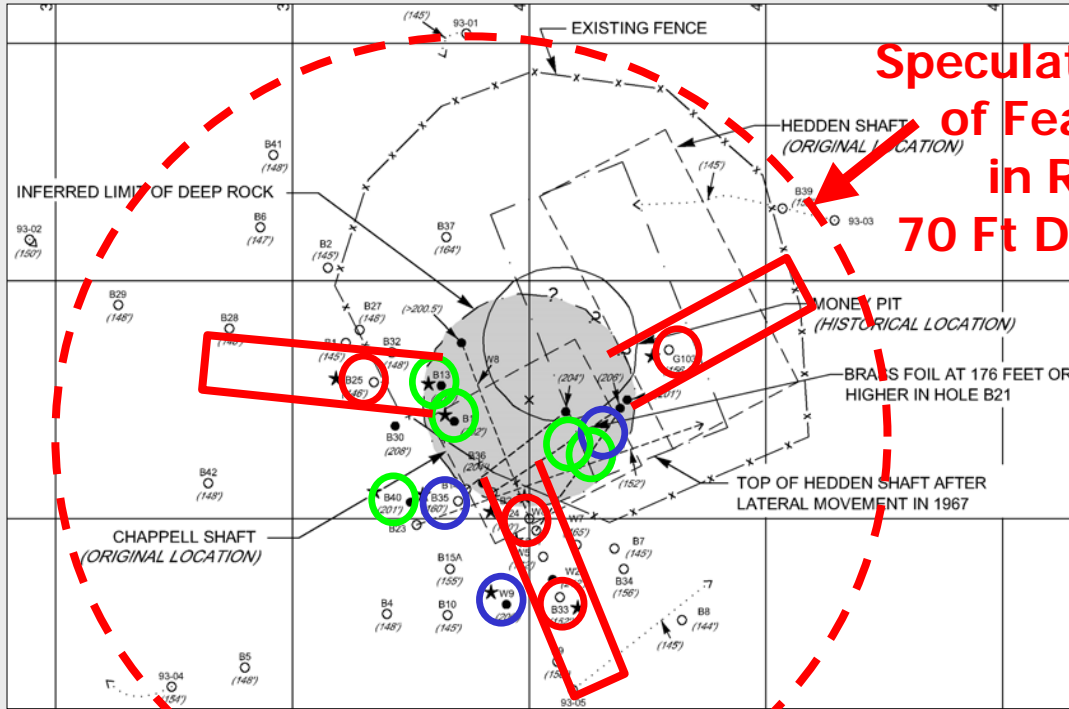
3. Other options could be considered but it is noted that geophysics, including ground penetrating radar, have not been successful.

4. Today we will discuss only Option 2, the large diameter shaft.

Archaeological Criteria for Shaft

- 1. Construction procedures should allow archaeological investigation as the shaft excavation proceeds.**
- 2. The shaft diameter at bedrock surface should be of sufficient size to include the possible range of locations where the original Money Pit excavation extended below bedrock surface.**
- 3. The shaft diameter at 200 feet depth should enclose a reasonable estimate of the lateral extent of the man-made chambers in bedrock.**
- 4. Construction procedures should be available to allow excavation beyond the limits of the shaft so that possible tunnels can be explored.**

