IBM

REMEDIAL ACTION PROJECT
Building 906
Final Report
Poughkeepsie, N.Y.

March, 1984
Ref. No. 1315

CONESTOGA-ROVERS & ASSOCIATES LIMITED

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1.0 INTRODUCTION

In early August, 1983, IBM Corporation (IBM) contracted with SCA Chemical Services Inc. (SCA) for a remedial action construction program at IBM's leased facility, Building 906. The location of Building 906 is illustrated on Figures 1a and 1b. Sevenson Construction Corporation (SCC) subcontracted with SCA to perform the earth moving and civil portions of the remedial construction. Conestoga-Rovers & Associates Limited (CRA) in turn subcontracted with SCC to provide engineering and analytical services for the project.

CRA conducted the initial phase of the remedial program which consisted of a comprehensive soil sampling and analysis program designed to delineate the areal and vertical extent of soils requiring excavation and disposal. The final report for the initial phase of work, entitled "Soil Sampling and Analysis - Adjacent to Building 906 - Poughkeepsie, New York", was submitted to IBM on October 3, 1983.

On the basis of analytical data derived from the initial phase of work, it was concluded that the boundaries of soils which required excavation and disposal at the southerly and northeasterly portion of the site were not defined. CRA recommended and received

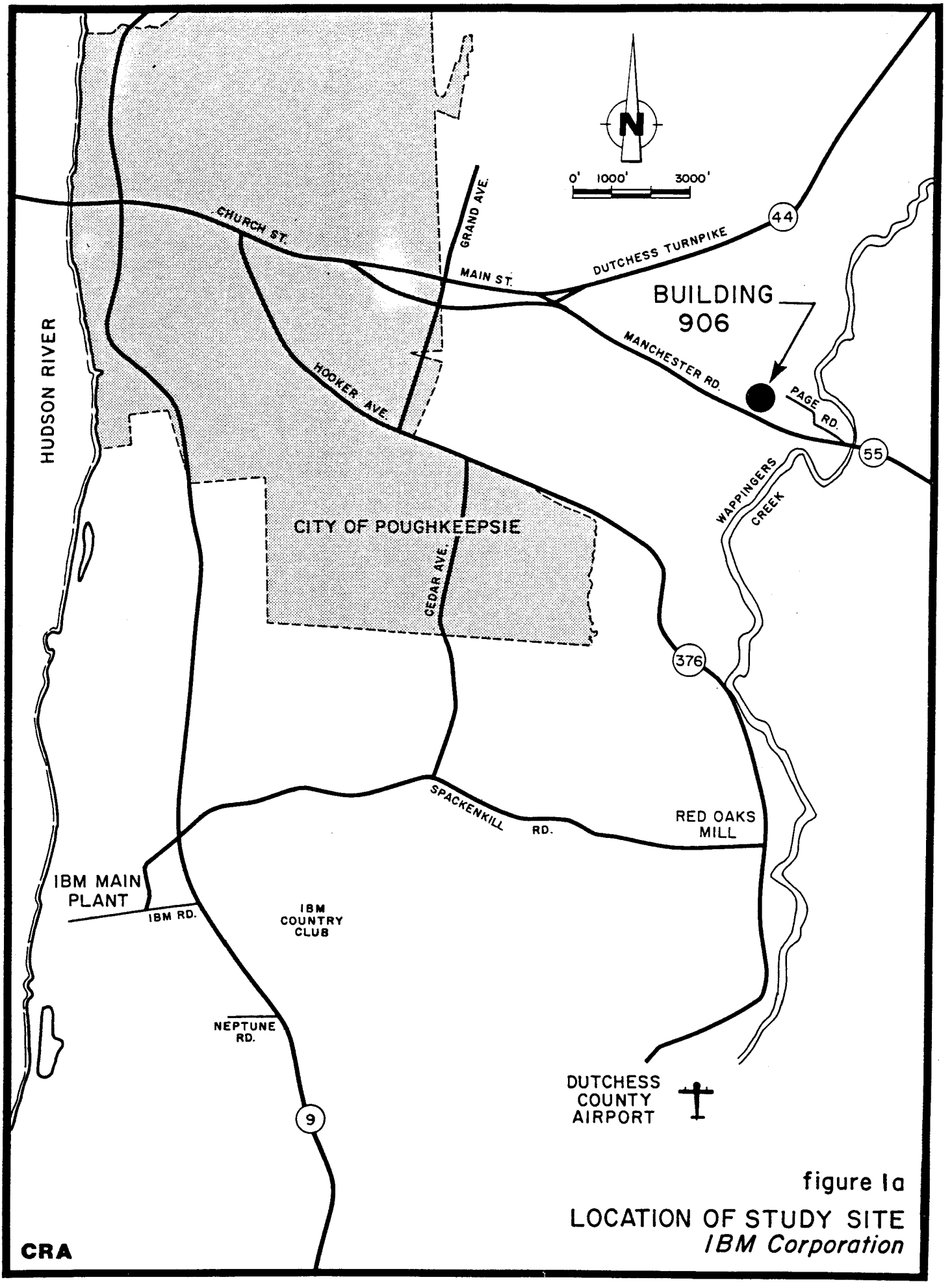

figure 1a

LOCATION OF STUDY SITE
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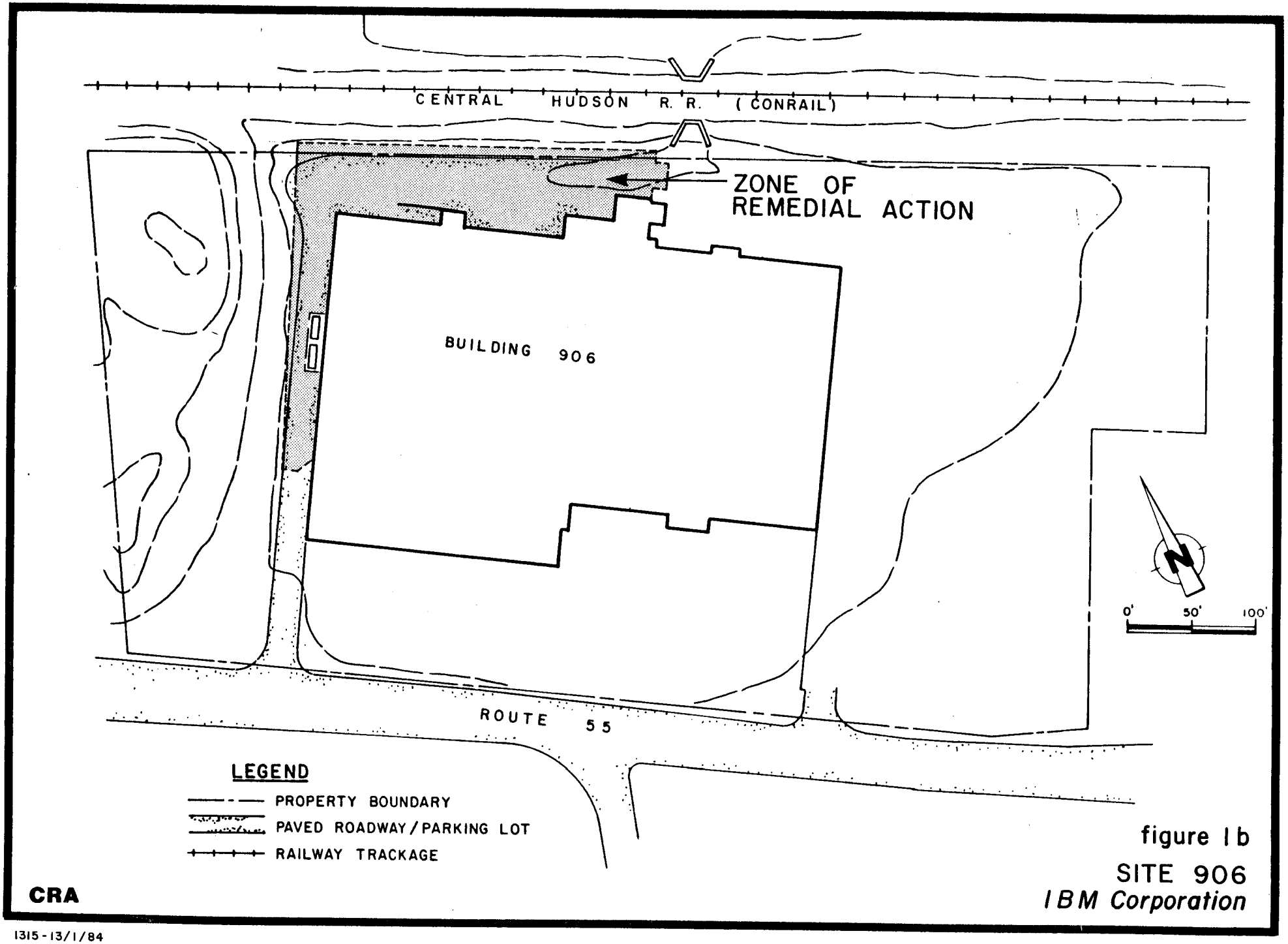

figure 1b

SITE 906

IBM Corporation

CRA

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approval from IBM to proceed with additional collection and analysis of soil samples in order to fully characterize the site.

Supplemental collection and analysis of soil samples was conducted by CRA during the period September 8 to October 18, 1983 and proceeded concurrently with the remedial construction. This phase of work resulted in a complete definition of the areal and vertical extent of soils requiring excavation and disposal. The final report, entitled "Supplemental Soil Sampling and Analysis - Adjacent to Building 906, Poughkeepsie, New York" was submitted to IBM in February, 1984.

This report has been organized to provide a summary review and oversight of the Building 906 remedial design and implementation. Problem definition and remedial design are discussed in Section 2 and remedial construction is discussed in Section 3. Section 4 addresses the effectiveness of the remedial action as constructed while conclusions are presented in Section 5.

2.0 PROBLEM DEFINITION

2.1 GENERAL

In March 1983, SCA in conjunction with SCC presented to IBM the proposal entitled "Excavation, Collection and Disposal of Contaminated Solids and Liquids - IBM Corporation - Poughkeepsie, New York". This proposal addressed the excavation, collection and disposal of solids and liquids containing organic chemicals which may be encountered beneath the parking lot and road access north of IBM Building 906.

The project objectives as defined by the SCA/SCC/CRA proposal were as follows:

1) To identify and excavate within the defined limits of the site all soils containing total volatile organics contamination in excess of 500 parts per billion (ppb).

2) To collect from within excavated areas all liquids including groundwater and surface runoff.

3) To dispose of all excavated soils containing total volatile organics concentrations in excess of 500

ppb by landfilling at a secure permitted facility.

4) To dispose as hazardous waste all collected liquids at a secure permitted facility.

5) To restore the site to pre-existing or better conditions.

6) To conduct all site activities in a fashion that would minimize adverse impact upon the adjacent IBM administrative facility, the surrounding environment, contractor and IBM personnel, and the general public at large.

7) To implement a project management plan which would provide effective cost control, accountability, and reporting.

8) To implement a site documentation protocol which would meet both IBM and regulatory requirements for the handling and disposal of hazardous waste.

The proposal was subsequently modified by negotiation to provide for an initial soil sampling and analysis program to accurately define the areal and vertical extent of sub-surface organic

chemicals prior to commencement of excavation and disposal activities. This site characterization would in turn allow precise determination of the quantities of soil requiring excavation and/or disposal and the requirement, if any, for foundation support of Building 906 during such excavation.

IBM authorized SCA to proceed with the approved remedial action program on August 2, 1983.

2.2 SAMPLING AND ANALYSIS OF SOILS

2.2.1 Soil Sampling Programs

2.2.1.1 General

A soil sampling and analytical program designed to delineate the areal and vertical extent of organic chemicals in soils north and west of Building 906 was completed during the periods August 4 to August 18, September 8 to September 9, September 27, and October 18, 1983. Table 1 provides a chronological summary of the sampling program.

TABLE 1

SAMPLING CHRONOLOGY
BUILDING 906 REMEDIAL ACTION PROGRAM

SAMPLING DATE		BOREHOLES		BOREHOLE	
FROM	TO	FROM	TO	TOTAL	COMMENTS
August 4, 1983	August 18, 1983	1	57	57	Boundaries of soils requiring excavation not defined for northeasterly and southerly portion of the site. Completed prior to construction phase.
September 8,1983	September 9, 1983	58	68	11	Boundaries of soils requiring excavation not defined for north easterly and southerly portion of the site. Completed during construction mobilization phase.
September 27, 1983	September 27, 1983	69	73	5	Boundary of soils requiring excavation not defined for southerly portion of the site. Completed during construction phase.
October 18, 1983	October 18, 1983	74	75	2	Boundaries of all soils requiring excavation defined for the site. Completed during construction phase.
			TOTAL	75	

2.2.1.2 Sequence of Sampling

The collection of soil samples was sequenced through five areas as illustrated on Figure 2. A description of the five areas is as follows:

Areas 1 and 2

Area 1 was the original study area for the proposed remedial action program. Within this area it was estimated that 42 boreholes averaging 12.5 feet in depth would be required to obtain the specified 264 samples. During the initial borehole installation program it was discovered that the average depth to bedrock throughout Area 1 was significantly less than the estimated 12.5 feet. At IBM's direction the sampling grid was expanded to include Area 2 where an additional 4 and 11 boreholes were installed west and north respectively of Building 906. A total of 262 samples were collected from Areas 1 and 2 during the period August 4 to August 18, 1983.

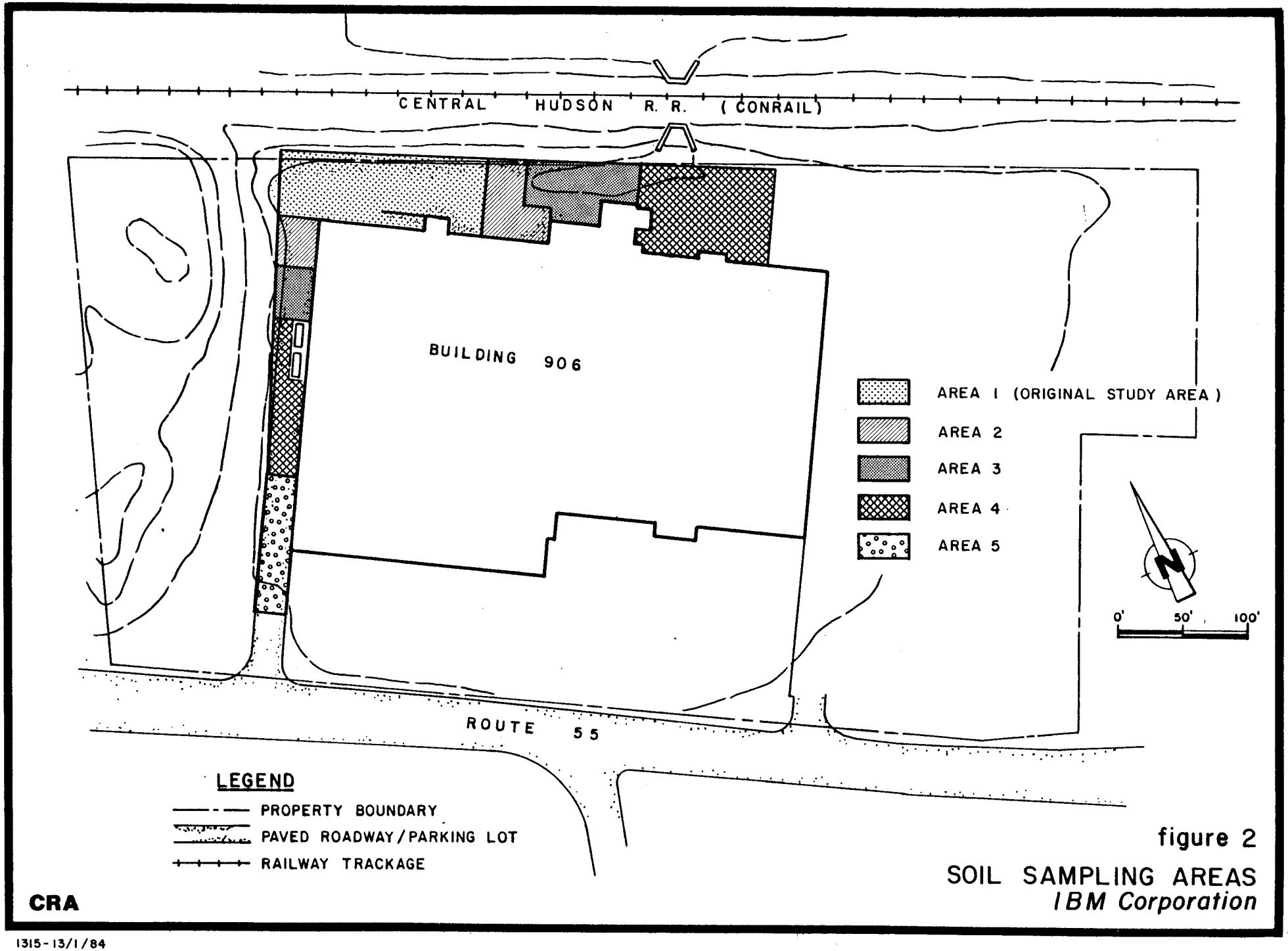

figure 2

SOIL SAMPLING AREAS

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Area 3

On the basis of analytical data derived from samples collected in Areas 1 and 2, it was determined that the boundaries of soils which required excavation and disposal at the southerly and north easterly portion of the site were not defined. CRA recommended and received approval from IBM to proceed with the collection of additional soil samples from Area 3 in order to fully characterize the site. Eleven additional boreholes were installed, four at the west side, and seven at the north side of Building 906. A total of 53 soil samples were collected from Area 3 during the period September 8 to September 9, 1983.

Area 4

On the basis of analytical data derived from soil samples collected from Area 3, it was determined that the boundaries of soil requiring excavation and disposal were not defined at the southerly and north easterly portion of the site. CRA recommended and received approval from IBM to install 5 additional boreholes in Area 4, 2 at the west side and 3 at the north side of Building 906.

A total of 26 soil samples were collected from Area 4 on September 27, 1983.

Area 5

On the basis of analytical data derived from soil samples collected from Area 4, it was determined that the boundaries of soils requiring excavation and disposal were not yet defined for the southerly portion of the site. CRA recommended and received approval from IBM to install two additional boreholes in Area 5 on the west side of Building 906., A total of 6 soil samples were collected from Area 5 on October 18, 1983. Data derived from the analysis of these samples indicated that the limits of soil requiring excavation and disposal were now defined.

2.2.1.3 Sampling Locations and Intervals

Continuous split spoon sampling was conducted at locations as detailed in Figure 3. Boreholes were installed by drill rigs equipped with rotary heads and 8-inch diameter hollow stem augers.

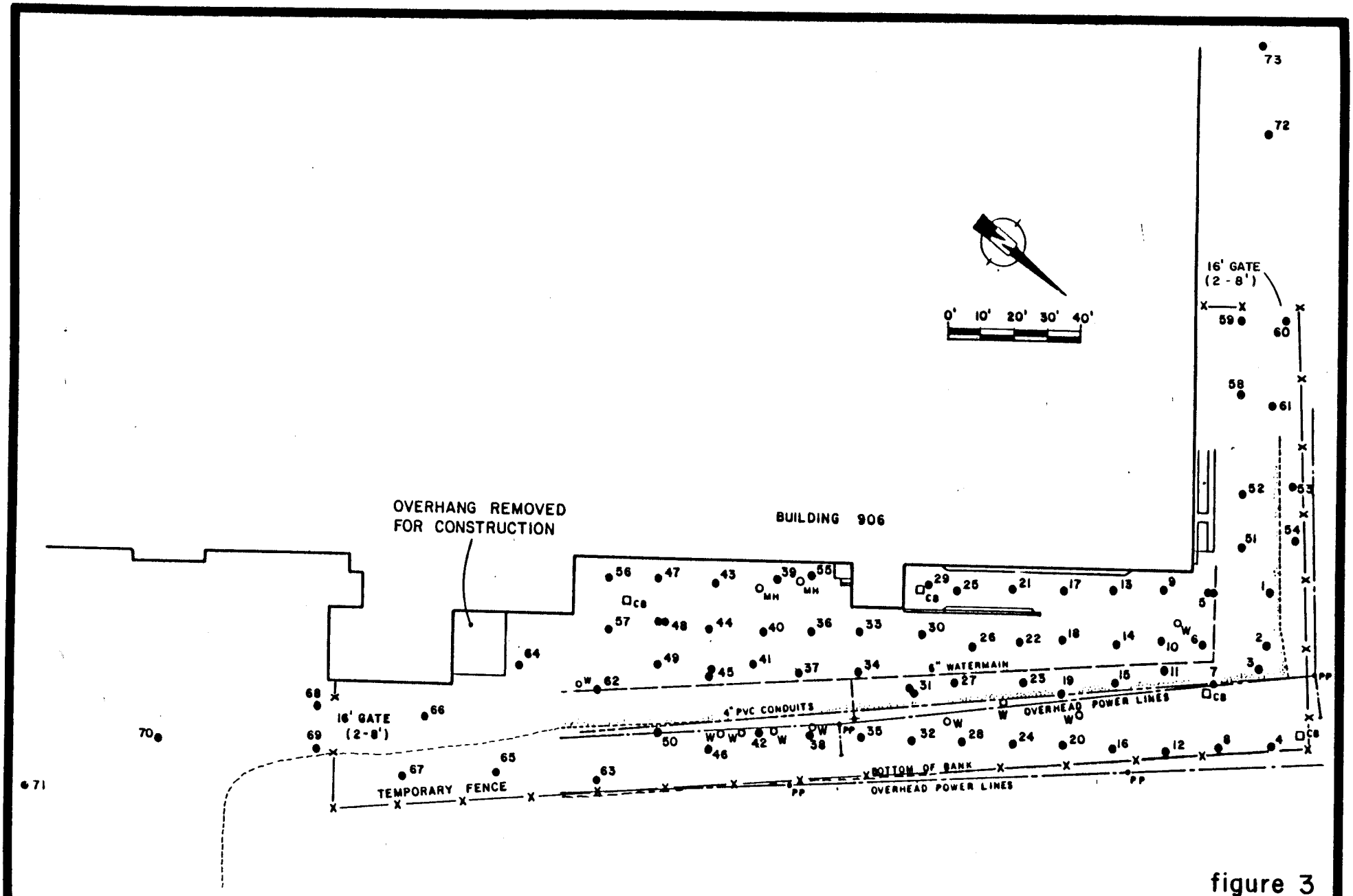

figure 3

BOREHOLE LOCATIONS

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Three-inch diameter, 24-inch long stainless steel split spoon sampling tools, driven at the desired depths with a 140-pound hammer having a vertical drop of 30 inches, were used to recover the soil samples. Samples were handled with stainless steel spatulas, knives and large spoons. For collection of samples for chemical analysis, a "clean" sampling protocol designed to minimize the potential for cross contamination, was adhered to. Details of the sample preparation and handling protocol are contained in Appendix A-1.

A total of 347 soil samples were collected for chemical analysis. Periodically, the soils encountered at various depths in some boreholes were of such size and composition (shattered rock, cobbles) that sample collection for chemical analysis was inappropriate. Where possible at these locations, only geologic samples were collected. A total of 346 geological samples were collected. Photographs 1 to 8 inclusive illustrate the sampling operation.

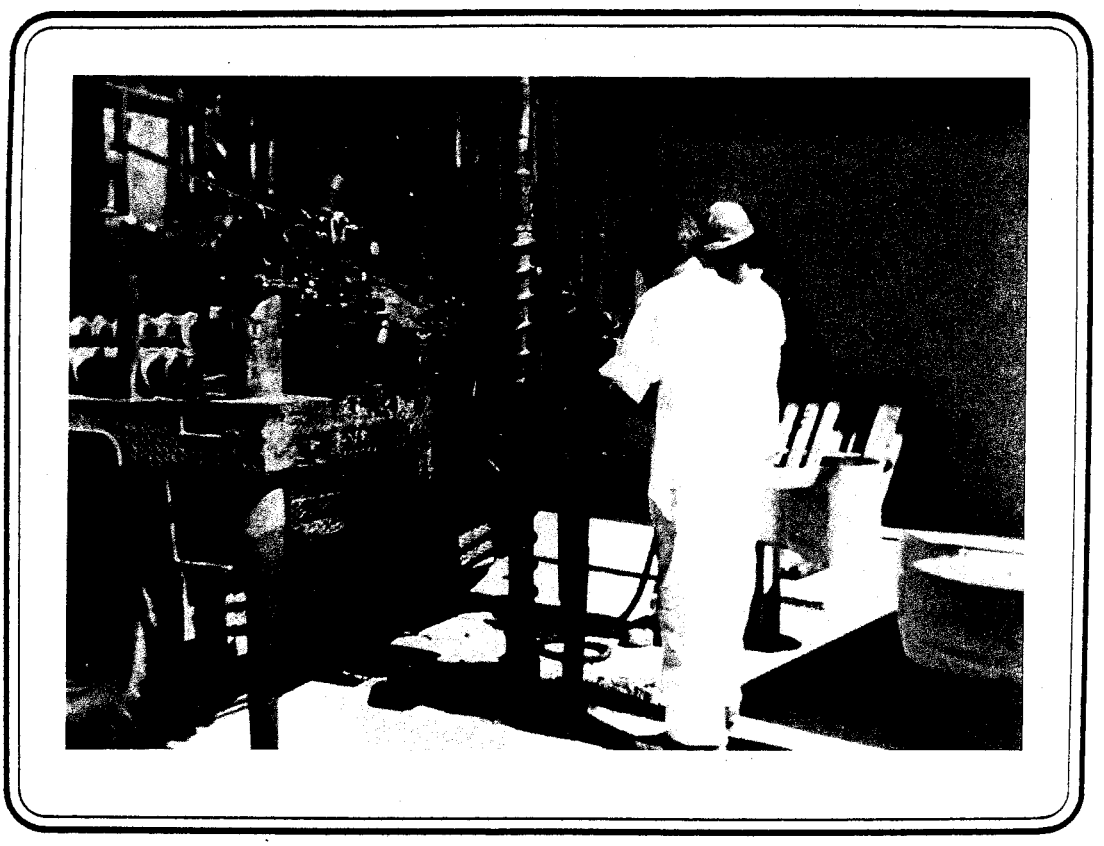

PHOTO 1
DRILLING CREW ADVANCING A BOREHOLE

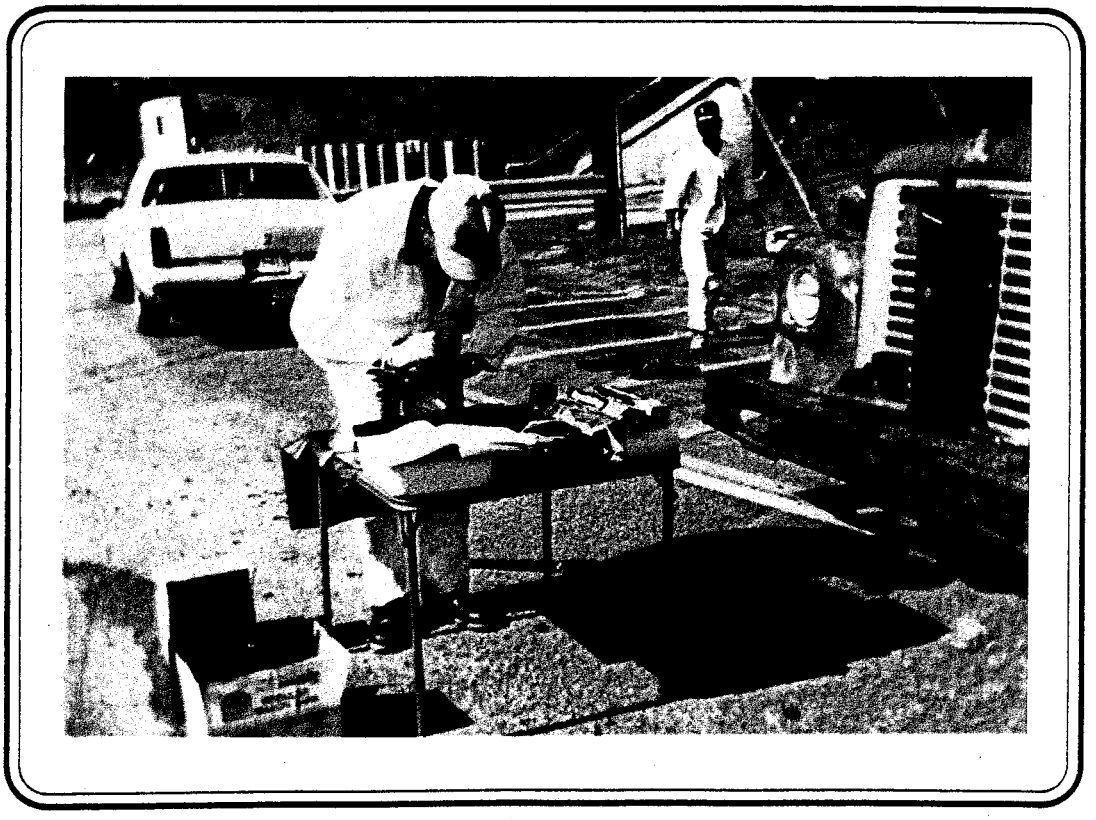

PHOTO 2
COLLECTION OF SOIL SAMPLE FROM SPLIT SPOON IN
4 OZ. VIAL FOR TOTAL VOLATILE ORGANIC ANALYSIS

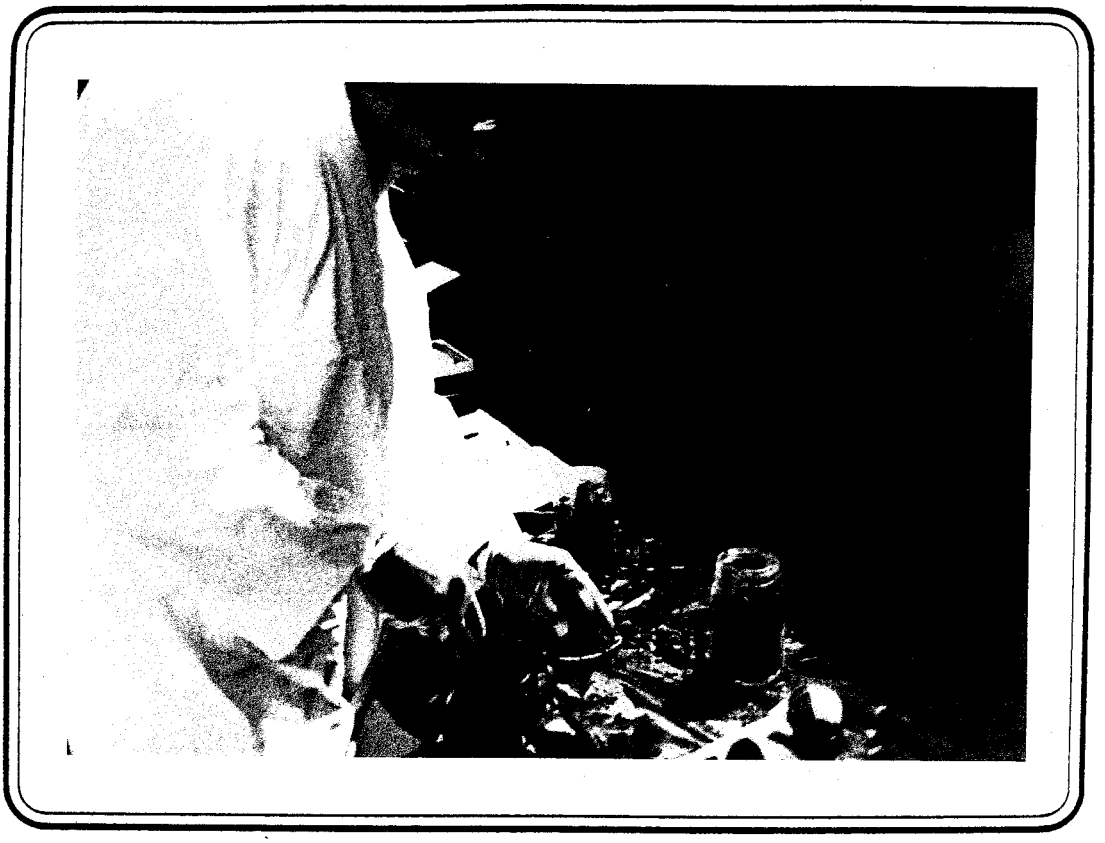

PHOTO 3
COLLECTION OF REMAINING SAMPLE FROM
SPLIT SPOON FOR RECORD SAMPLE

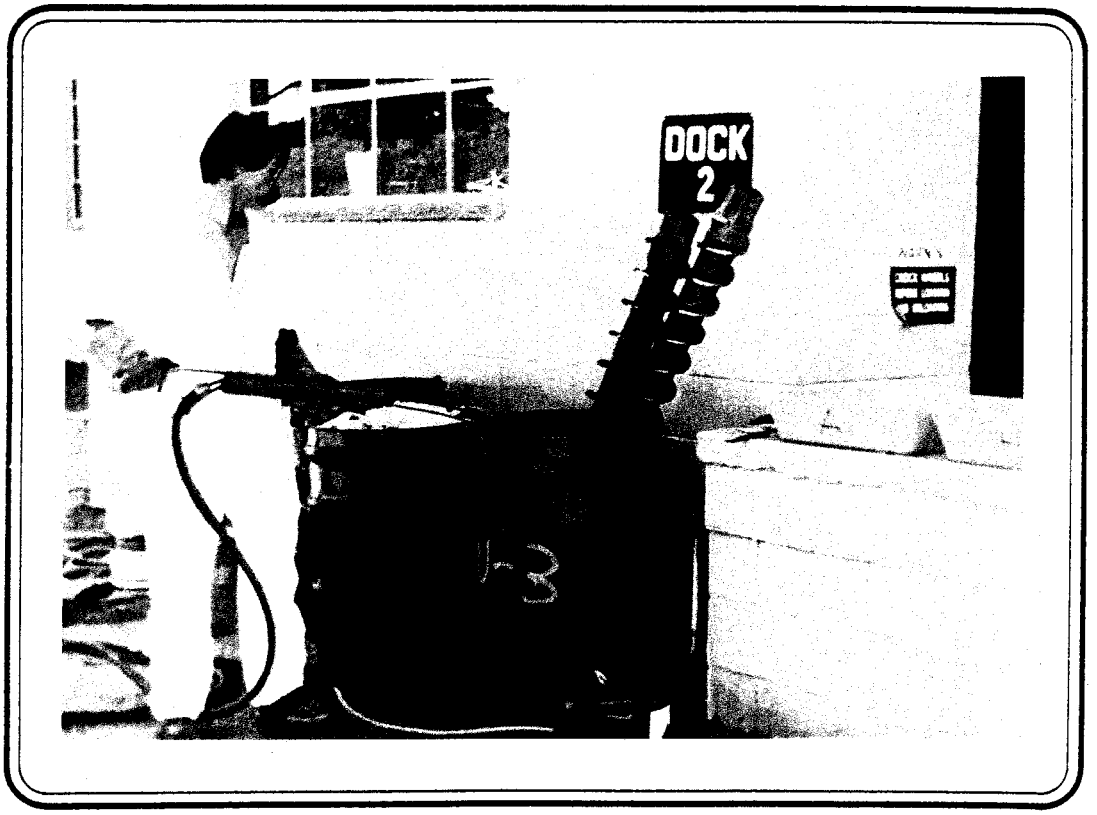

PHOTO 4
DECONTAMINATION OF AUGERS WITH HIGH PRESSURE STEAM
CLEAN USING INDUSTRIAL DETERGENT BETWEEN EACH BOREHOLE
TO PREVENT CROSS-CONTAMINATION

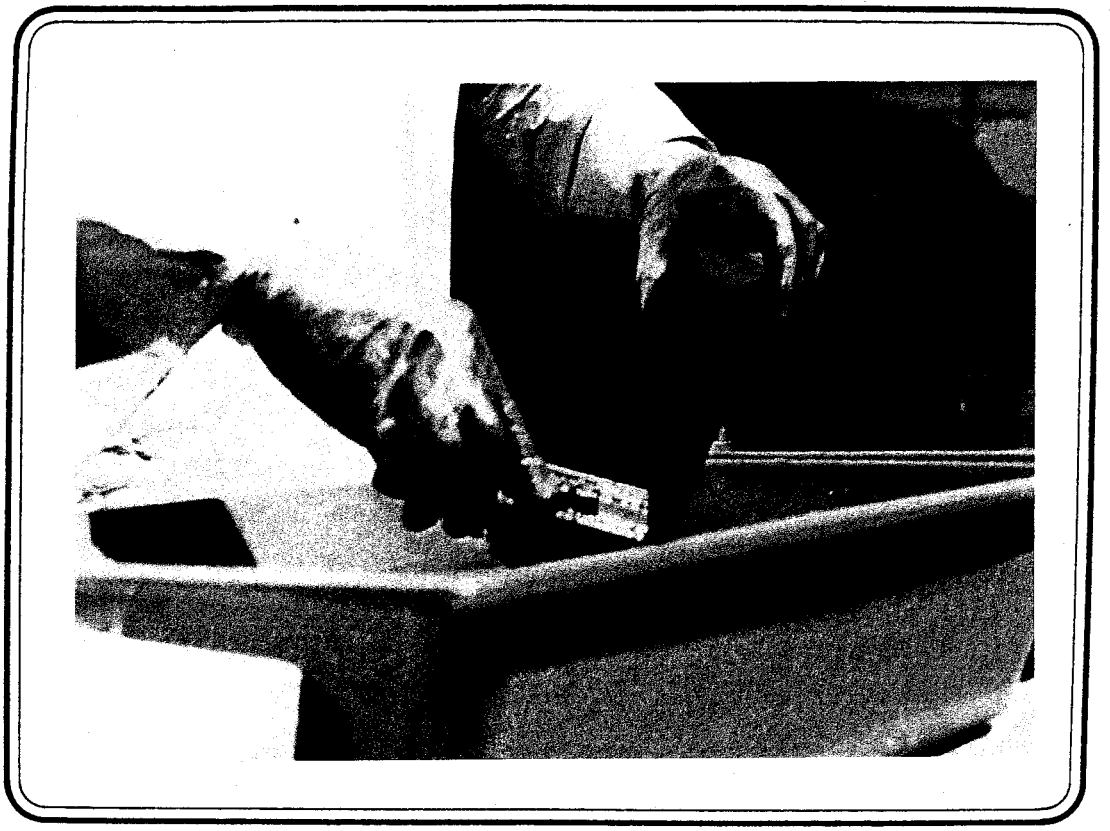

PHOTO 5
DECONTAMINATION OF SPLIT SPOONS IN AN ACETONE-HEXANE-ACETONE-DISTILLED WATER RINSE BETWEEN EACH SAMPLE. SPOONS WERE TOWEL WIPED AND HEAT DRIED

PHOTO 6
DRUMS CONTAINING SAMPLING DEBRIS SUCH AS RINSE WATER, SAMPLING CONSUMABLES, REMAINING SOIL FROM THE SPLIT SPOONS AND SOILS FROM THE AUGERING

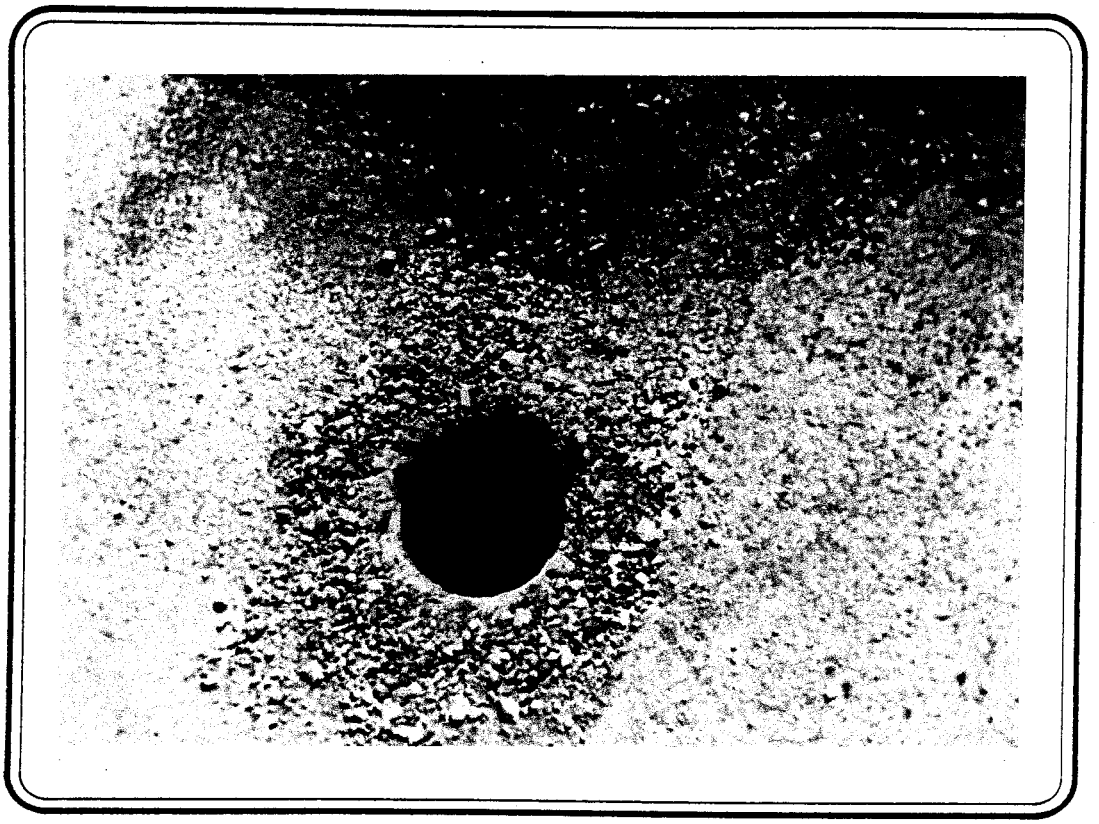

PHOTO 7
A TYPICAL BOREHOLE. THE SOILS IN THE UPPER PART OF THE PICTURE BROUGHT UP BY THE AUGERING OPERATION WERE DISPOSED IN DRUMS SIMILAR TO THOSE SHOWN IN PHOTO 6. THIS WAS TO REDUCE THE POSSIBILITY OF CROSS-CONTAMINATION IN THE DIFFERENT LAYERS OF EACH BOREHOLE.

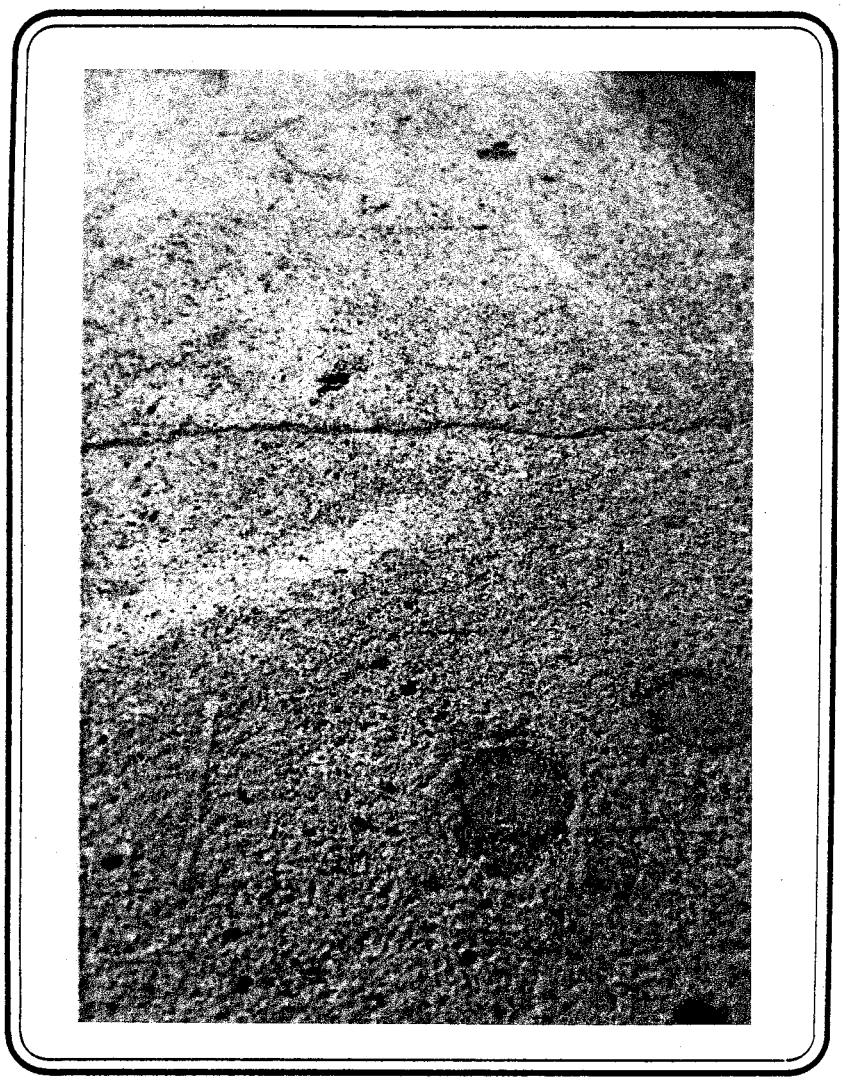

PHOTO 8
BOREHOLE FILLED TO ORIGINAL LEVEL
WITH CLEAN OFF-SITE FILL AND TAMPED

2.2.2 Chemical Analysis of Soil Samples

2.2.2.1 General

Chemical analysis of soil samples was conducted by an independent laboratory (Velsicol Chemical Corporation, Memphis, Tennessee) contracted by CRA.

The initial 262 samples were analyzed for total priority pollutant volatile organics (TVO) concentration using a modified purge and trap GC/MS technique (EPA Method 624). The remainder of the samples were analyzed for TVO concentrations using a methanol extraction followed by Method 624 (GC/MS). A total of 62 samples were speciated into individual priority pollutant volatile organic compounds.

Priority pollutant base/neutral and acid/phenolic analysis was conducted on 65 of the collected samples using EPA Method 625 (GC/MS).

2.2.2.2 Total Volatile Organics

TVO concentrations are detailed in Tables 4 and 6 within Appendix A-2. A maximum concentration of 17,000 parts per billion (ppb) was reported for sample BH23 (7' to 8'). In total, 108 of the 347 soil samples were reported as having a TVO concentration equal to or greater than 500 ppb.