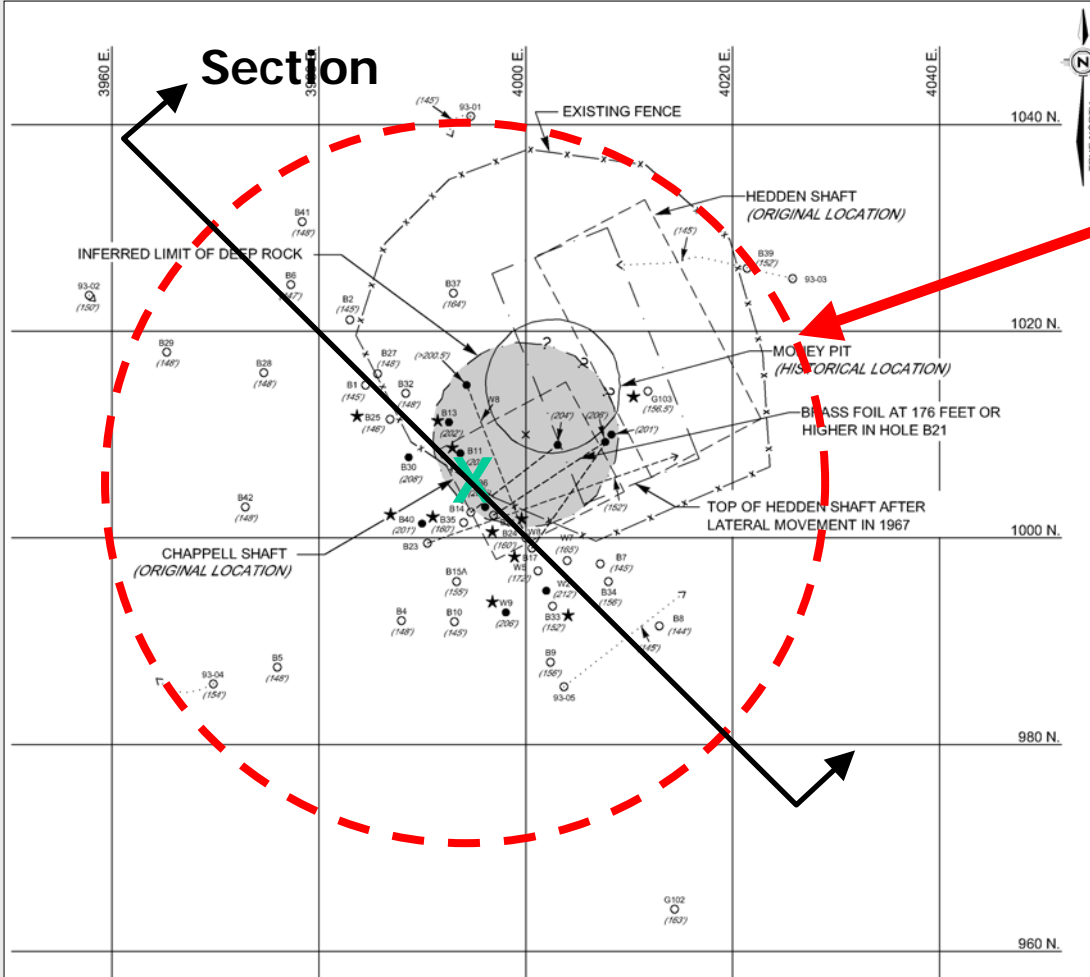
Limit of Archaeological Features in Bedrock



★ HOLES WITH ARCHAEOLOGICAL FEATURES (NOTE 2)