2.2.2.3 Volatile Organic Compound Speciation

A qualitative identification of organic volatile species was completed on three samples collected during the initial sampling program. The analytical data indicated that positively identified compounds present were methyl chloride, tetrachloroethylene, and trichloroethylene. During the supplemental sampling and analysis program, 59 samples were selected for quantitative priority pollutant volatile organic speciation. Of the 59 samples selected, 40 samples were from soils that were excavated and disposed by secure landfilling, while 19 samples were from soils that remained

at the site. The samples selected for quantitative speciation are detailed in Table 7 in Appendix B. Speciation data for the 59 samples are contained in Table 8 in Appendix B, (Group 1 - Soils Excavated and Disposed by Secure Landfill) and in Table 9 in Appendix B (Group 2 - Soils Retained On-Site).

For both sets of samples, tetrachloroethylene and trichloroethylene were identified as the two most prevalent volatile compounds present, and contributed the majority of the mass of volatile organic compounds in on-site soils. Other compounds identified as present in both sample groups above a concentration of 10 ppb were: bromodichloromethane: dibromochloromethane; bromoform; trichlorofluoromethane; 1,1-dichloroethene; chloroform; 1,2-dichloroethene; 1,1,1-trichloroethane; toluene; and ethyl benzene. Benzene was identified as present in Group 1 samples from soils disposed by secure landfilling but was not present in soils retained at the site.

2.2.2.4 Base Neutral/Acid Phenolics

Priority pollutant base/neutral and acid/phenolic analytical data are presented in Table 10 in Appendix C.

Of the base neutral fraction, only di-n-butyl phthalate and bis(2-ethyl hexyl) phthalate were identified and confirmed. The highest concentration for di-n-butyl and bis(2-ethylexyl) phthalate was 20 and 3.1 parts per million (ppm), respectively. Of the 65 samples analyzed, 16 were reported as containing total phthalate concentrations in excess of 5.0 ppm.

No compounds in the priority pollutant acid/phenolic fraction were identified as present.

2.2.2.5 Split Sample Analysis

As an additional quality control measure, selected soil samples were split in the field at the time of sampling. Each sample so split was analyzed concurrently by

the project laboratory (Velsicol) and an IBM selected laboratory, Environmental Testing and Certification (ETC) of Edison, New Jersey.

Data reported by both laboratories for TVO analysis of split samples are contained in Table 11 in Appendix D. A comparison of total volatile organic data indicates generally good agreement between the two laboratories.

Data reported by both laboratories for priority pollutant base/neutral and acid/phenolic analysis for split samples are contained in Table 12 and 13 in Appendix D. A comparison of base/neutral analytical data indicates reasonably close agreement between the two laboratories. Apparent differences are consistent with the non-homogenous nature of the samples and the expected physical state of phthalates that may be in them.

Neither laboratory detected compounds of the acid/phenolic fraction.

3.0 REMEDIAL DESIGN

3.1 GENERAL

The areal and vertical extent of soils requiring excavation and disposal was defined on the basis of data derived from the analysis of collected soil samples and in accordance with agreements reached between the New York State Department of Environmental Conservation (NYSDEC) and IBM, and with direction provided by IBM staff.

Criteria for the excavation and disposal of soils were as follows:

i) All soil intervals containing a concentration equal to or greater than 500 ppb of priority pollutant total volatile organics would be excavated and disposed by off-site secure landfilling. This criterion was approved by the NYSDEC on June 29, 1983 (letter from W.G. Sullivan, NYSDEC, to R.M. Spaan, IBM).

ii) At IBM's direction, soil intervals BH14 (6'-8'), BH15 (2'-4'), BH15 (4'-6'), BH20 (4'-6'), and BH41 (2'-4') with TVO concentrations of 440, 460, 470, 470 and 490 ppb respectively, were also to be

removed although their concentrations were less than the 500 ppb removal criterion.

iii) All soil intervals analyzed for base/neutral compounds having a reported concentration of total phthalates in excess of 5 ppm were to be excavated and disposed by secure off-site landfilling.

This criterion was selected on the basis of the following considerations. Sampling of site soils indicated only di-n-butyl and bis(2-ethyl hexyl) phthalate present. Monitoring of groundwater by IBM prior to site remediation did not reveal the presence of phthalates. This is consistent with the fact that most phthalates are relatively insoluble in water and are generally relatively immobile in a soil matrix. EPA 1980 Ambient Water Quality Criteria for the protection of human health from the toxic properties of a pollutant injested through water and contaminated aquatic organisms stipulates maximum allowable concentrations for toxicity protection for di-n-butyl and bis(2-ethyl hexyl) phthalate of 34 ppm and 15 ppm, respectively. Considering that partition coefficients for phthalates in a groundwater/soil environment are roughly on the order of 1000, the

allowable limits in water for toxicity protection would equate to allowable limits in soil of approximately 3 orders of magnitude larger. In lieu of further studies on this matter, IBM has conservatively selected 5 ppm as a removal criteria.

3.2 EXCAVATION AND BACKFILL

On the basis of the removal criteria discussed in Section 3.1, areas of soil within the site requiring excavation and off-site disposal by secure landfilling were delineated.

Figure 4 in Appendix E details the areal extent of all boreholes having one or more sampling interval containing a concentration of total volatile organics equal to or greater than 500 ppb.

Figures 5 to 12 inclusive, in Appendix E, detail the areal extent of soils having total volatile organic concentrations equal to or greater than 500 ppb for each 2-foot depth interval from ground level to 14 feet, and for the 14 to 15-foot depth increment.

Figure 13 in Appendix E details the location of 19 cross-sections oriented at right angles on the east side to Building 906, labelled as stations with the prefix "B". Figures 14 to 39 inclusive, in Appendix E, detail the design limits of soil requiring excavation and secure off-site landfill disposal.

Excavated soils that did not require off-site disposal were to be temporarily stockpiled on-site and used as backfill to the excavation. The short fall in backfill material was to be made up by imported clean fill. To the extent possible, backfilling with clean imported or reusable excavated on-site soil was to follow immediately behind the excavation. This methodology would minimize the quantity of liquids requiring collection in the event of rainfall. In addition, all areas adjacent to open excavated areas were to be bermed or sloped away from

the excavation area. Backfill was specified to be be compacted to a minimum density of 90% standard proctor.

3.3 EXCAVATION AND DISPOSAL QUANTITIES

On the basis of the design cross-sections discussed in Section 3.2 it was estimated that approximately 3160 cubic yards or 3920 tons, using a field measured conversion factor of 1.24 tons per cubic yard, of soil required excavation and secure landfill disposal. Additionally, it was estimated that approximately 1190 cubic yards or 1480 tons of clean soil would be excavated and stockpiled on-site for subsequent use as backfill.

3.4 SURFICIAL DRAINAGE

The design required the construction of earthen berms at either end of the area to be excavated if required to prevent storm waters from draining into excavated areas. Also, if required, a lateral interceptor ditch would be constructed to collect and drain stormwater runoff from the railroad embankment. A field survey for ground elevations to

confirm localized drainage patterns would be made prior to commencement of construction. All storm sewers and catchbasins located within areas to be excavated would be removed and replaced with new materials following backfill of the excavation. Storm water runoff from the roof of Building 906 via the roof drains would be diverted from its existing discharge points to outside of the area of excavation.

3.5 EQUIPMENT DECONTAMINATION

A temporary equipment decontamination facility was to be constructed on-site. All equipment would be decontaminated prior to removal from site or prior to handling clean materials. All wash waters would be collected and disposed of as hazardous waste.

3.6 TEMPORARY SERVICES

Water services located within the excavation area would be replaced by temporary services. If necessary, the existing fire hydrant would be removed and reinstated beyond the limits of the excavation area.

Sanitary services from the building were to be intercepted at the building line and drained to a temporary holding tank supplied by the contractor. Sanitary wastes would be periodically removed from the holding tank by a vacuum tanker truck and disposed of as directed by IBM.

The two existing septic tanks and wet wells located within areas to be excavated would be pumped empty and removed. Both the structures and contents were to be disposed as hazardous waste. The septic tanks and wet wells would be replaced with new structures following backfilling operations. All weeping tile systems would be reconnected.

3.7 SECURITY FENCING

Temporary fencing would be erected around the site of work to segregate work and non-work areas, and to prevent entry of unauthorized personnel into the site. Fencing would be removed at the conclusion of the project.

3.8 BUILDING 906 - NORTH WALL

Prior to commencing site operations, the contractor was required to secure and bar all doors from Building 906 that exited into the zone of work. The contractor was also required, at the direction of IBM, to cover 7 windows adjacent to the excavation area with plywood and insulated blankets.

3.9 BUILDING 906 - FOUNDATION SUPPORT

On the basis of the design cross-sections, it was estimated that foundation support for Building 906 would be required for 246 lineal feet as detailed on Figure 40 in Appendix E.

The foundation support system was designed to provide underpinning of Building 906 to bedrock using concrete piers and horizontal I beams with inter pier lagging installed as excavation proceeded. This system was selected on the basis of least cost due to the relatively shallow depth to bedrock. An important added benefit of this method was the reduction in vibration and noise as compared to conventional pile driving techniques.

3.10 TRANSPORTATION AND OFF-SITE SECURE DISPOSAL OF SOILS

3.10.1 Transportation

Soils requiring off-site disposal were to be transported in licensed hazardous waste tractor trailer units each having a capacity of 21 tons. Each unit would be fitted with a modified water tight tail gate and would be securely tarped prior to leaving the site. Liquids were to be transported in licensed tanker trucks having a capacity of 5,000 gallons.

Transport routes would be submitted to IBM for approval prior to commencement of haulage operations.

3.10.2 Disposal

Soils designated for removal were to be disposed by landfilling at the SCA Model City, N.Y. secure permitted facility. Collected liquids were also to be disposed at the Model City permitted facility.

For purposes of transport and disposal manifesting, IBM would be the generator of wastes at the Poughkeepsie Site.

3.11 RESTORATION

Following completion of excavation and backfilling operations, the site would be restored to to pre-existing conditions or as directed by IBM.

3.12 PROJECT CLOSE OUT

Project close out was to consist of the following activities:

a) Decontamination of all contractor equipment and materials within the work zone, and removal from site of same.

b) Decontamination and removal from site of temporary structures installed by the contractor.

c) Disconnection and/or securement of temporary utilities to the site.

d) Collection and processing of wash water residuals within the equipment decontamination facility.

e) Removal and disposal of the temporary equipment decontamination facility.

f) Exit medical examinations.

g) Close out of the Project Documentation files and handover to IBM.

3.13 HEALTH AND SAFETY PLAN

A Health and Safety Plan was required to provide for the protection of on- site personnel and the general public. A copy of the designed Health and Safety Plan is contained in Appendix F.

4.0 REMEDIAL CONSTRUCTION

4.1 MOBILIZATION

SCA/SCC commenced mobilization for the remedial action project at Building 906 during the period September 5 to September 19, 1983. The following work items were completed.

a) Construction equipment transported to site.

b) The equipment storage trailer which housed all consumable equipment, potable water, emergency eyewash, portable shower, hand wash basin, fire extinguishers, overpack drums, and other miscellaneous equipment was transported to site. This facility is illustrated as Photograph 9.

c) The security fence was installed around the perimeter of the work area. This area is discussed further in Section 3.4. Portions of the fenced area are illustrated as Photographs 10, 11 and 12.

d) The seven windows in the north wall of Building 906 adjacent to the active work areas were covered with plywood sheeting and the plywood in turn covered with insulated blankets. This is illustrated in Photograph 13.

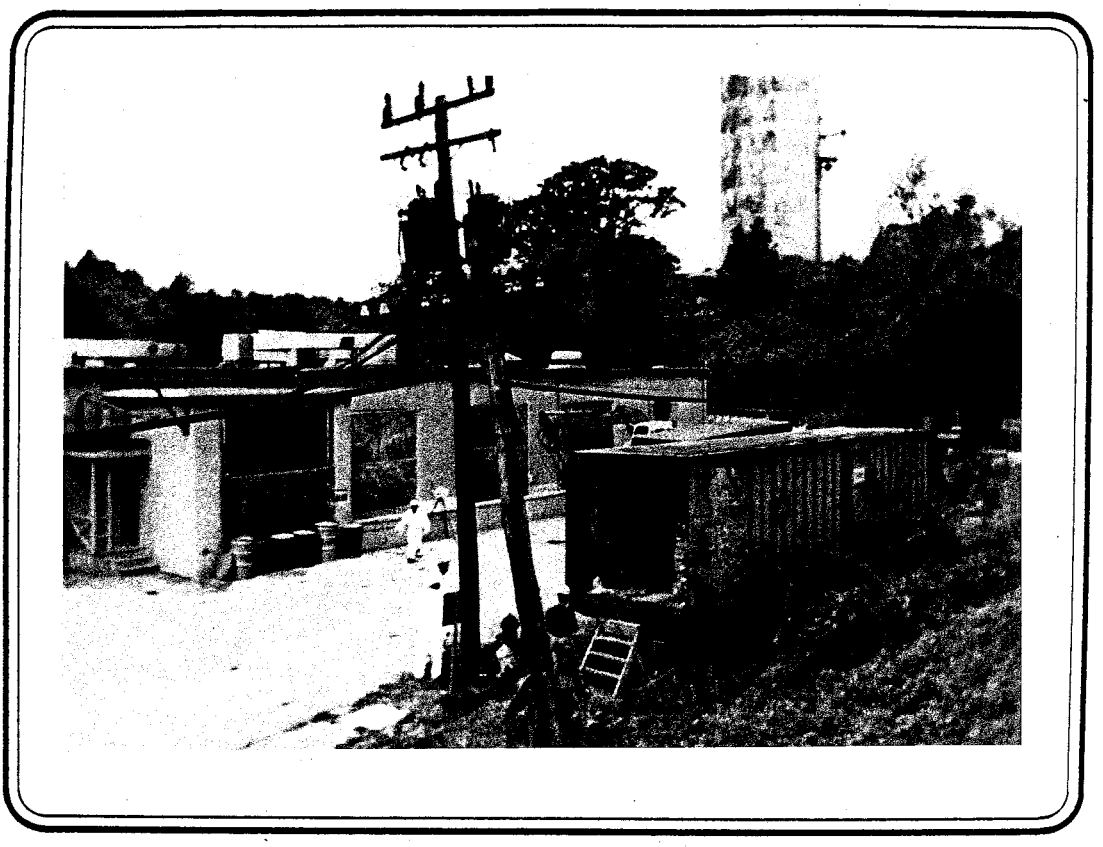

PHOTO 9
ON-SITE EQUIPMENT STORAGE TRAILER

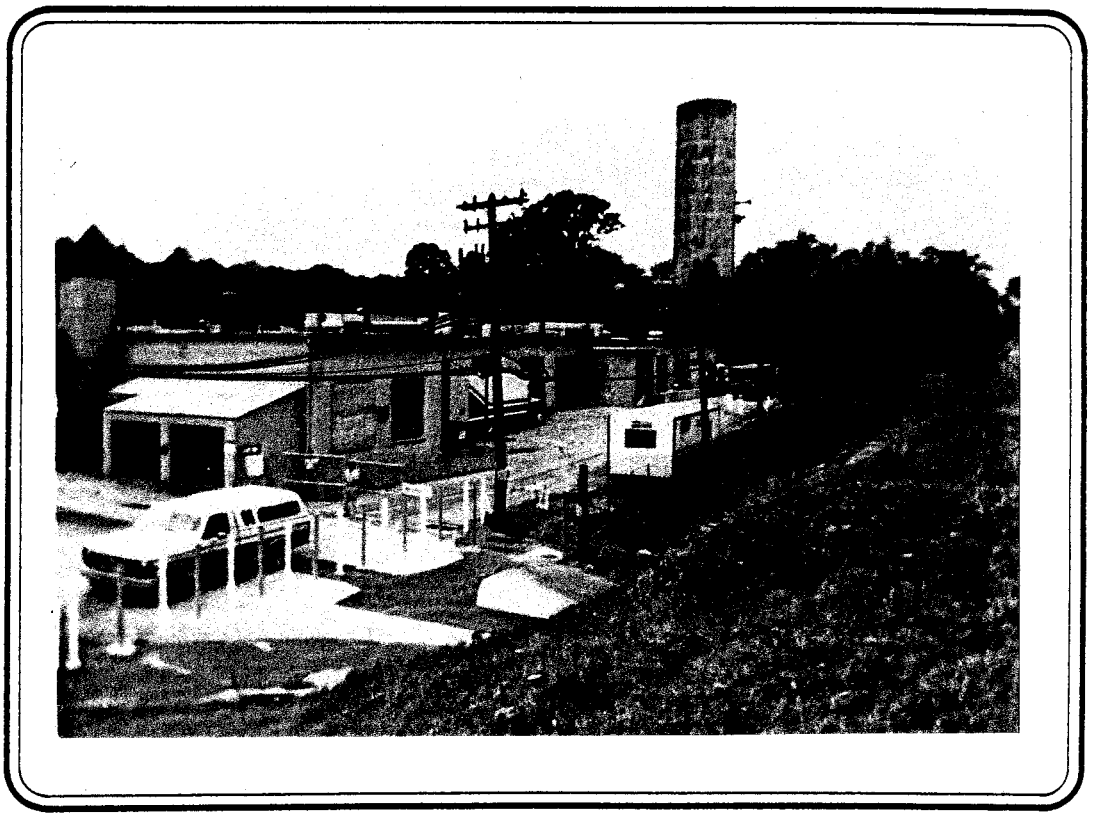

PHOTO 10
FRONT OF SITE SHOWING ACCESS GATE AND PARTIAL FENCING.
THE SITE OFFICE AND COMMAND POST IS LOCATED IN THE
WHITE TRAILER IN THE FOREGROUND

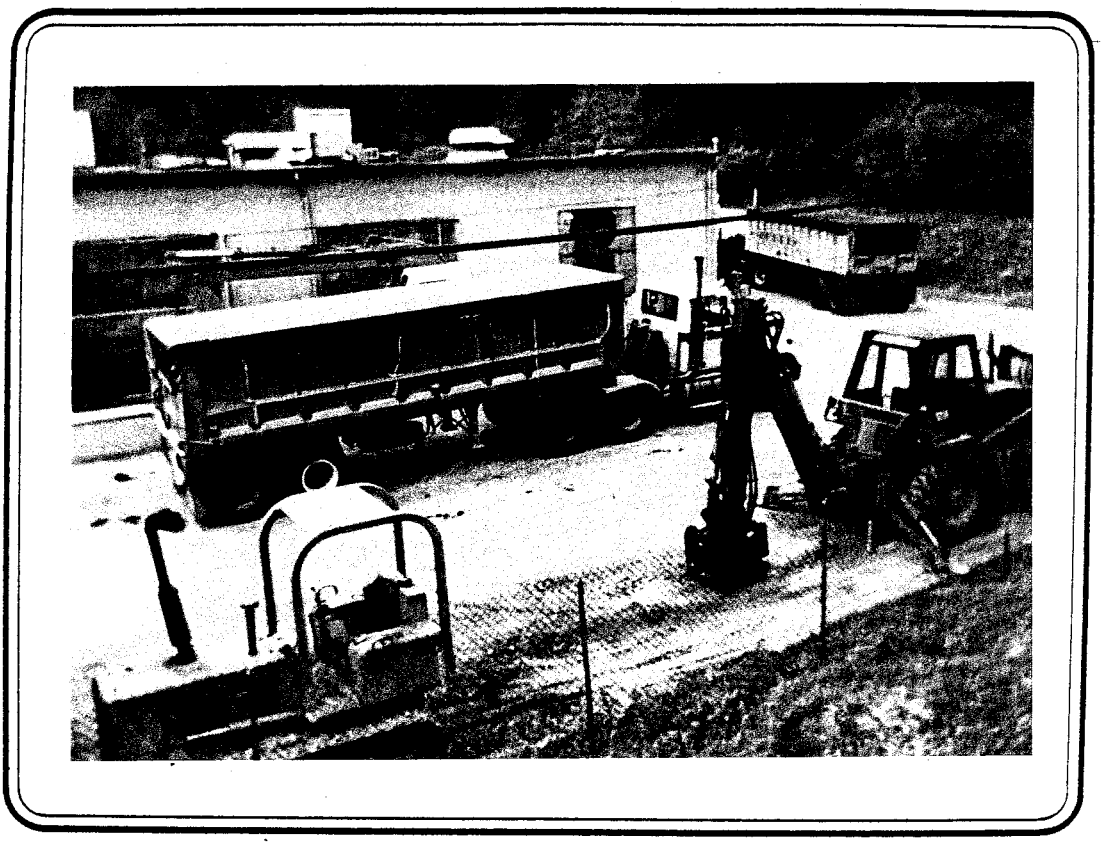

PHOTO 11
MIDDLE OF SITE SHOWING FENCING

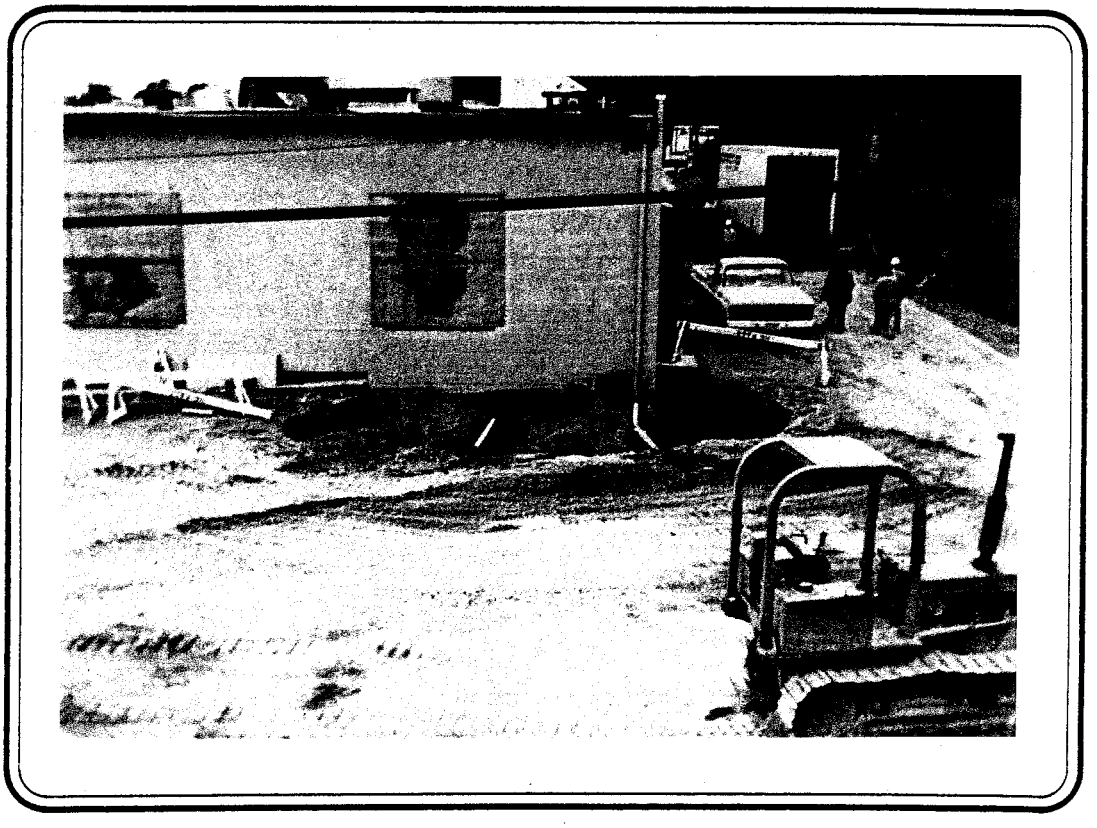

PHOTO 12
NORTHERLY PART OF SITE SHOWING FENCING AND EGRESS GATE (WHERE WHITE BOX VAN IS EXITING)

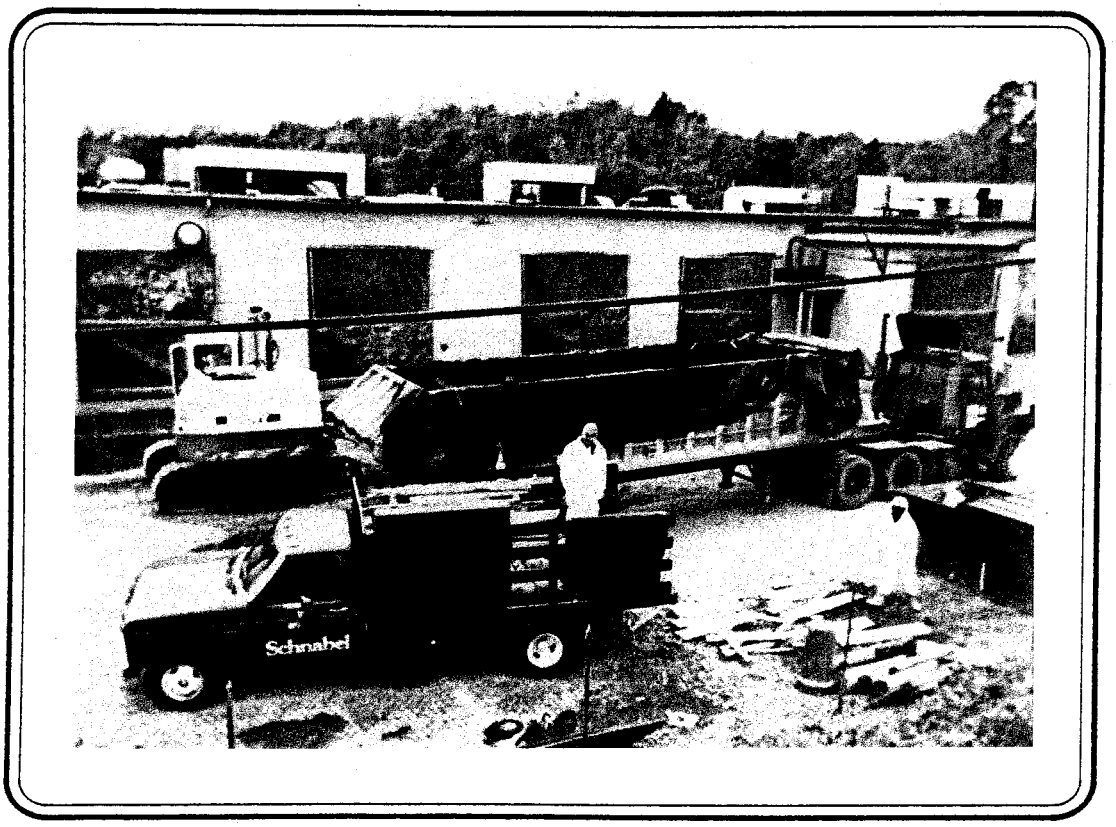

PHOTO 13
WINDOWS ADJACENT TO THE ACTIVE WORK AREAS COVERED WITH PLYWOOD SHEETING AND BLUE INSULATING BLANKETS

e) The placement of the site office and command post including telephone and electrical hookup. This facility is illustrated by Photograph 10.

f) All doors from Building 906 adjacent to the active work areas were closed to pedestrian traffic and posted.

g) Washroom facilities were provided by IBM and were located immediately inside the north entrance to Building 906.

h) Parking facilities were arranged with the IBM on-site representative. The location of the parking area is shown on Figure 4.

i) Off-site clean fill, bank run gravel and #4 stone was stockpiled in the parking area for replacement of material excavated in the remedial action zone. The location of this stockpile is shown on Figure 4 and Photograph 14.

j) Contact was made with local emergency repsonse authorities and IBM and emergency response telephone numbers were permanently displayed adjacent to the on-site telephone.

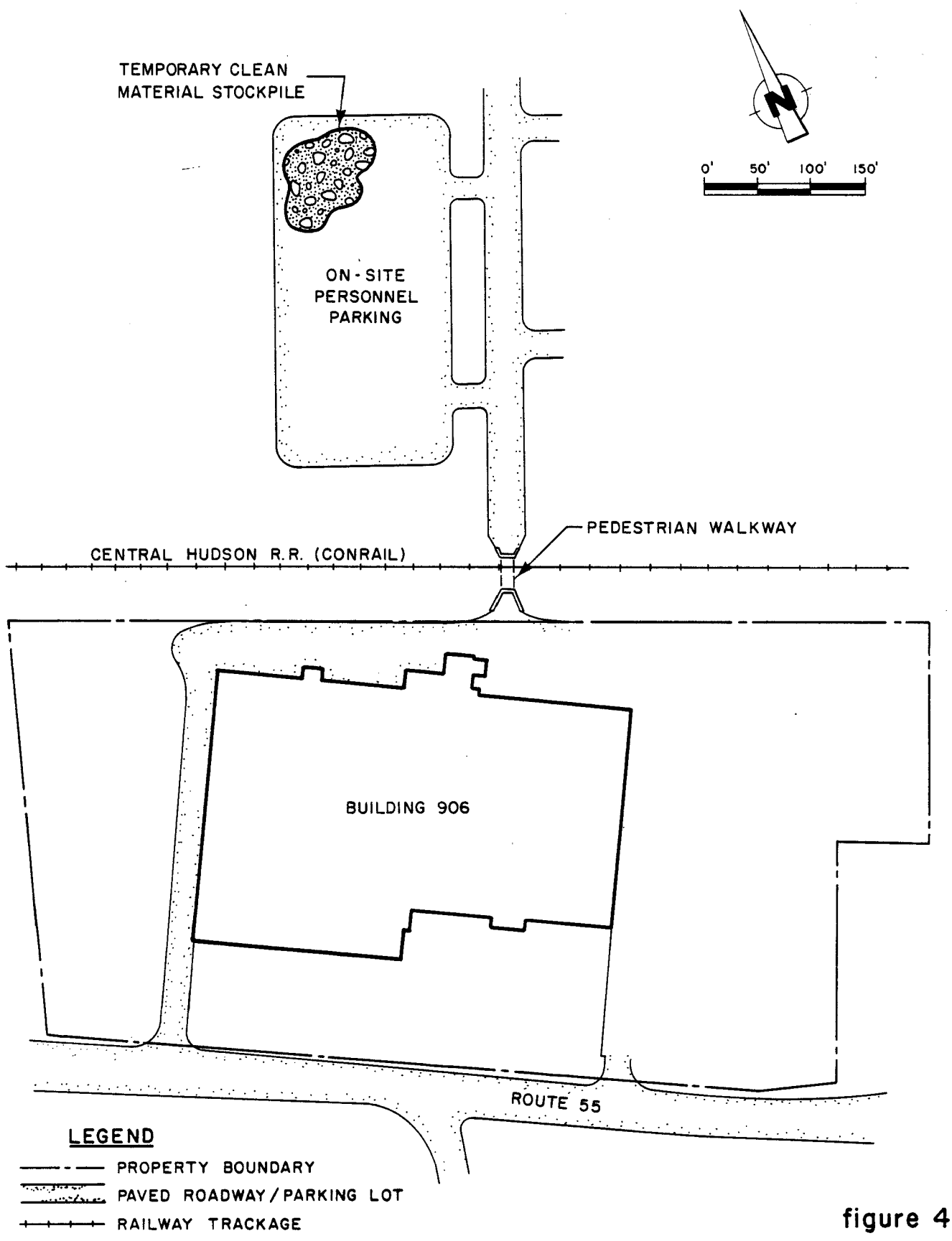

figure 4

PARKING AND
MATERIAL STOCKPILE AREA
IBM Corporation

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PHOTO 14
STOCKPILE OF OFF-SITE CLEAN MATERIAL FOR BACKFILLING
OF THE REMEDIAL ACTION AREA

k) Arrangements were made for all dedicated on-site personnel to take entrance and exit physicals at the beginning and completion of the project. These medicals were performed at the Medicus Clinic on Route 9 in Wappingers Falls, N.Y. and are on file in SCC's main office in Niagara Falls, N.Y.

l) Project signs and notices were posted in accordance with the IBM on-site representatives' instructions.

m) The site office or command post was equipped to act as the Emergency Medical Facility.

4.2 SOIL EXCAVATION AND BACKFILL

4.2.1 General

Excavation of site soils commenced on September 21, 1983 and was completed on October 21, 1983.

A total of 2,575 cubic yards of soil were excavated and disposed by secure landfilling at SCA's Model City, N.Y. permitted facility.

A total of 1,172 cubic yards of soil were excavated and reused as backfill following the completion of excavation. A total of 2,410 cubic yards of imported bank run granular and 190 cubic yards of #4 stone were also used to complete the requirements for backfill quantities.

4.2.2 Site Conditions

Obstructions, including outside pad mounted air conditioners, high voltage overhead power lines, and a large network of underground utilities such as wet wells, tile beds, storm sewers, watermains and conduits, congested the site and caused numerous problems related to site Health and Safety. Revisions to the proposed plan of work made for safety considerations are discussed in Section 4.2.3.

Figure 5 and photographs 15, 16, 17, 18, and 19 illustrate the extent of existing obstructions.

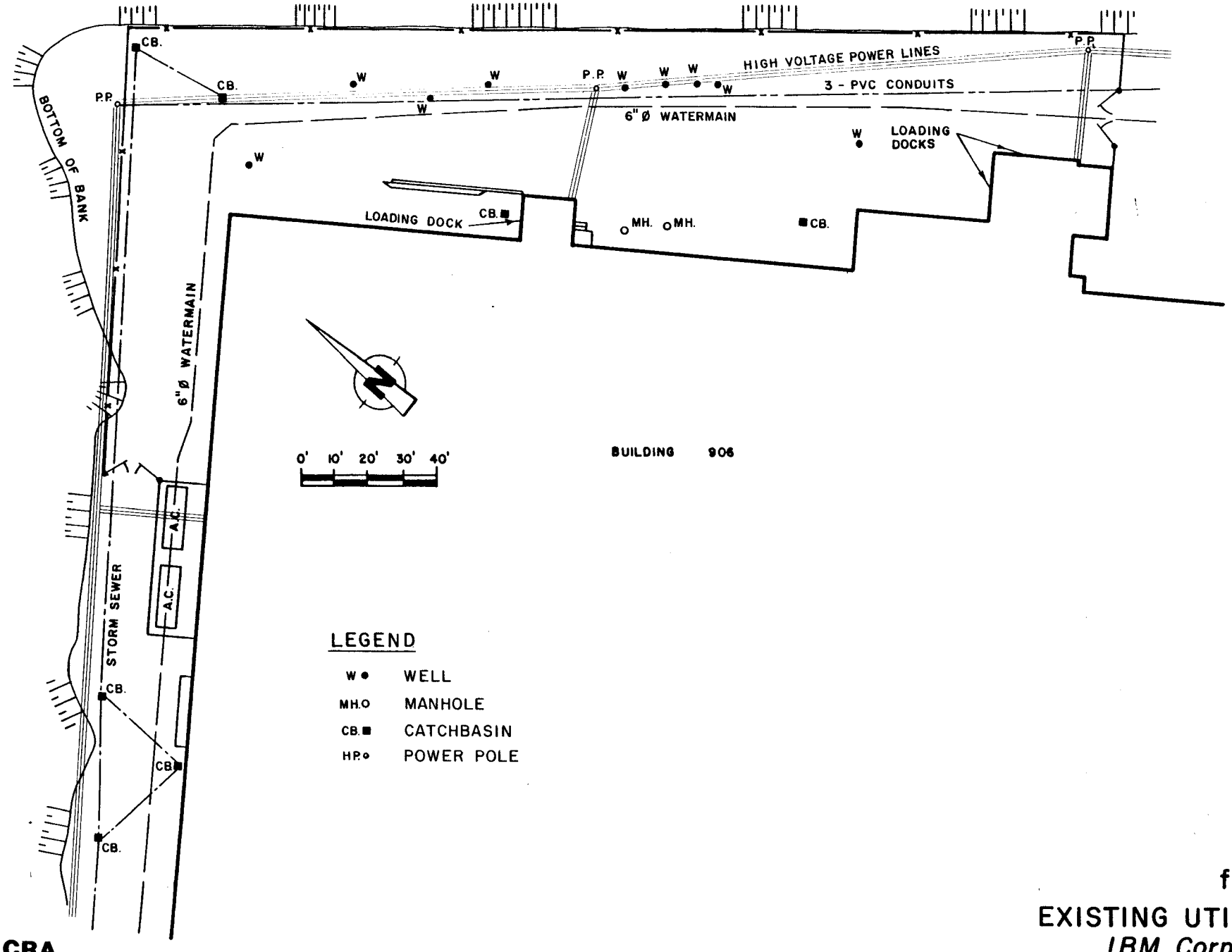

figure 5

EXISTING UTILITIES

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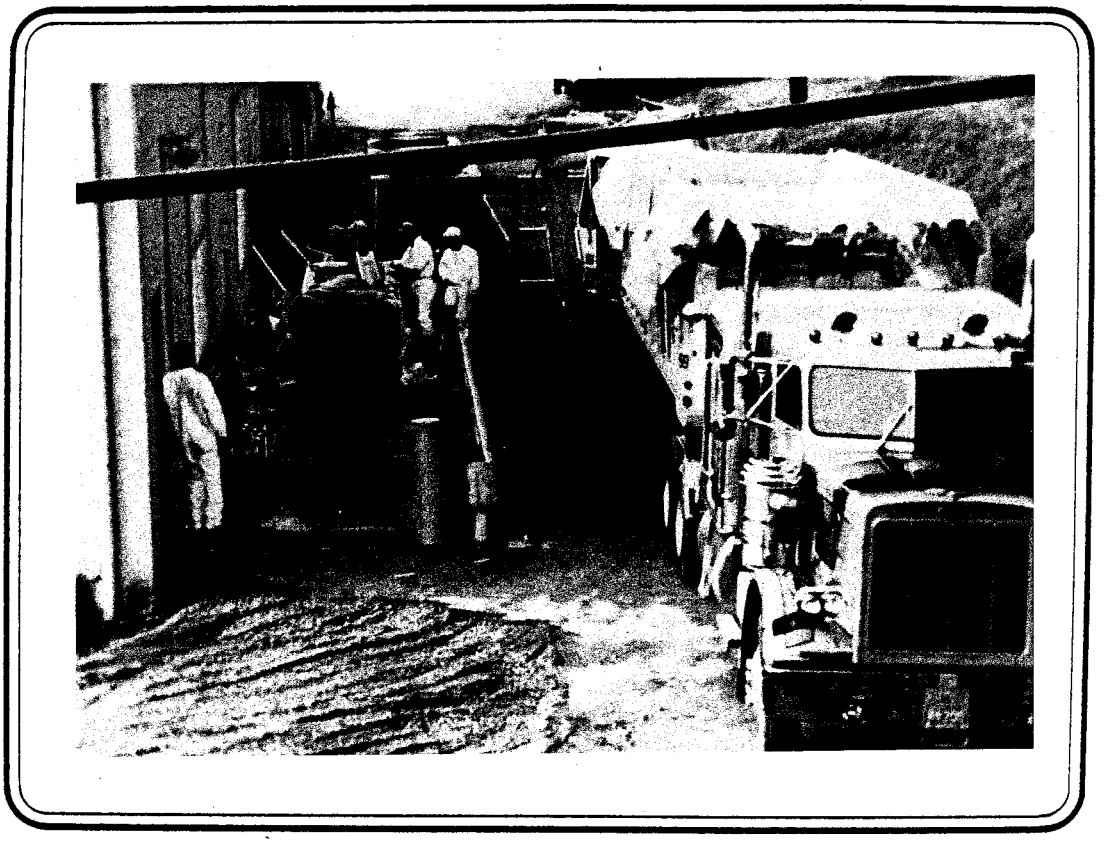

PHOTO 15
LIMITED SITE AREA. PLEASE NOTE THE BUILDING AT LEFT, THE AIR HANDLERS AT LEFT, AND THE FENCE ON THE RIGHT.

PHOTO 16
HIGH VOLTAGE TRANSFORMERS, POWER LINES AND OVERHEAD UTILITIES IN THE AREA OF EXCAVATION. THESE UTILITIES WERE ALSO VERY LOW.

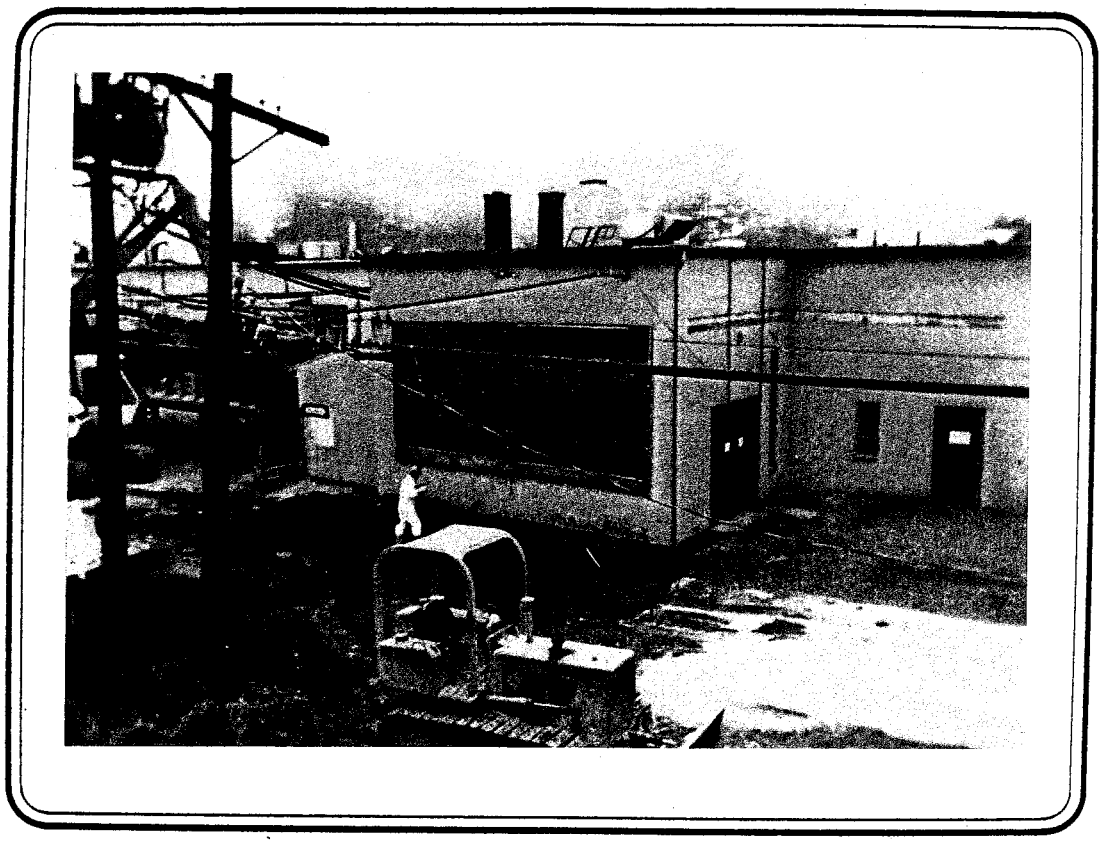

PHOTO 17
HIGH VOLTAGE TRANFORMERS, POWER LINES AND OVERHEAD UTILITIES IN THE AREA OF EXCAVATION. THESE UTILITIES WERE ALSO VERY LOW.

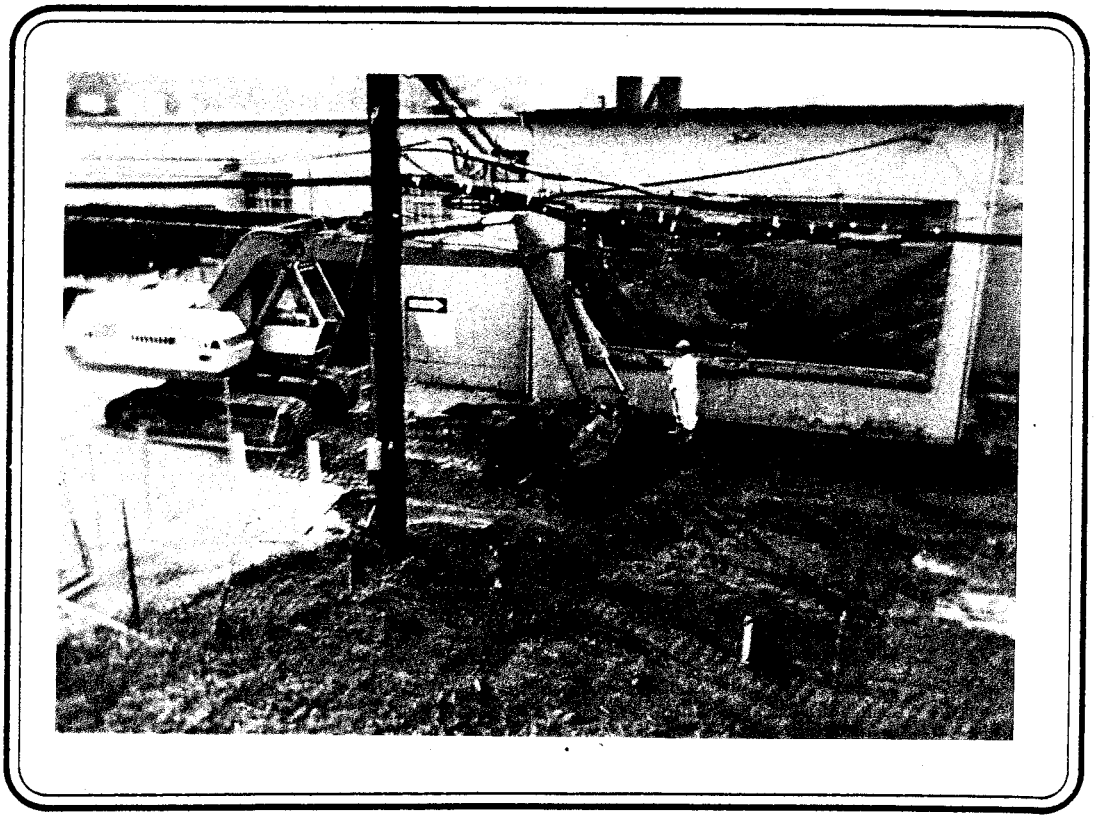

PHOTO 18
HIGH VOLTAGE TRANSFORMERS, POWER LINES AND OVERHEAD UTILITIES IN THE AREA OF EXCAVATION. THESE UTILITIES WERE ALSO VERY LOW.