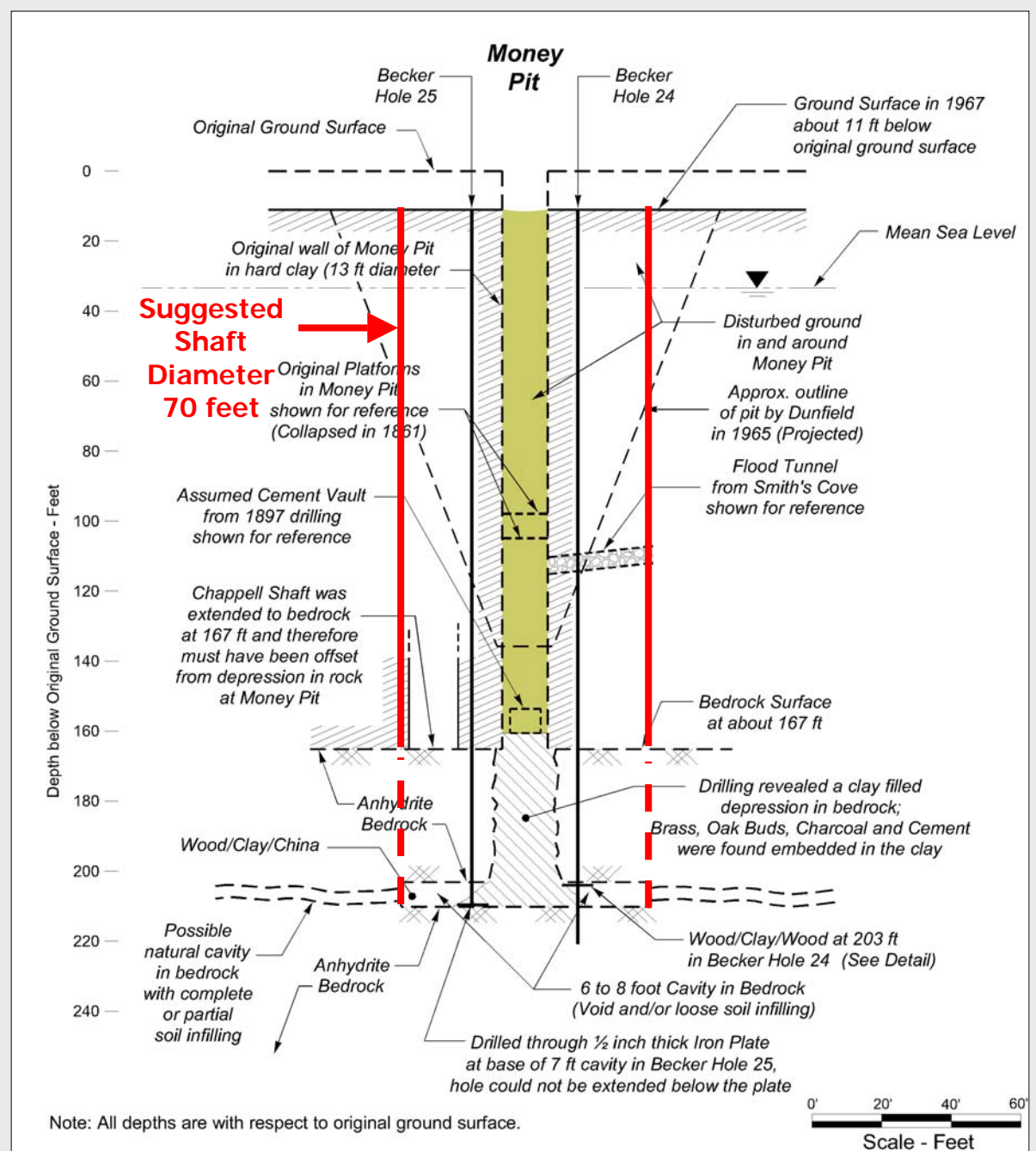
HOLE	FEATURES	DEPTH
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B13	<u>PUDDLED CLAY</u>	184-200
B17	<u>PUDDLED CLAY</u>	176-198
B21	<u>BRASS FOIL</u> , <u>PUDDLED CLAY</u> , STAGNANT WATER	176-205
B24	<u>INFERRED CHAMBER</u> , CHINA FRAGMENT, WOOD	192-199
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Location and Diameter of Shaft



**Suggested
Shaft
Diameter
70 feet**

Schematic Section of Shaft



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7. Conclusions

1. The geotechnical conditions have been defined to the extent required for conceptual studies of a shaft extending to 200 feet depth.
2. The archaeological evidence indicates that man made chambers exist in the bedrock at the Money Pit.
3. There is no physical evidence to indicate the nature of artifacts or treasure (if any) which may be contained in the man made chambers.
4. An investigation phase of borehole and downhole camera work may be considered to possibly verify the nature of the underground workings, to possibly define what is contained therein and to better define the location and diameter of a proposed shaft.
5. A shaft excavation to bedrock surface is expected to resolve the nature of the presumed chests with coins drilled at 100 feet in 1849 and 150 feet in 1897, and the parchment may be recovered.
6. A shaft excavation to 200 feet is expected to recover significant evidence (and possibly artifacts and treasure) which will result in:
 1. An obvious solution to the mystery (possibly by recovery of the parchment)
 2. A solution determined in conjunction with related historical and archaeological studies or verification
 3. The Oak Island mystery is not resolved (very unlikely outcome)

7. Acknowledgements

The permission of David Tobias and Dan Blankenship to present this information is gratefully acknowledged



Oak Island Group

Charles Brown

Dan Blankenship

Mrs. Sobey

Bill Ulrich

Bill Parkin

????

Bill Sobey

Oak Island 1986