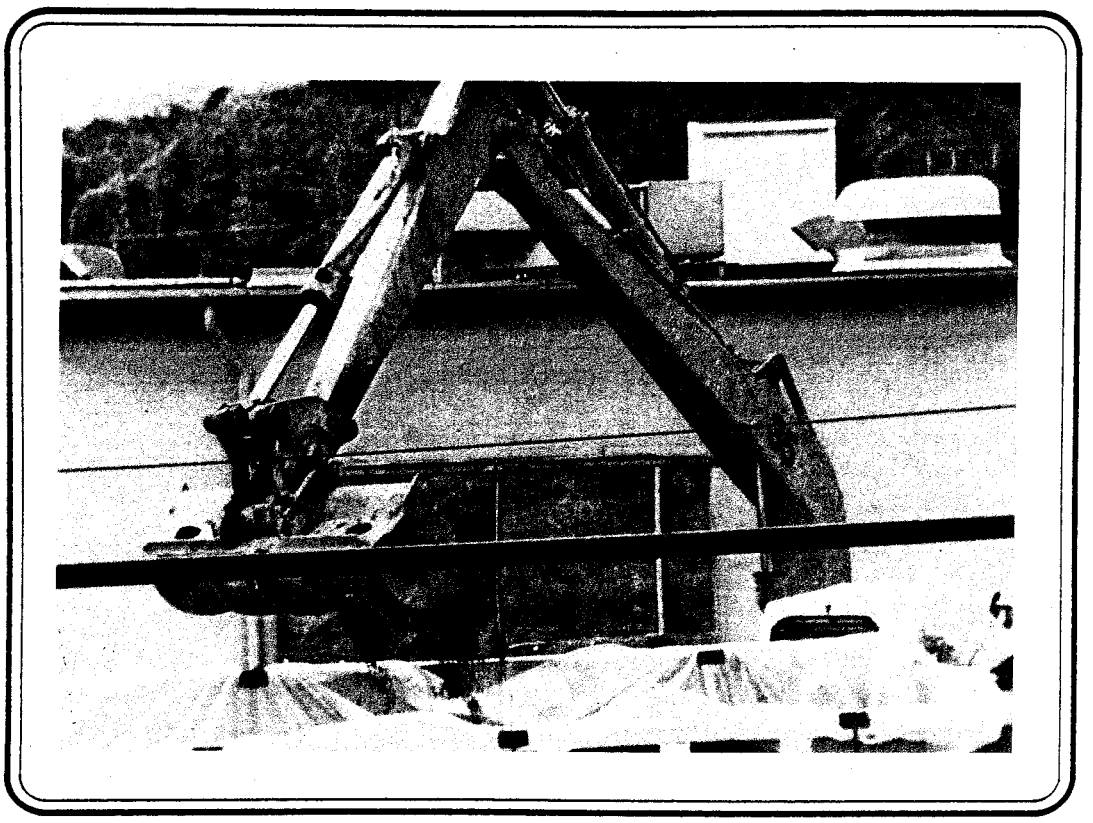

PHOTO 19
HIGH VOLTAGE TRANSFORMERS, POWER LINES AND OVERHEAD UTILITIES IN THE AREA OF EXCAVATION. THESE UTILITIES WERE ALSO VERY LOW.

4.2.3 Earth Excavation Quantities

Figure 6 details the location of 22 cross-sections oriented at right angles on the easterly side of Building 906, labelled as stations with the prefix "A", and 23 cross-sections oriented at right angles on the northerly side of Building 906, labelled as stations with the prefix "B".

Figures 7 to 51 inclusive detail the limit of soil excavated and disposed by secure landfill. The figures also reflect changes to the original design plan of excavation which were made on the basis of health and safety considerations and potential impact on third party consumers.

Revisions to the design plan of excavation were made in the following instances.

(i) A high voltage power line approximately parallelled the buiding on both the north and west sides. Services entered the building at two locations on the north and one location on the west. The IBM site

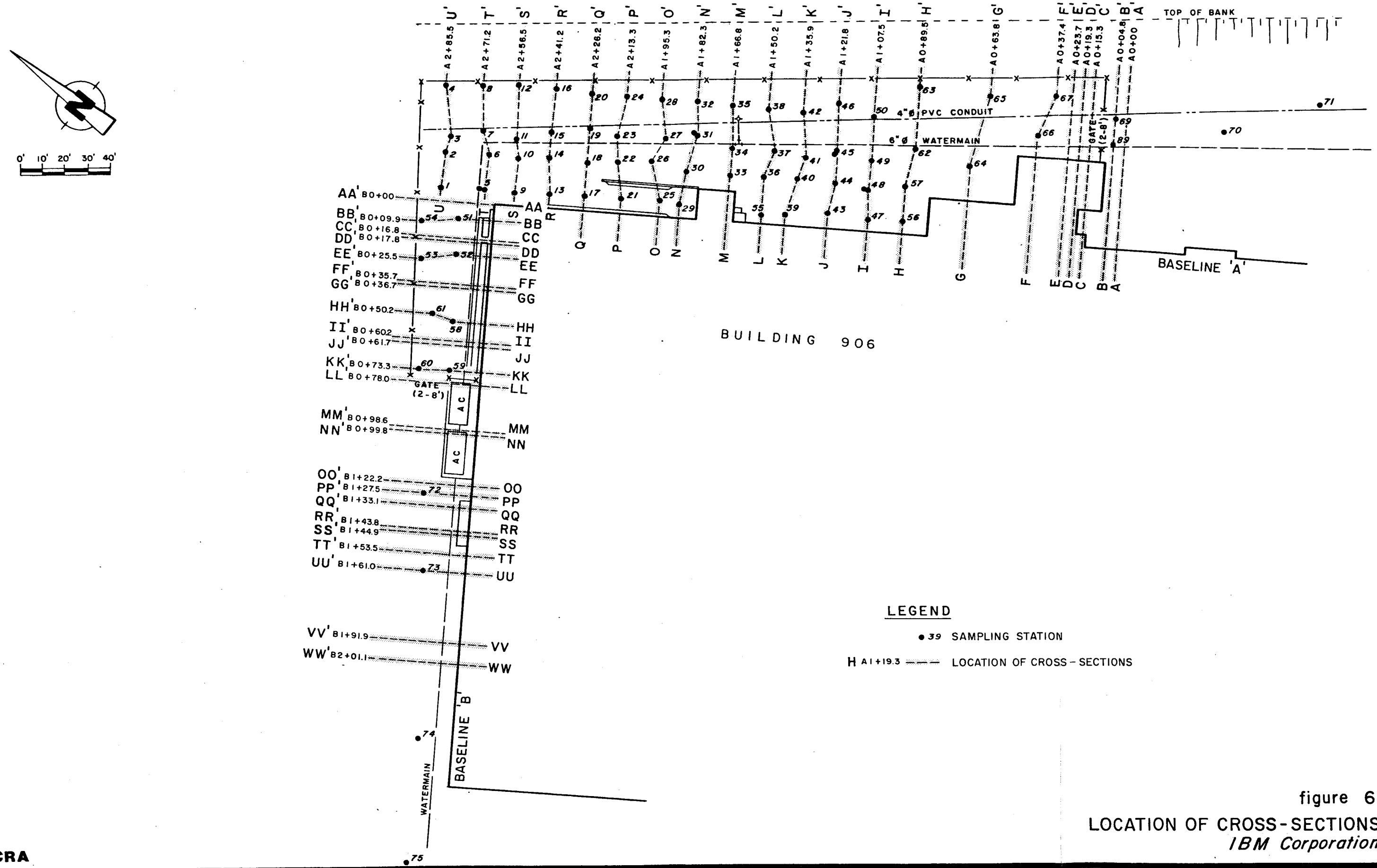

figure 6

LOCATION OF CROSS-SECTIONS

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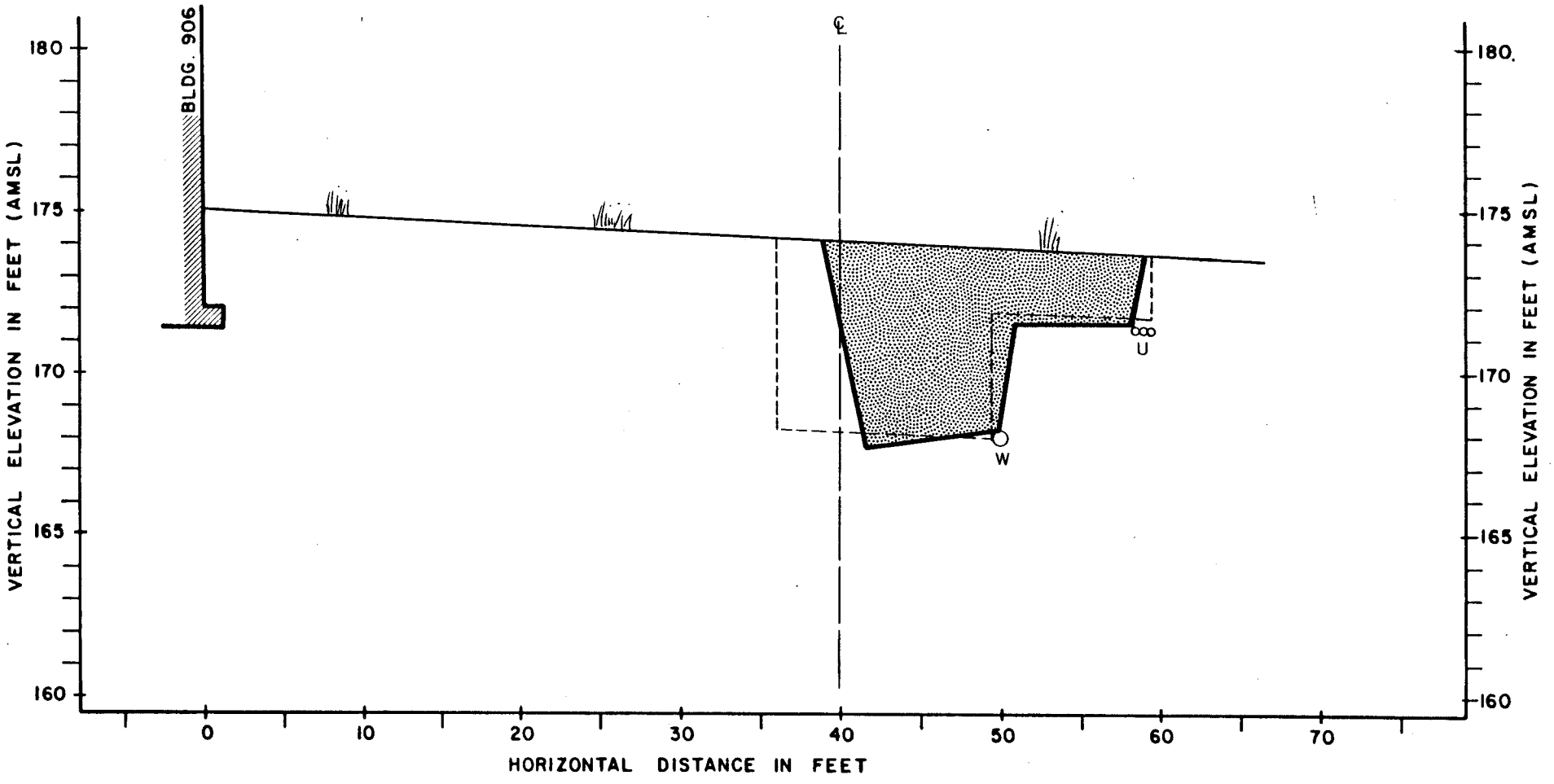

LEGEND

- EXTENT OF SOILS EXCAVATED AND DISPOSED BY SECURE LANDFILL
- N.A. — EXTENT OF CLEAN SOIL EXCAVATED AND REPLACED
- ----- LIMIT OF SOILS WITH CHEMICAL PRESENCE ORIGINALLY PROPOSED FOR EXCAVATION
- U — EXISTING UTILITIES
- W — EXISTING WATERMAIN
- S — EXISTING STORM SEWER
- ORIGINAL GROUND
- LIMIT OF SOILS EXCAVATED

figure 7

STATION A 0+00
AS CONSTRUCTED
CROSS-SECTION A - A'
IBM Corporation

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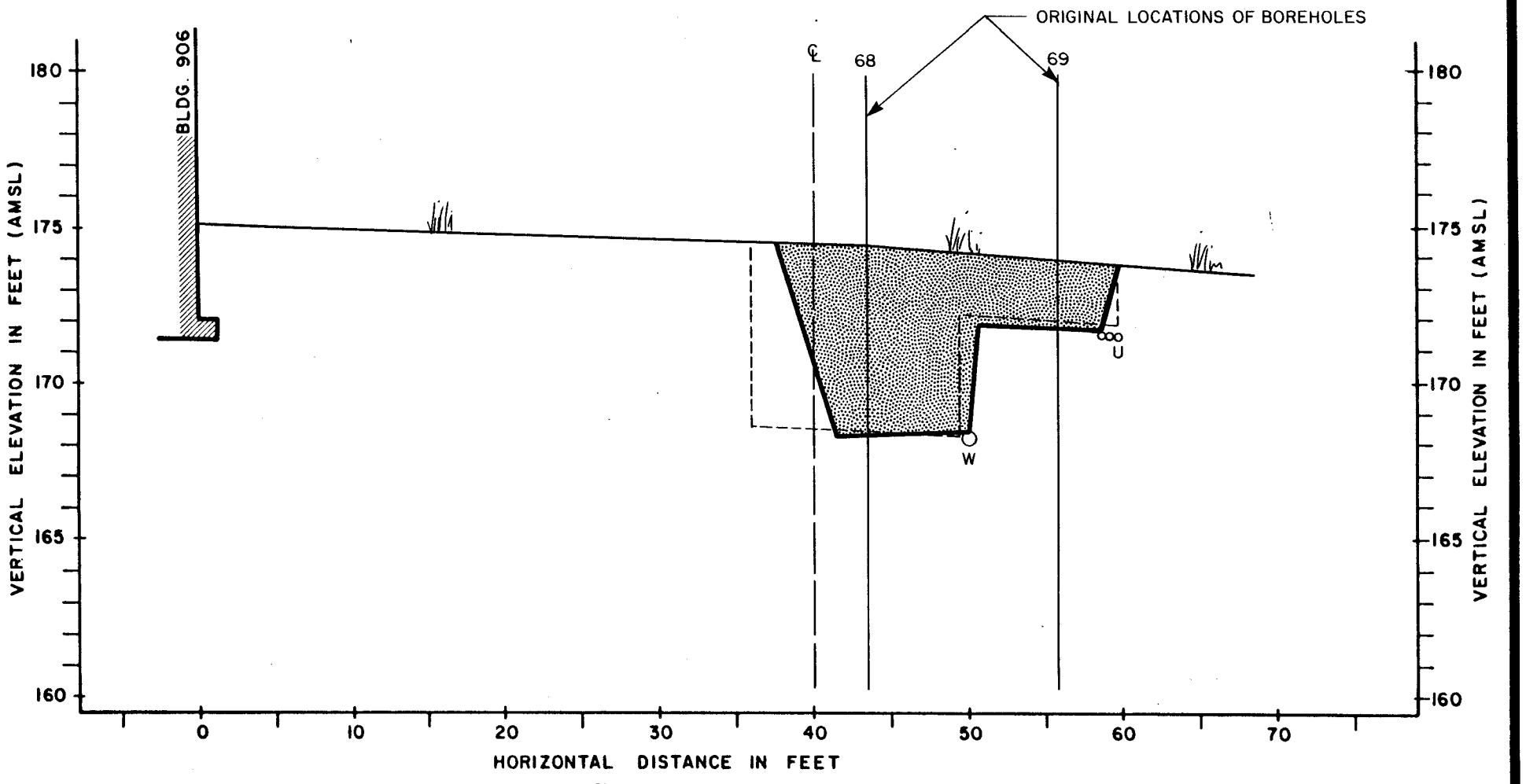


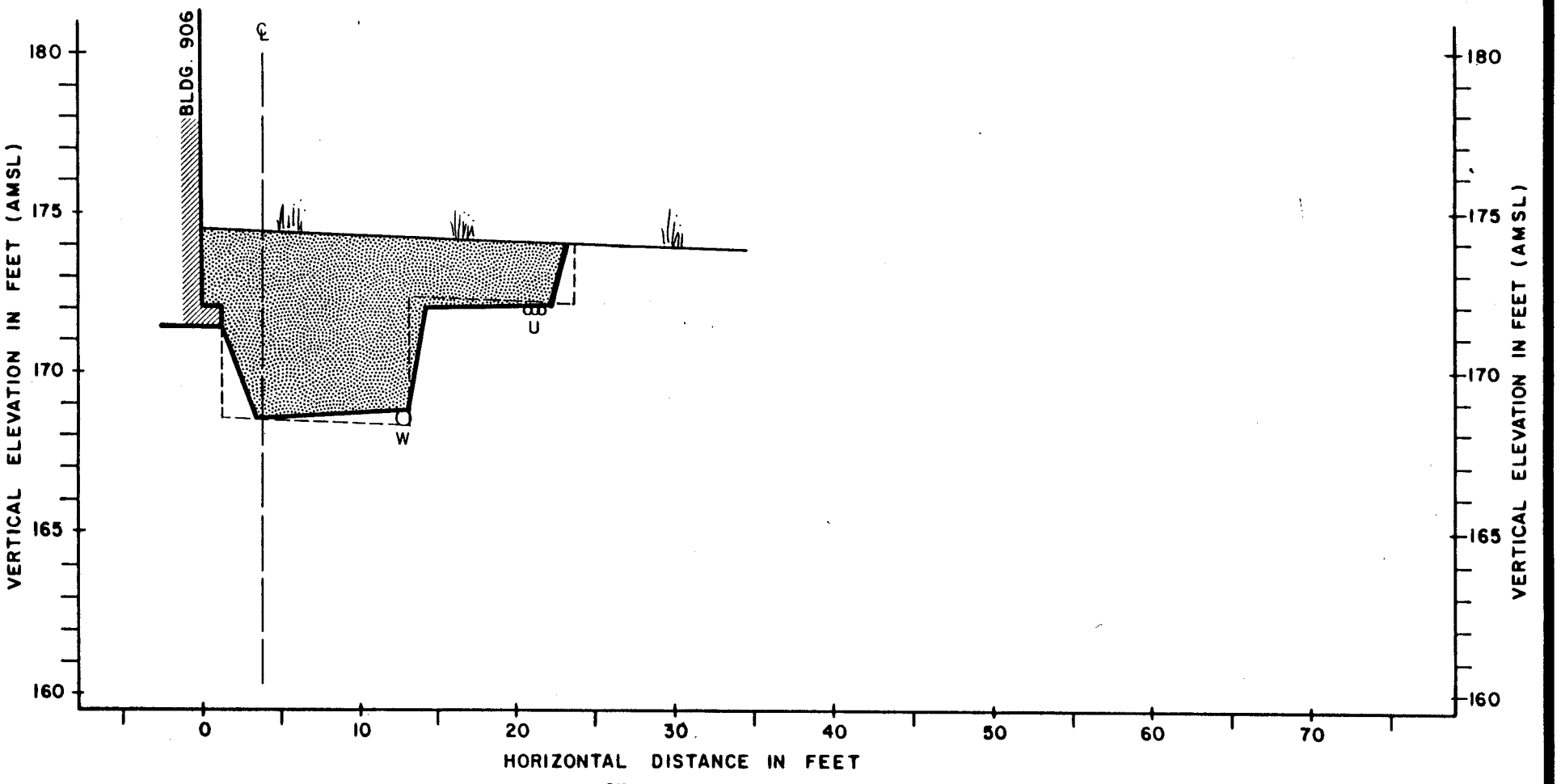
figure 8

STATION A0+04.8
AS CONSTRUCTED
CROSS-SECTION B-B'

CRA

IBM Corporation

1315-13/1/84



LEGEND

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- N.A. EXTENT OF CLEAN SOIL EXCAVATED AND REPLACED
- ----- LIMIT OF SOILS WITH CHEMICAL PRESENCE ORIGINALLY PROPOSED FOR EXCAVATION
- U EXISTING UTILITIES
- W EXISTING WATERMAIN
- S EXISTING STORM SEWER
- ORIGINAL GROUND
- LIMIT OF SOILS EXCAVATED

figure 9

STATION A0+15.3
AS CONSTRUCTED
CROSS-SECTION C-C'

CRA

IBM Corporation

1315-13/1/84

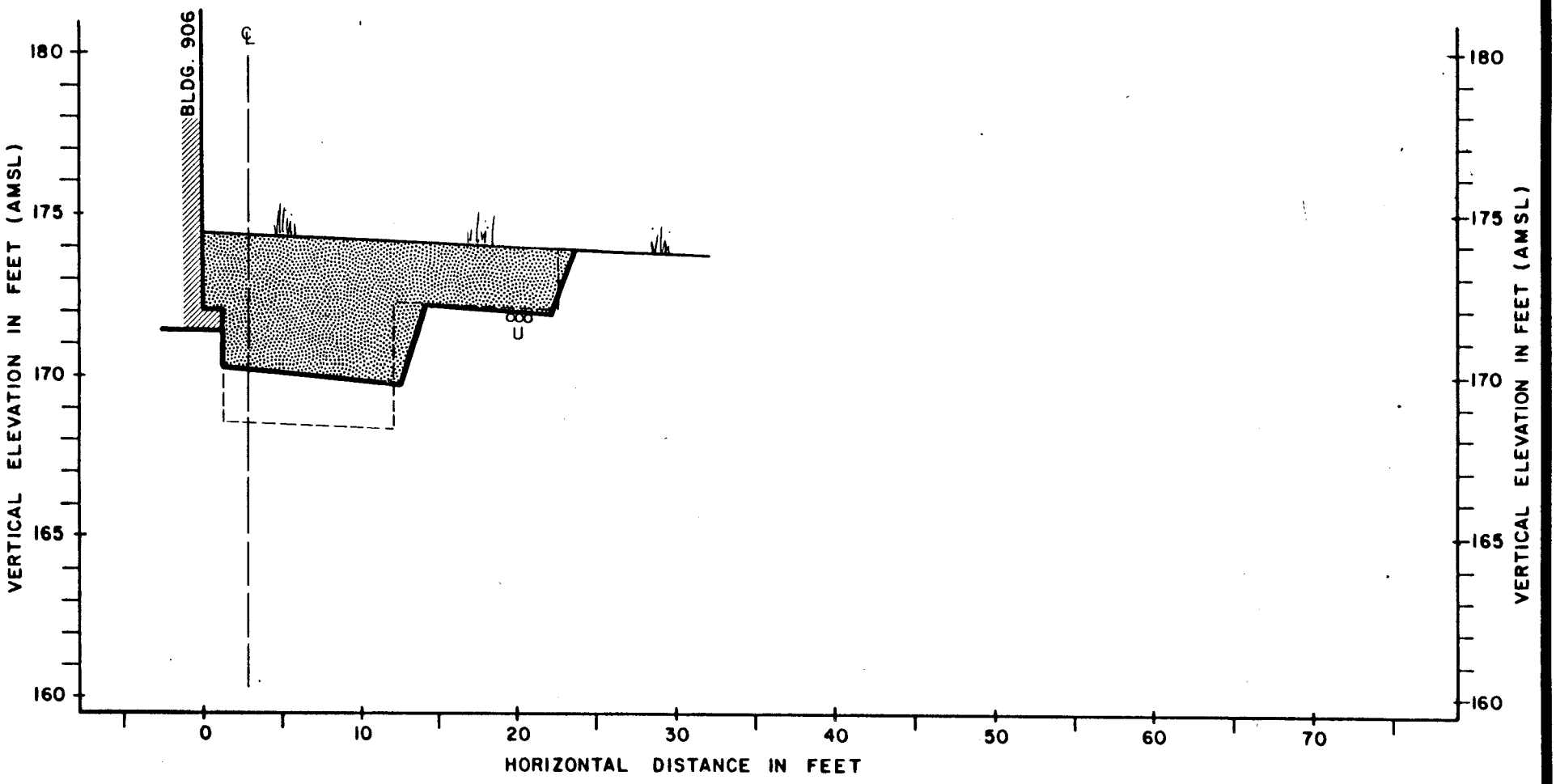

figure 10

STATION A0+19.3
AS CONSTRUCTED
CROSS-SECTION D-D'

CRA

IBM Corporation

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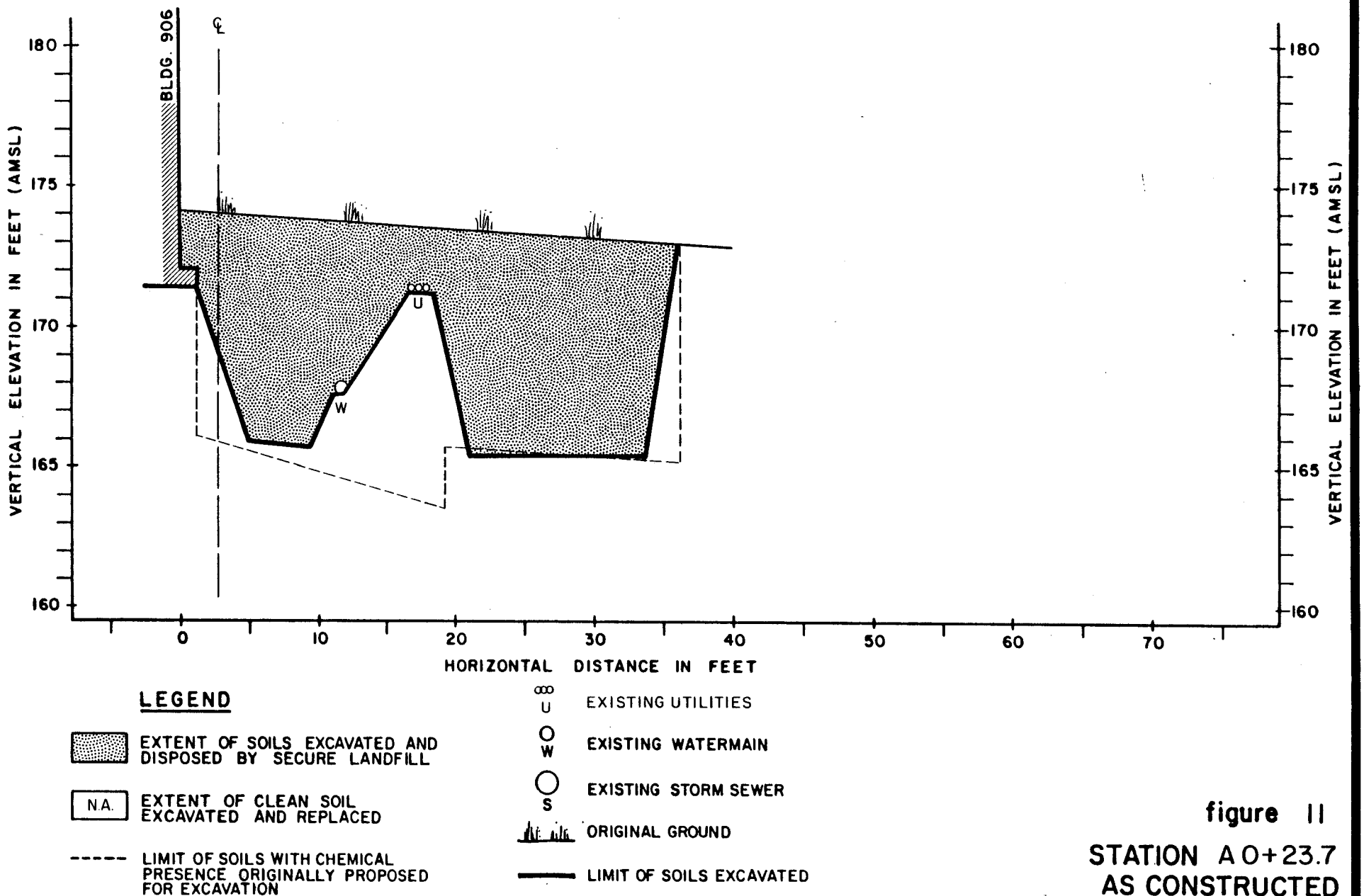

figure 11

STATION A 0+23.7
AS CONSTRUCTED
CROSS-SECTION E-E'

IBM Corporation

CRA

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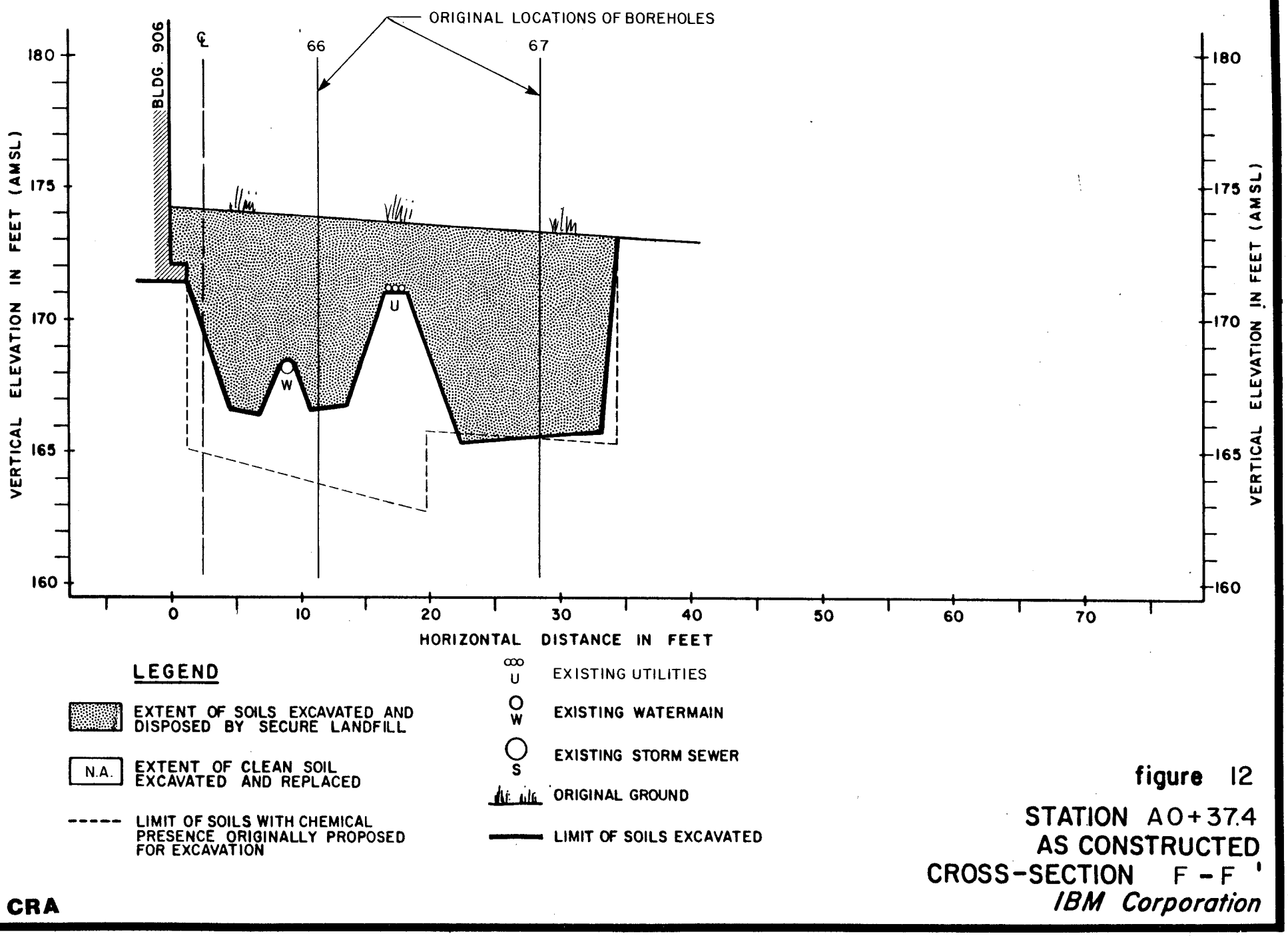

figure 12

STATION A0+37.4
AS CONSTRUCTED
CROSS-SECTION F - F'

IBM Corporation

CRA

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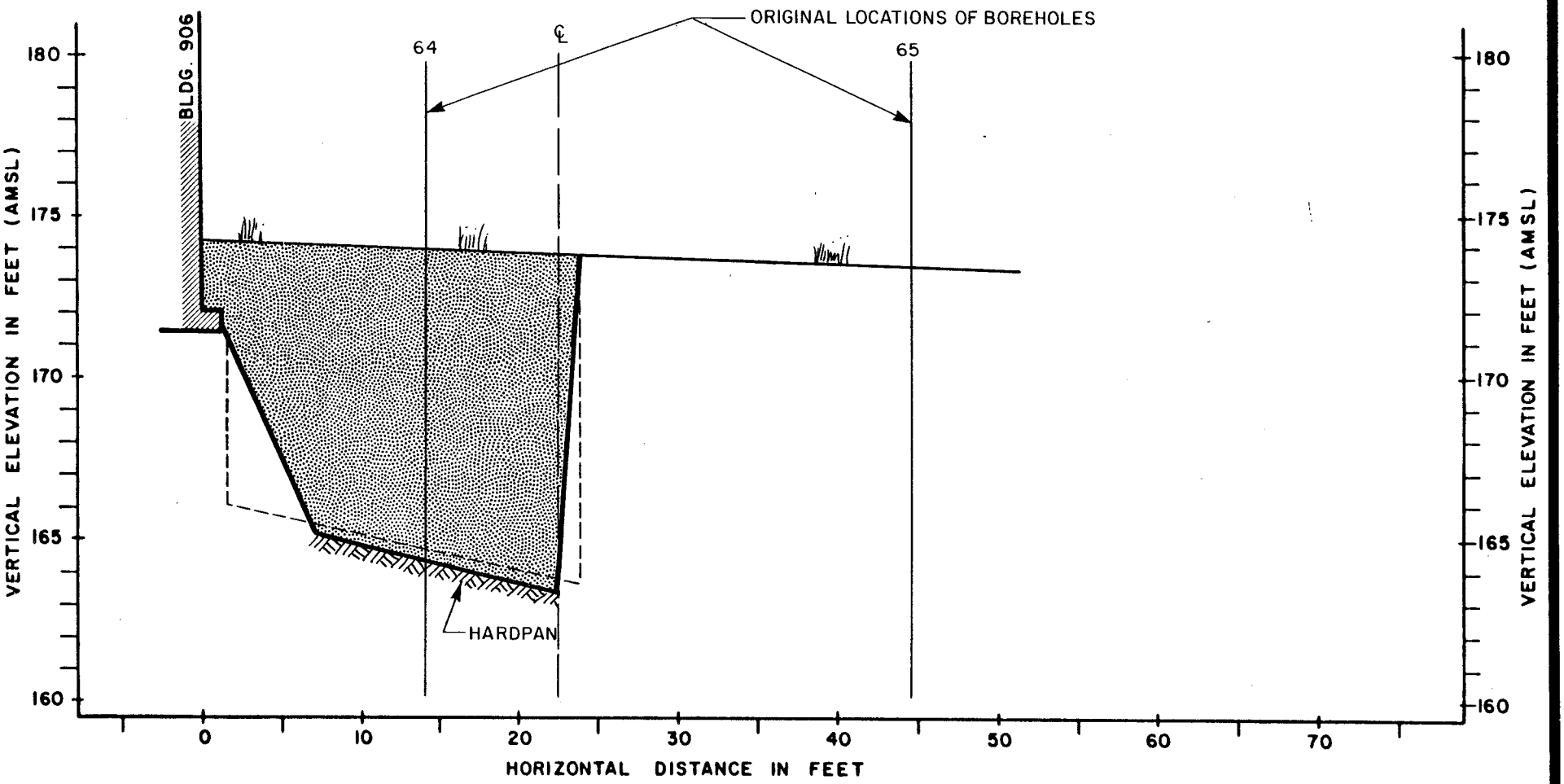

LEGEND

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- N.A. EXTENT OF CLEAN SOIL EXCAVATED AND REPLACED
- ----- LIMIT OF SOILS WITH CHEMICAL PRESENCE ORIGINALLY PROPOSED FOR EXCAVATION
- U EXISTING UTILITIES
- W EXISTING WATERMAIN
- S EXISTING STORM SEWER
- ORIGINAL GROUND
- LIMIT OF SOILS EXCAVATED

figure 13

STATION A0+63.8
AS CONSTRUCTED
CROSS-SECTION G-G'
IBM Corporation

CRA

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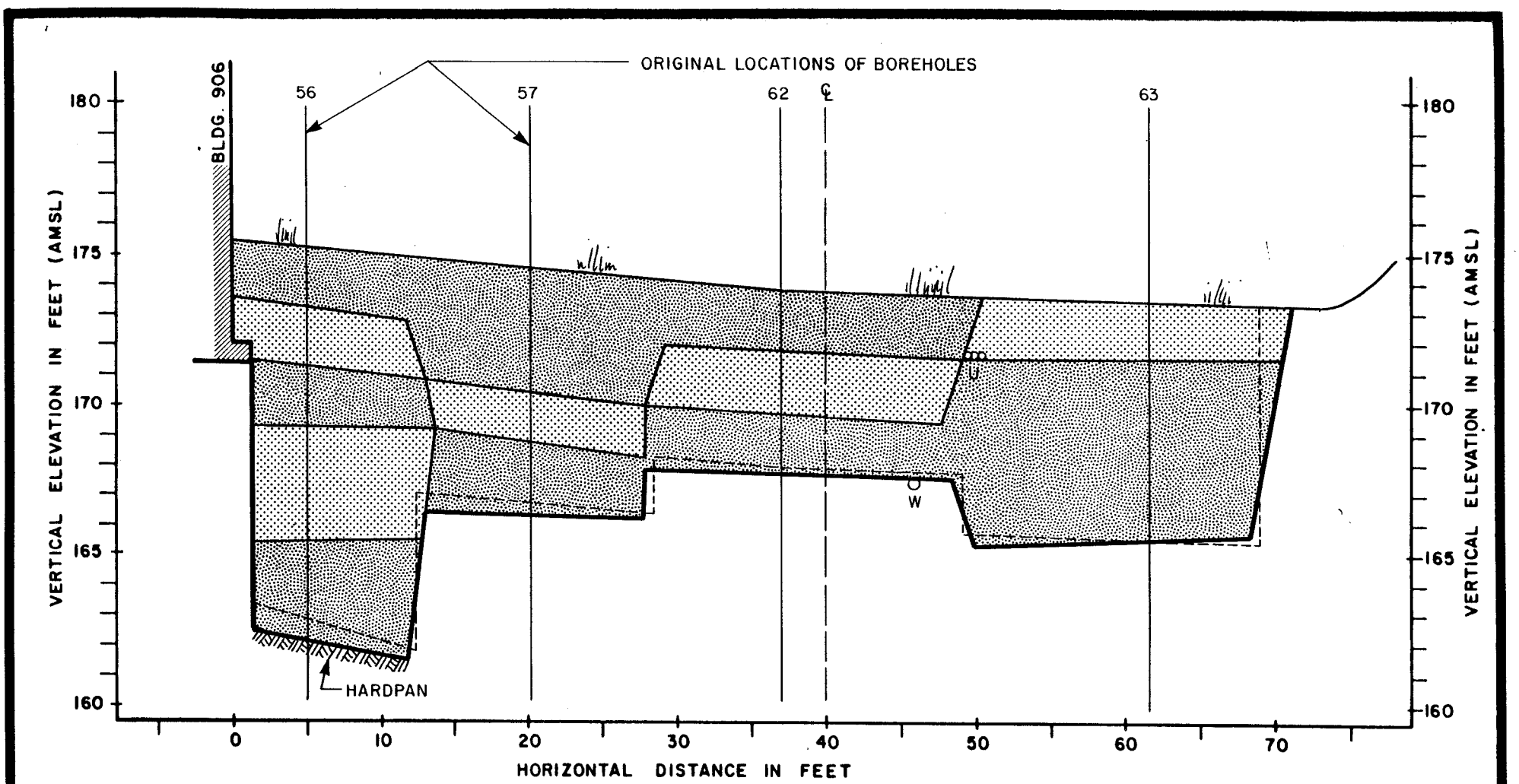

figure 14

STATION A0+89.5
AS CONSTRUCTED
CROSS-SECTION H-H'
IBM Corporation

CRA

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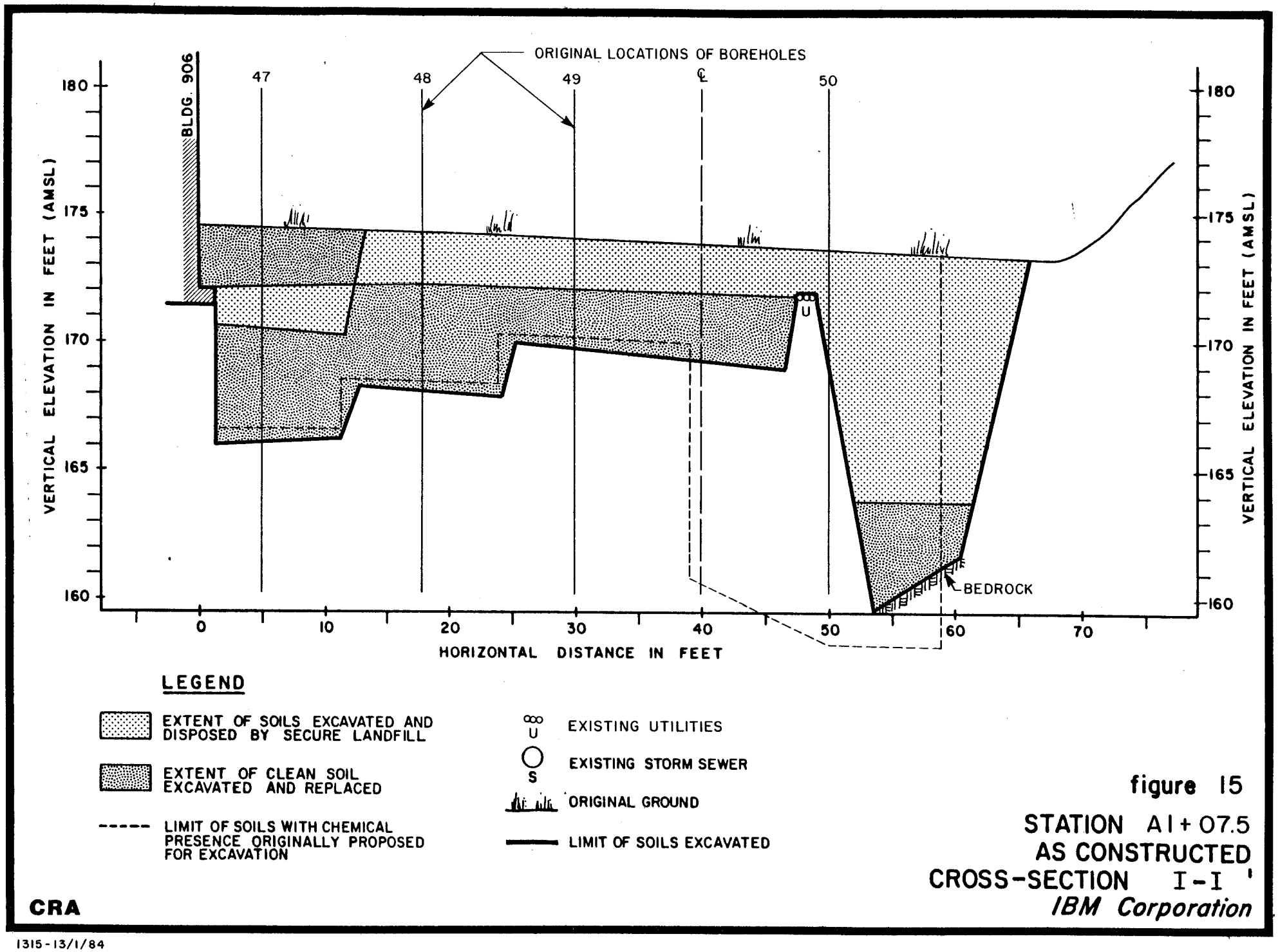


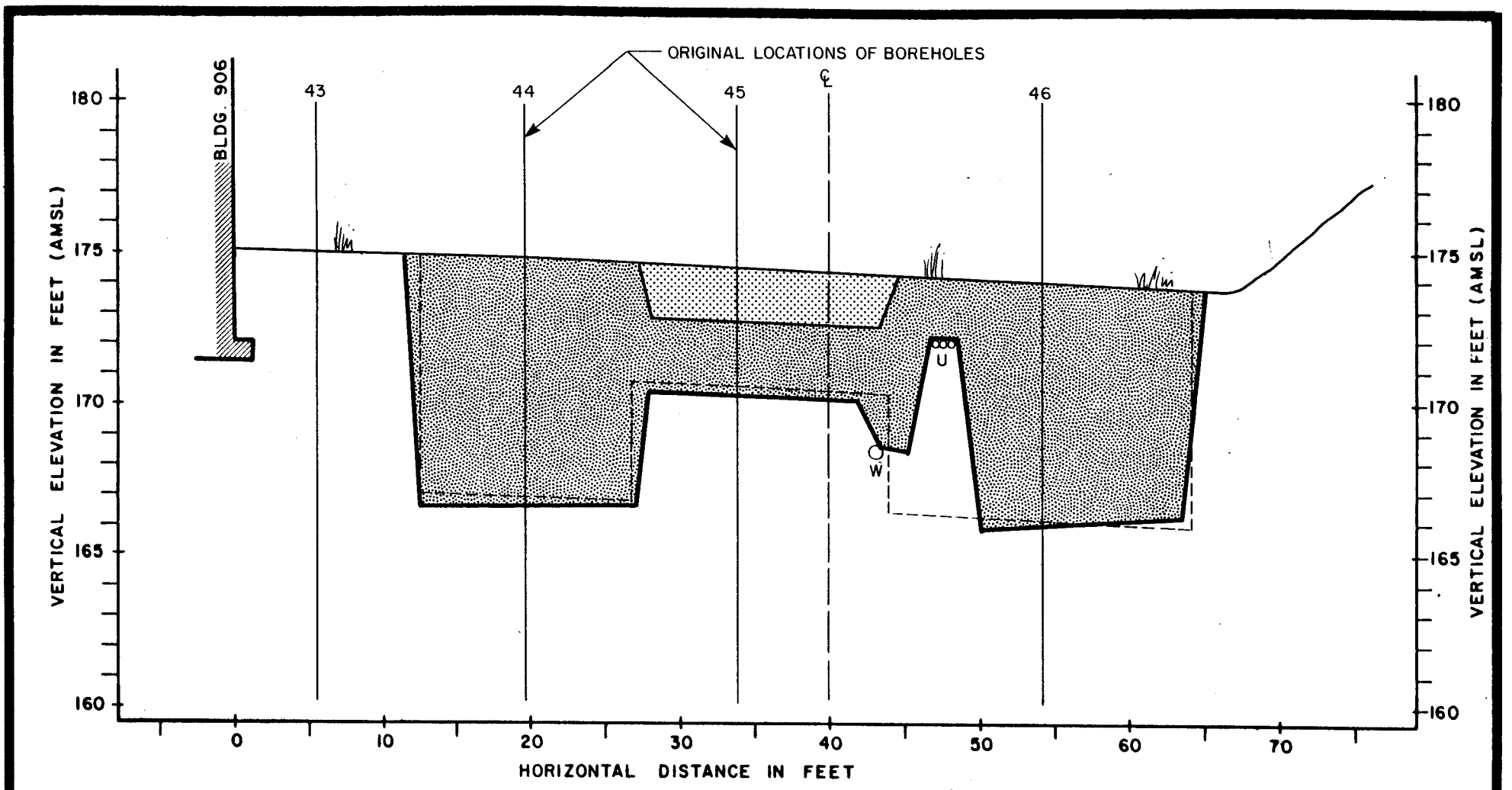
figure 15

STATION A1+07.5
AS CONSTRUCTED
CROSS-SECTION I-I'

IBM Corporation

CRA

1315-13/1/84



LEGEND

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- EXTENT OF CLEAN SOIL EXCAVATED AND REPLACED
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- U — EXISTING UTILITIES
- W — EXISTING WATERMAIN
- S — EXISTING STORM SEWER
- ORIGINAL GROUND
- LIMIT OF SOILS EXCAVATED

figure 16

STATION A1+21.8
AS CONSTRUCTED
CROSS-SECTION J-J'
IBM Corporation

CRA

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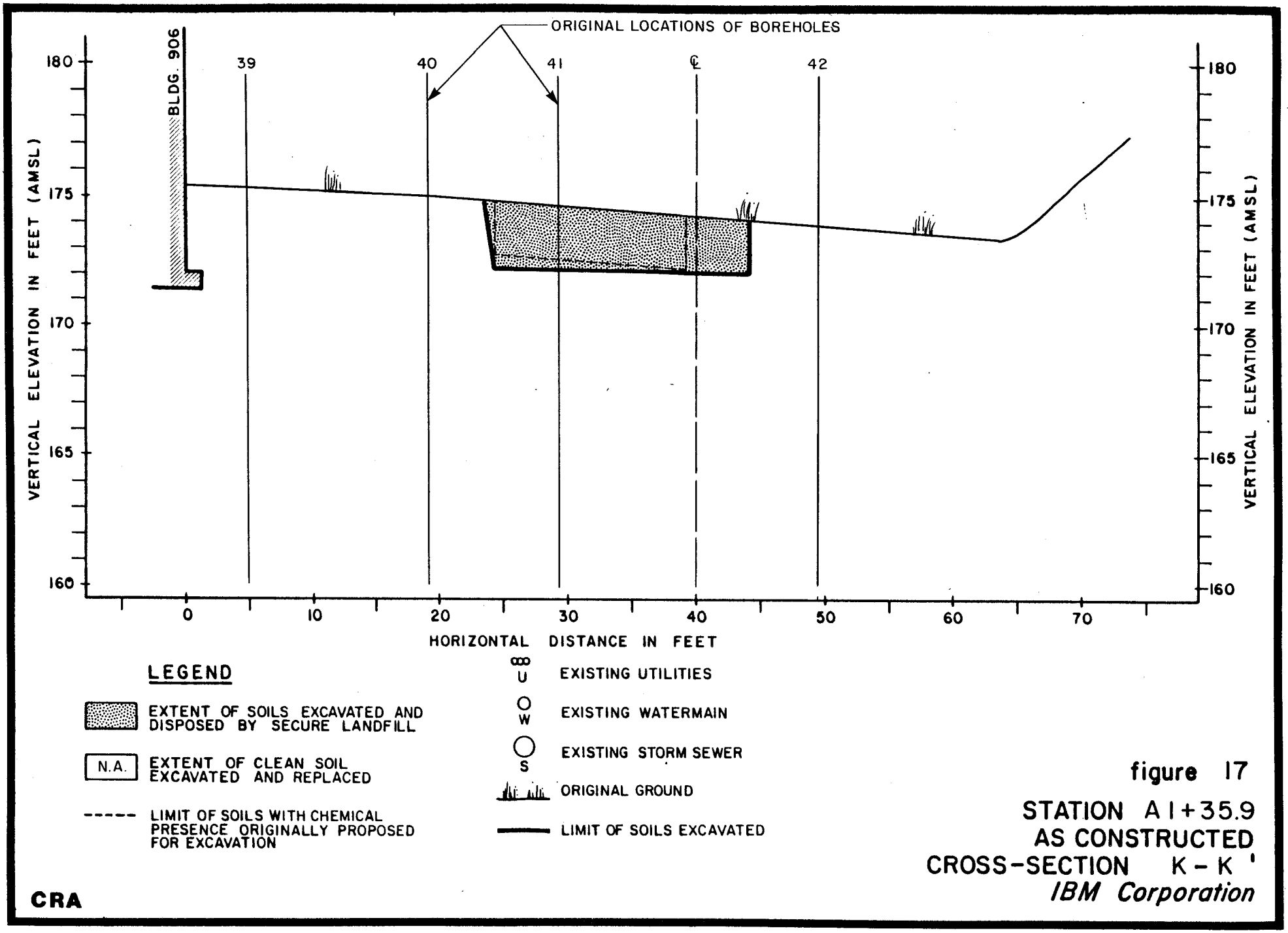


figure 17

STATION A1+35.9
AS CONSTRUCTED
CROSS-SECTION K - K'
IBM Corporation

CRA

1315-13/1/84

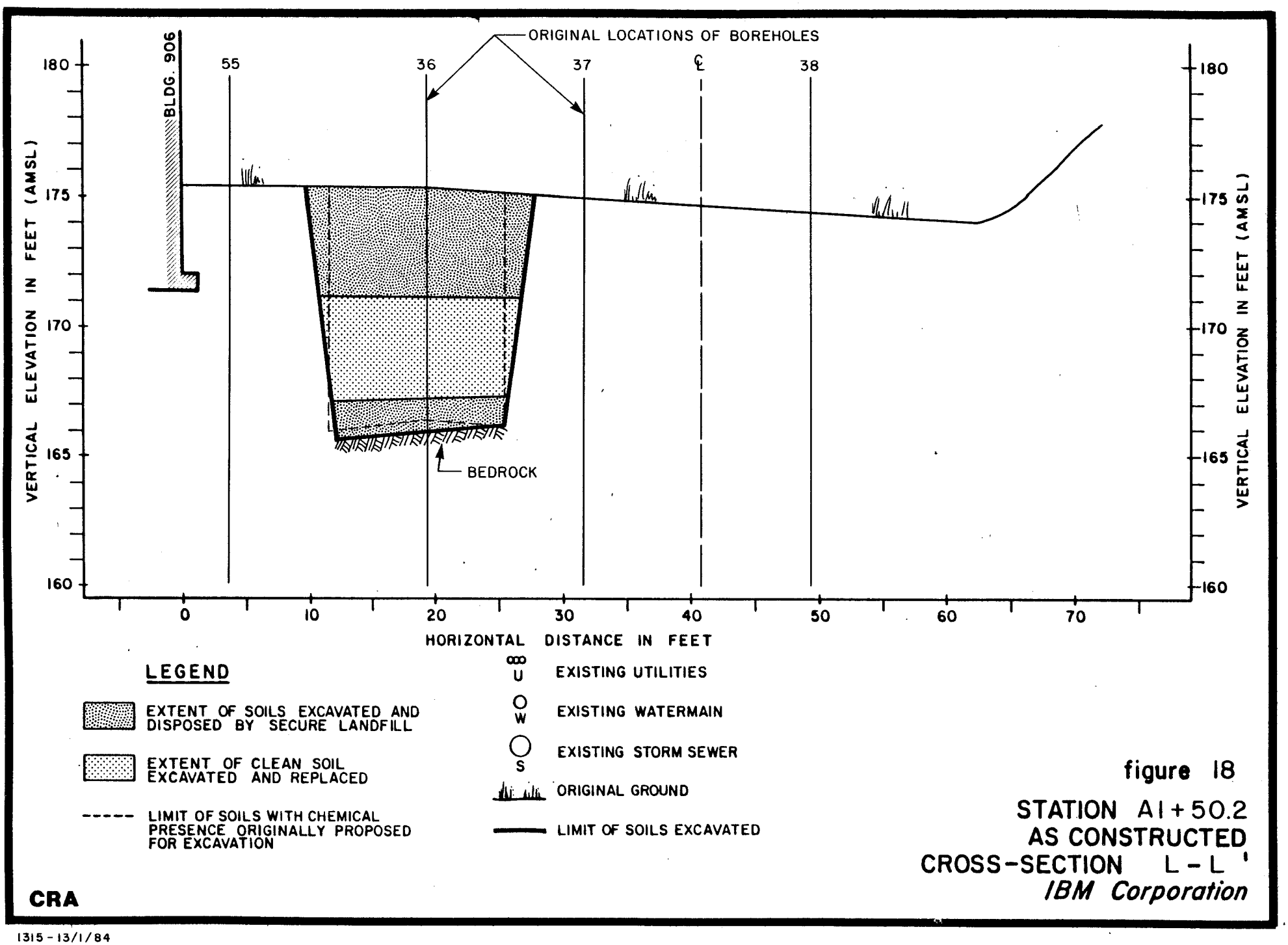


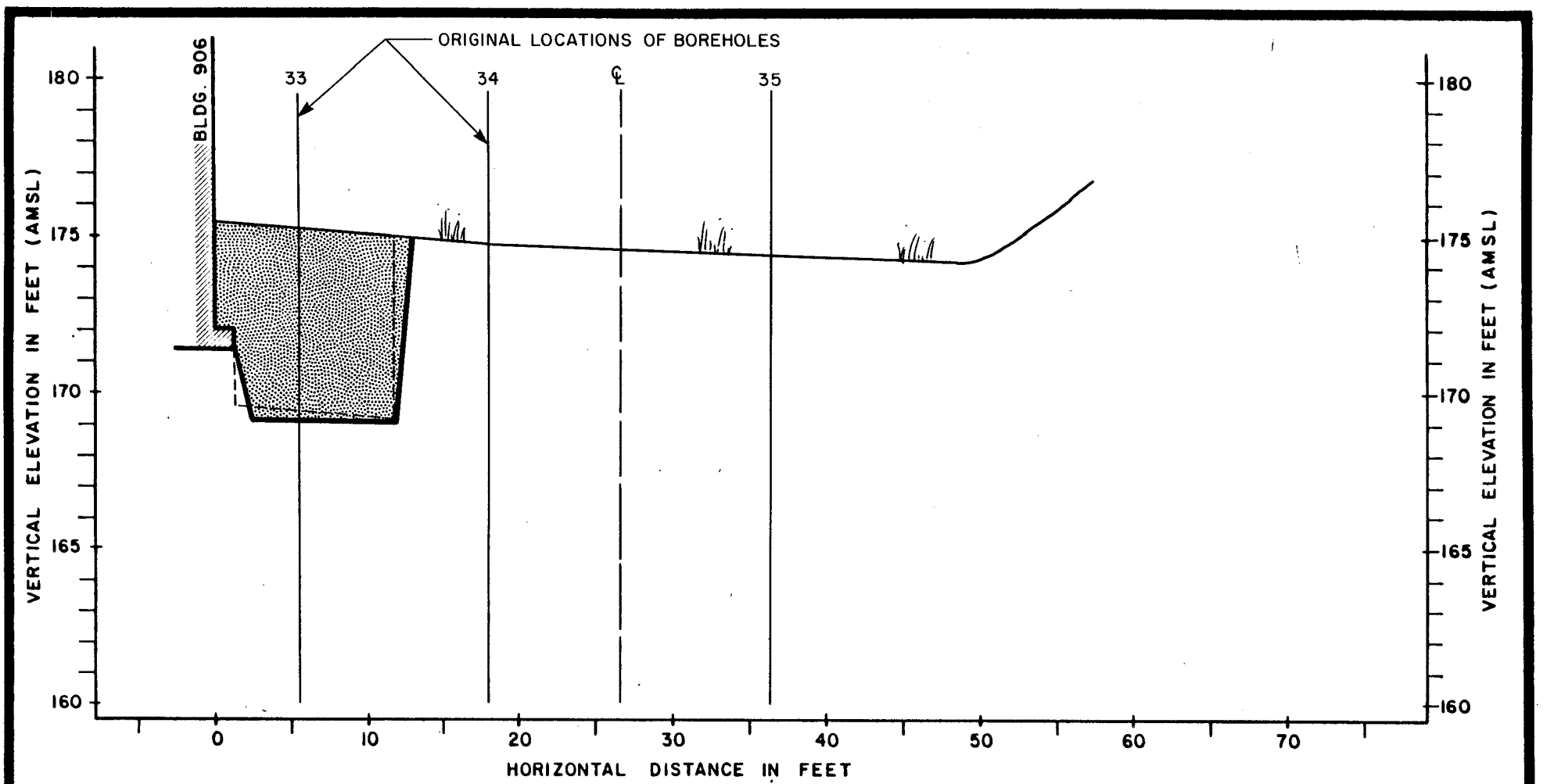
figure 18

STATION A1+50.2
AS CONSTRUCTED
CROSS-SECTION L-L'

IBM Corporation

CRA

1315-13/1/84



LEGEND

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- N.A. EXTENT OF CLEAN SOIL EXCAVATED AND REPLACED
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- U EXISTING UTILITIES
- W EXISTING WATERMAIN
- S EXISTING STORM SEWER
- ORIGINAL GROUND
- LIMIT OF SOILS EXCAVATED

CRA

figure 19

STATION A1+66.8
AS CONSTRUCTED
CROSS-SECTION M-M'
IBM Corporation

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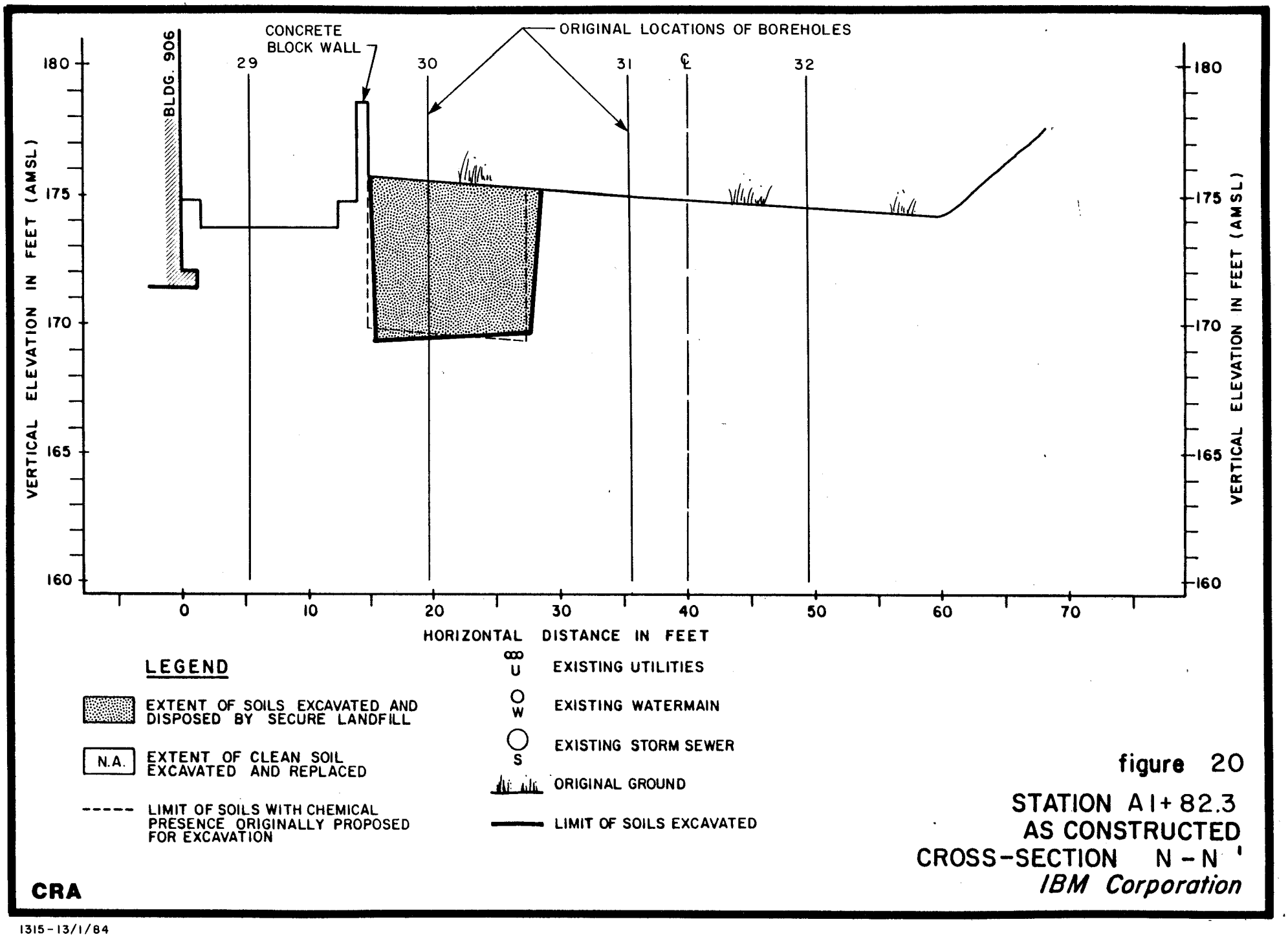

figure 20

STATION A1+82.3
AS CONSTRUCTED
CROSS-SECTION N-N'
IBM Corporation

CRA

1315-13/1/84

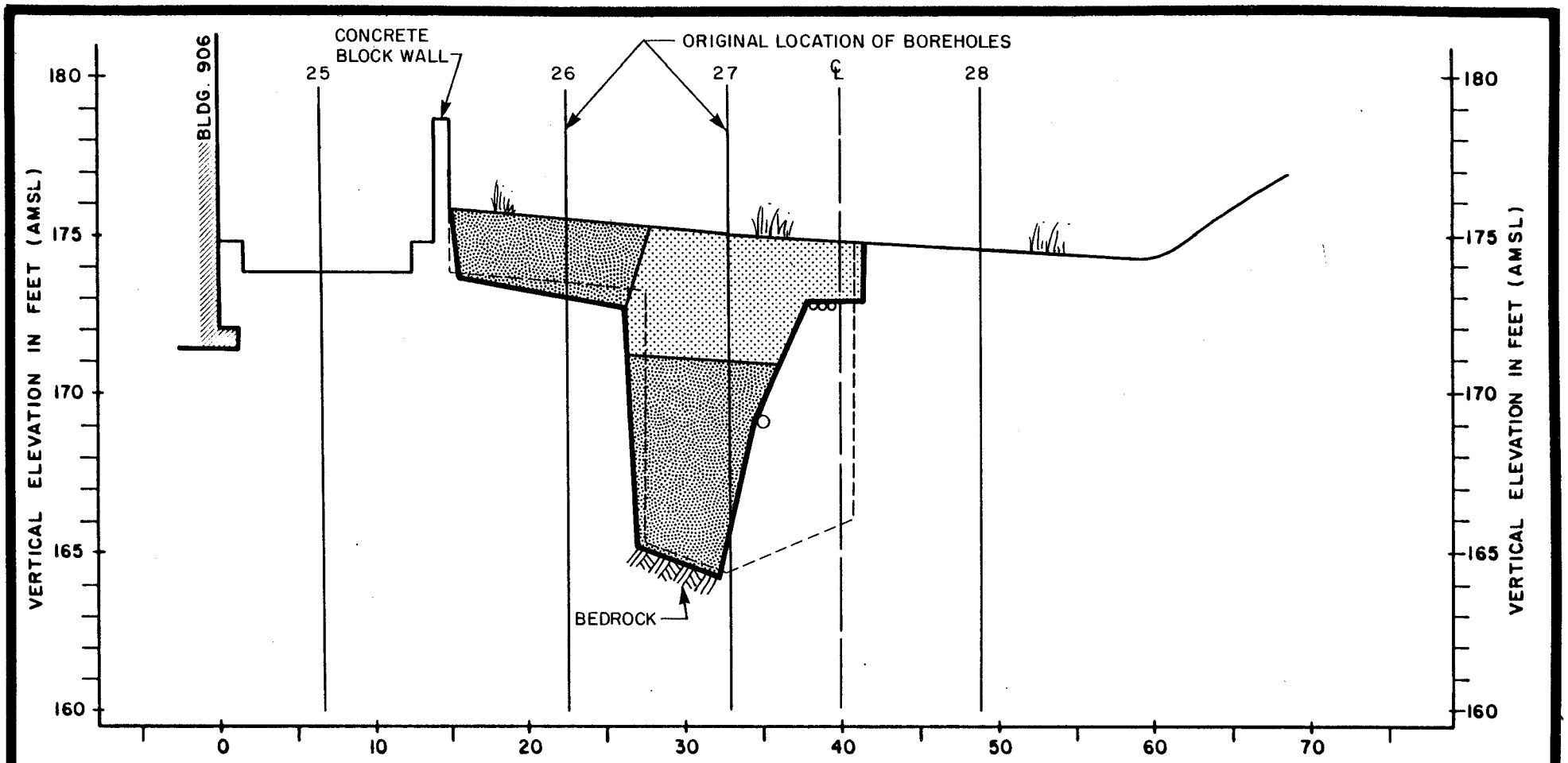

figure 21

STATION A 1+95.3
AS CONSTRUCTED
CROSS-SECTION 0-0'
IBM Corporation

CRA

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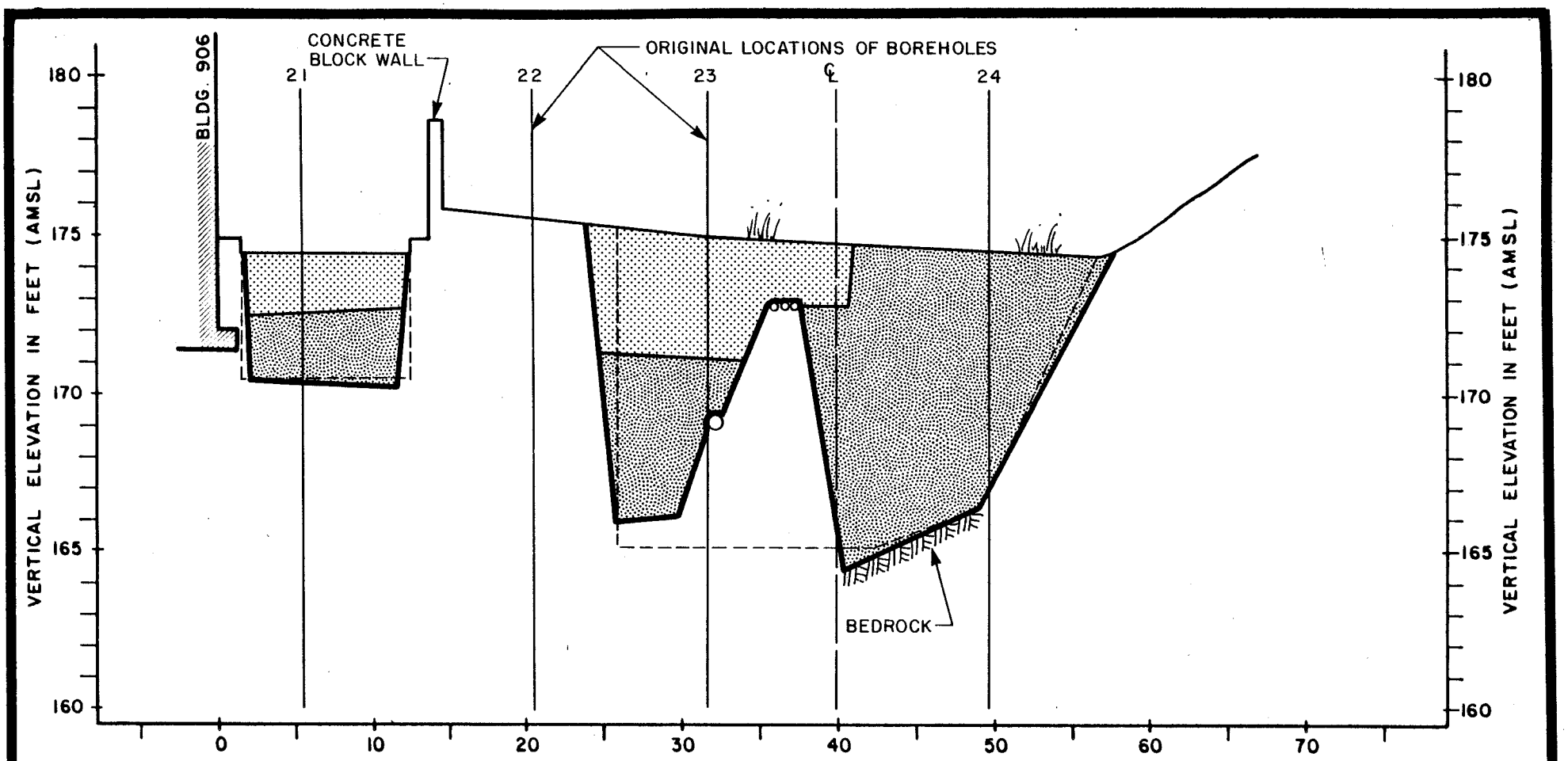


LEGEND

- EXTENT OF SOILS EXCAVATED AND DISPOSED BY SECURE LANDFILL
- EXTENT OF CLEAN SOIL EXCAVATED AND REPLACED
- ----- LIMIT OF SOILS WITH CHEMICAL PRESENCE ORIGINALLY PROPOSED FOR EXCAVATION
- U EXISTING UTILITIES
- W EXISTING WATERMAIN
- S EXISTING STORM SEWER
- ORIGINAL GROUND
- LIMIT OF SOILS EXCAVATED

figure 22

STATION A 2+13.3
AS CONSTRUCTED
CROSS-SECTION P - P'
IBM Corporation

CRA

1315-13/1/84

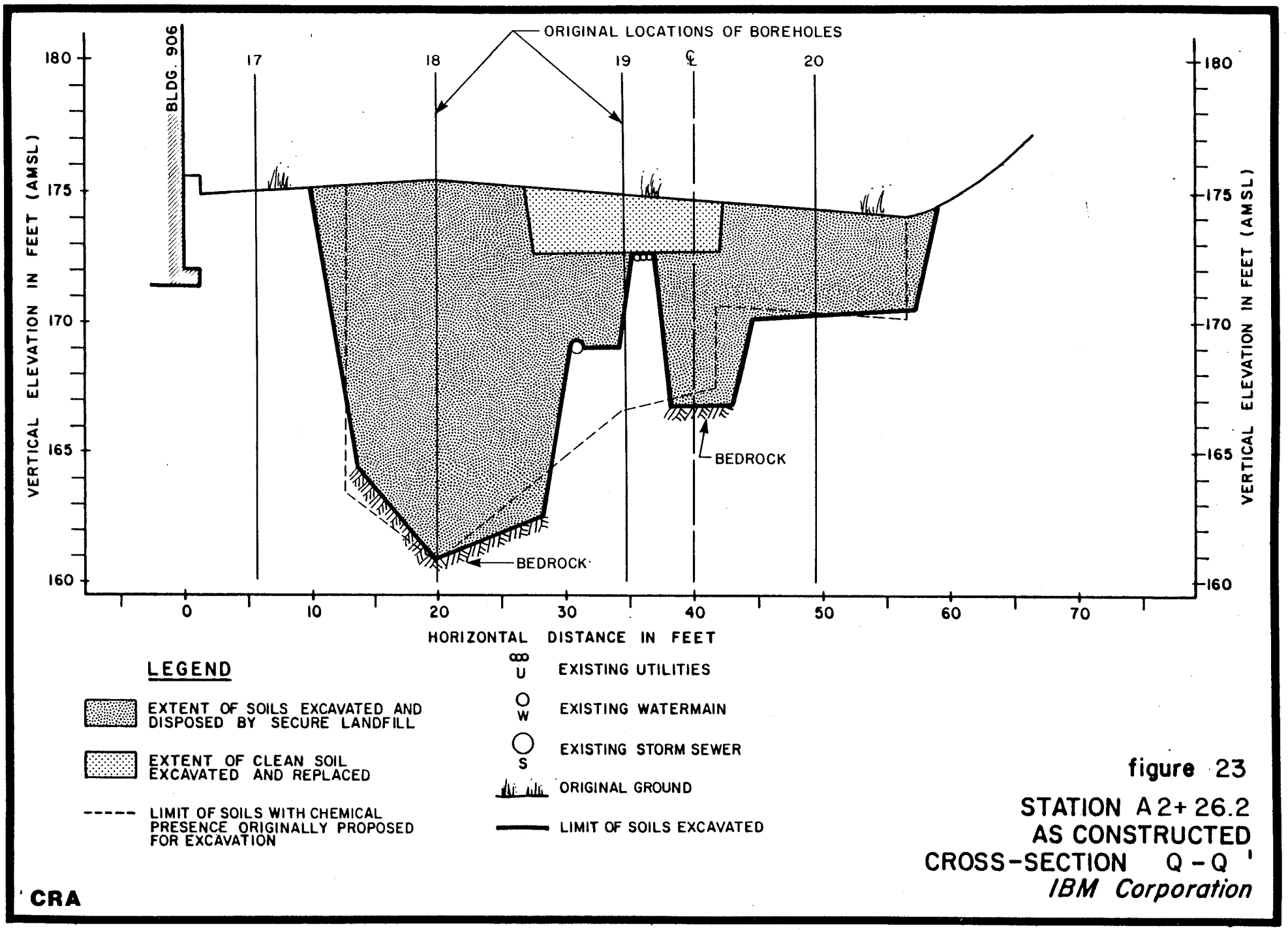


figure 23

STATION A 2+ 26.2
AS CONSTRUCTED
CROSS-SECTION Q - Q'

IBM Corporation

CRA

1315-13/1/84

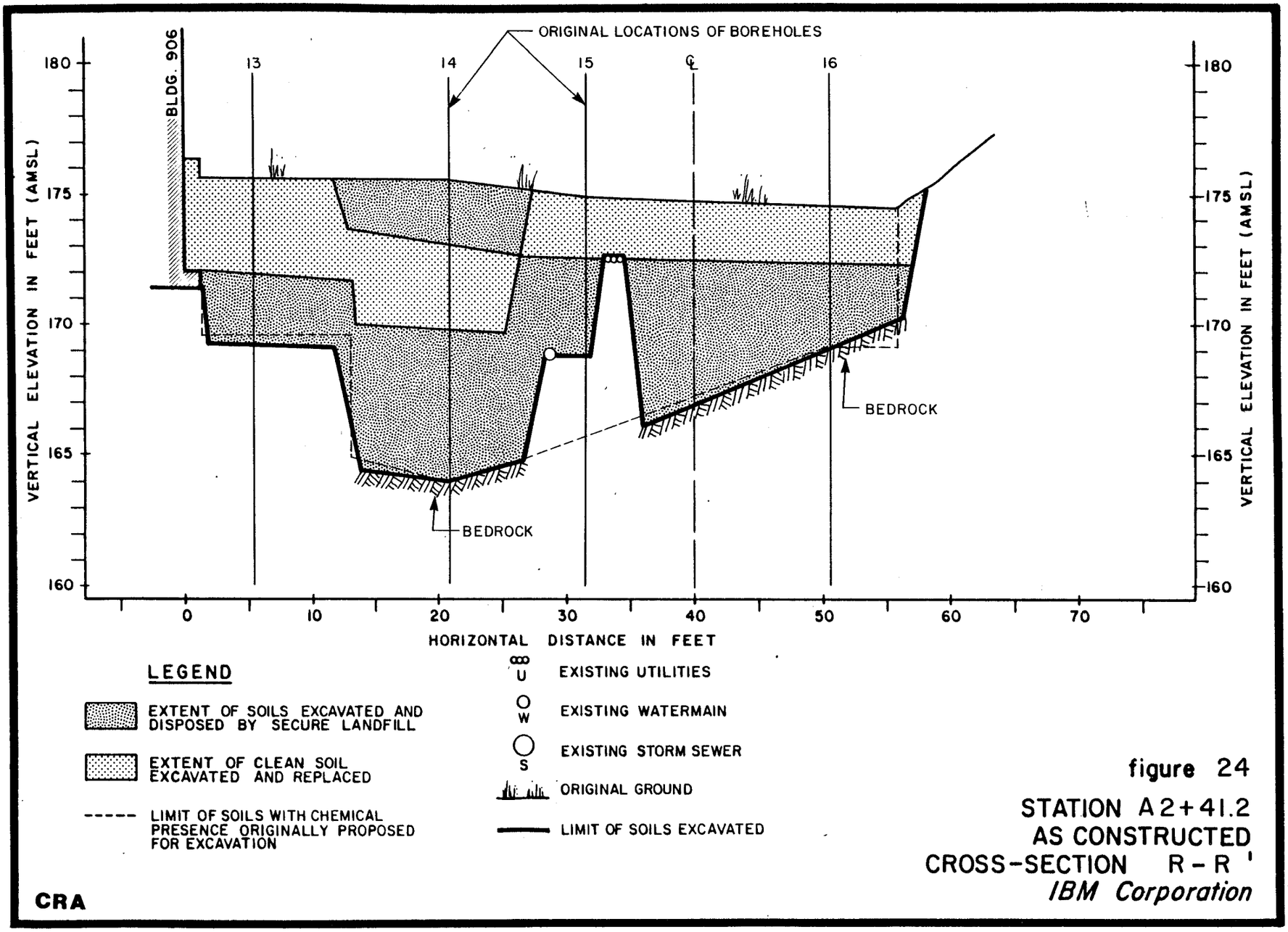


figure 24

STATION A2+41.2
AS CONSTRUCTED
CROSS-SECTION R-R'
IBM Corporation

CRA

1315-13/1/84

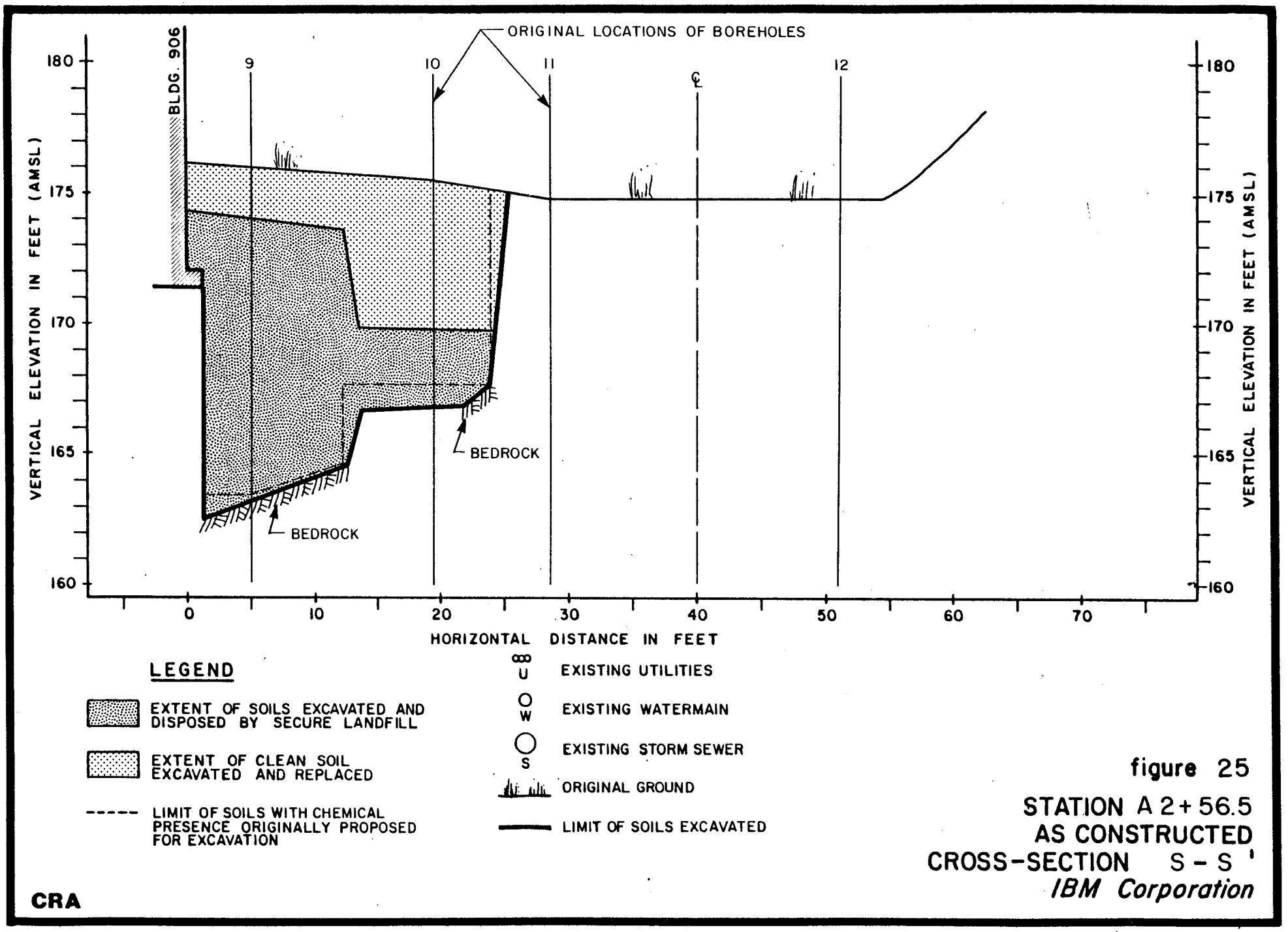


figure 25

STATION A 2+56.5
AS CONSTRUCTED
CROSS-SECTION S - S'
IBM Corporation

CRA

1315-13/1/84

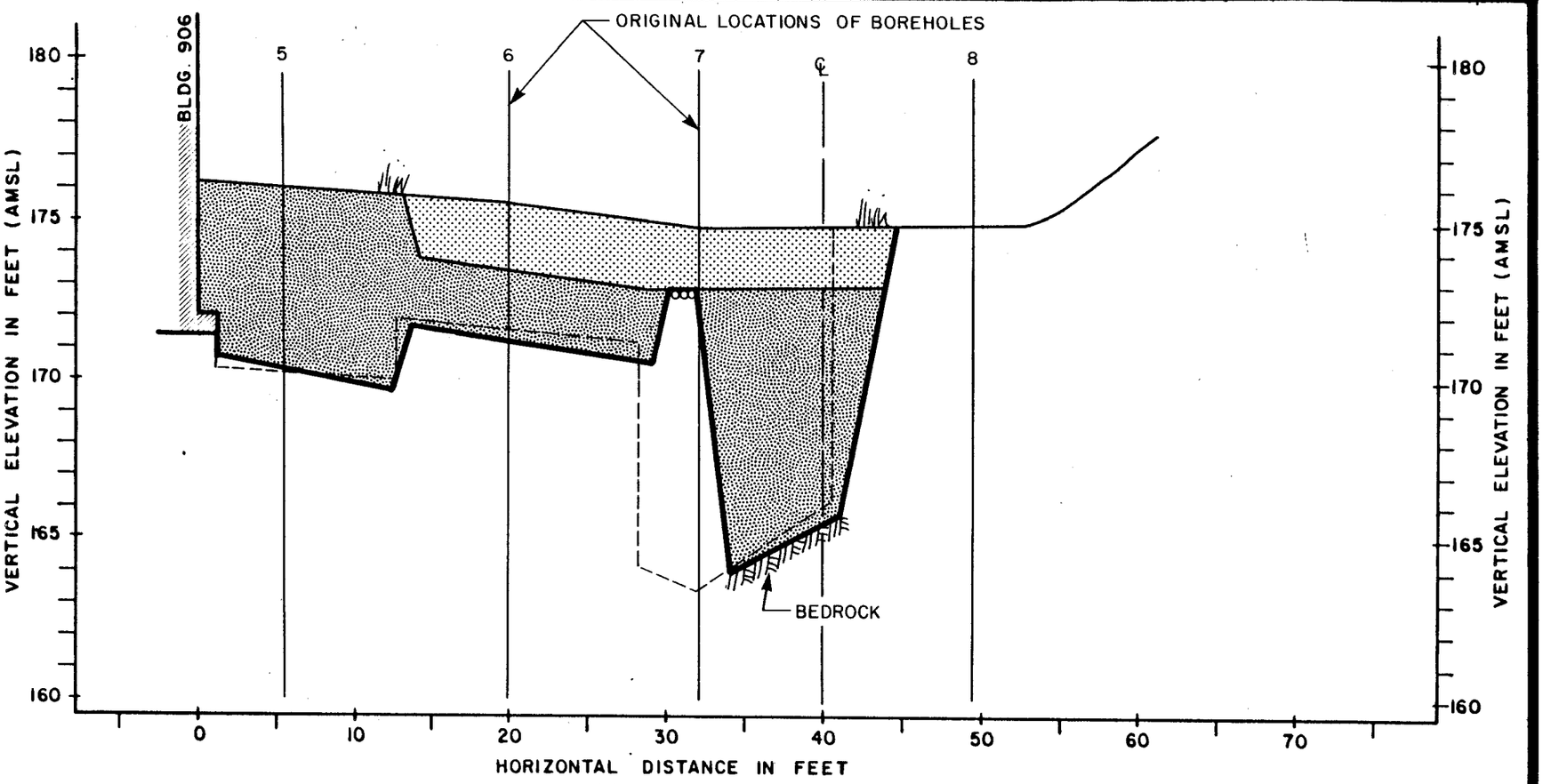


figure 26

STATION A 2+71.2
AS CONSTRUCTED
CROSS-SECTION T - T '
IBM Corporation

CRA

1315-13/1/84

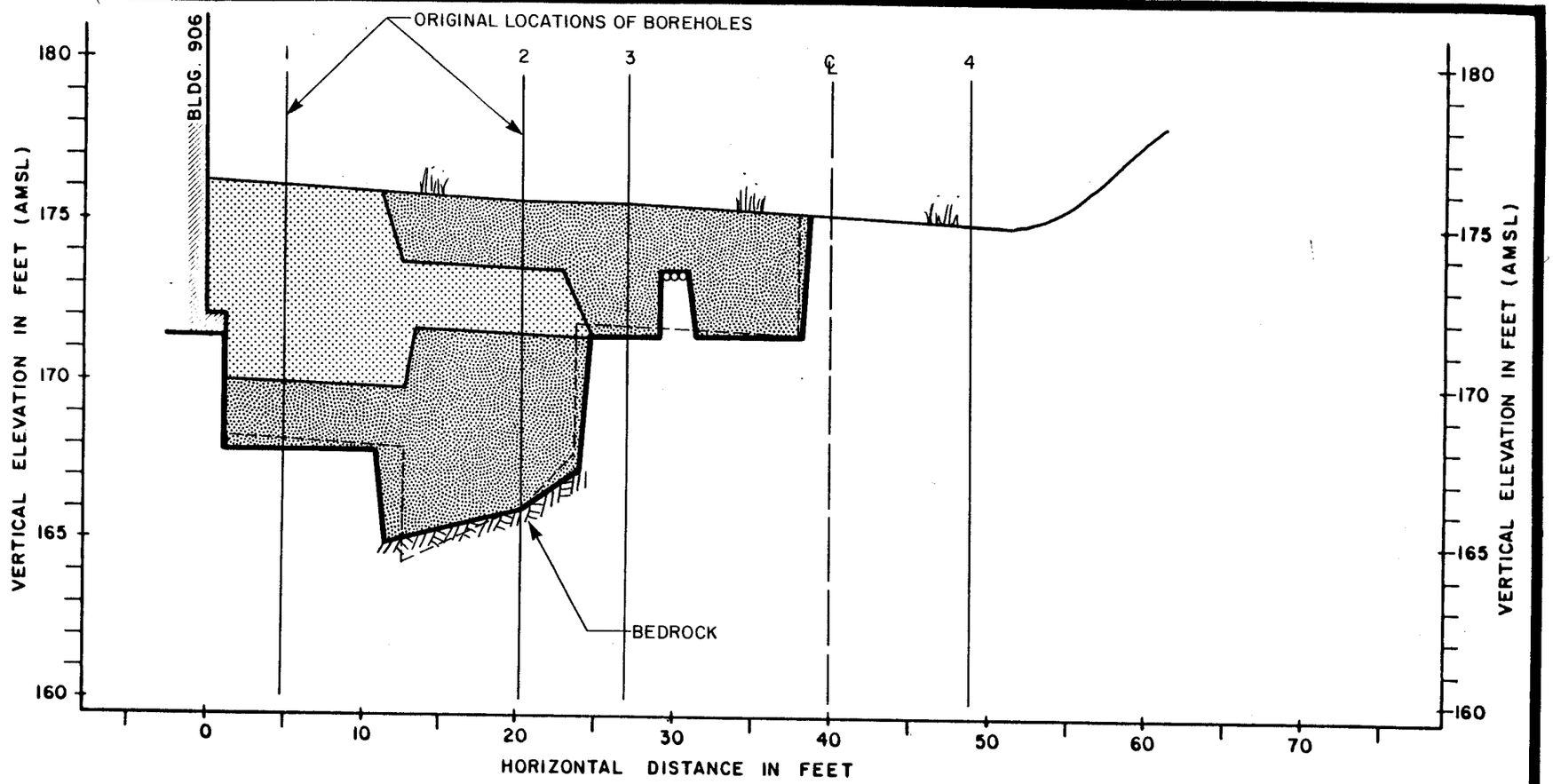


figure 27

STATION A 2+85.5
AS CONSTRUCTED
CROSS-SECTION U - U'
IBM Corporation

CRA

1315-13/1/84

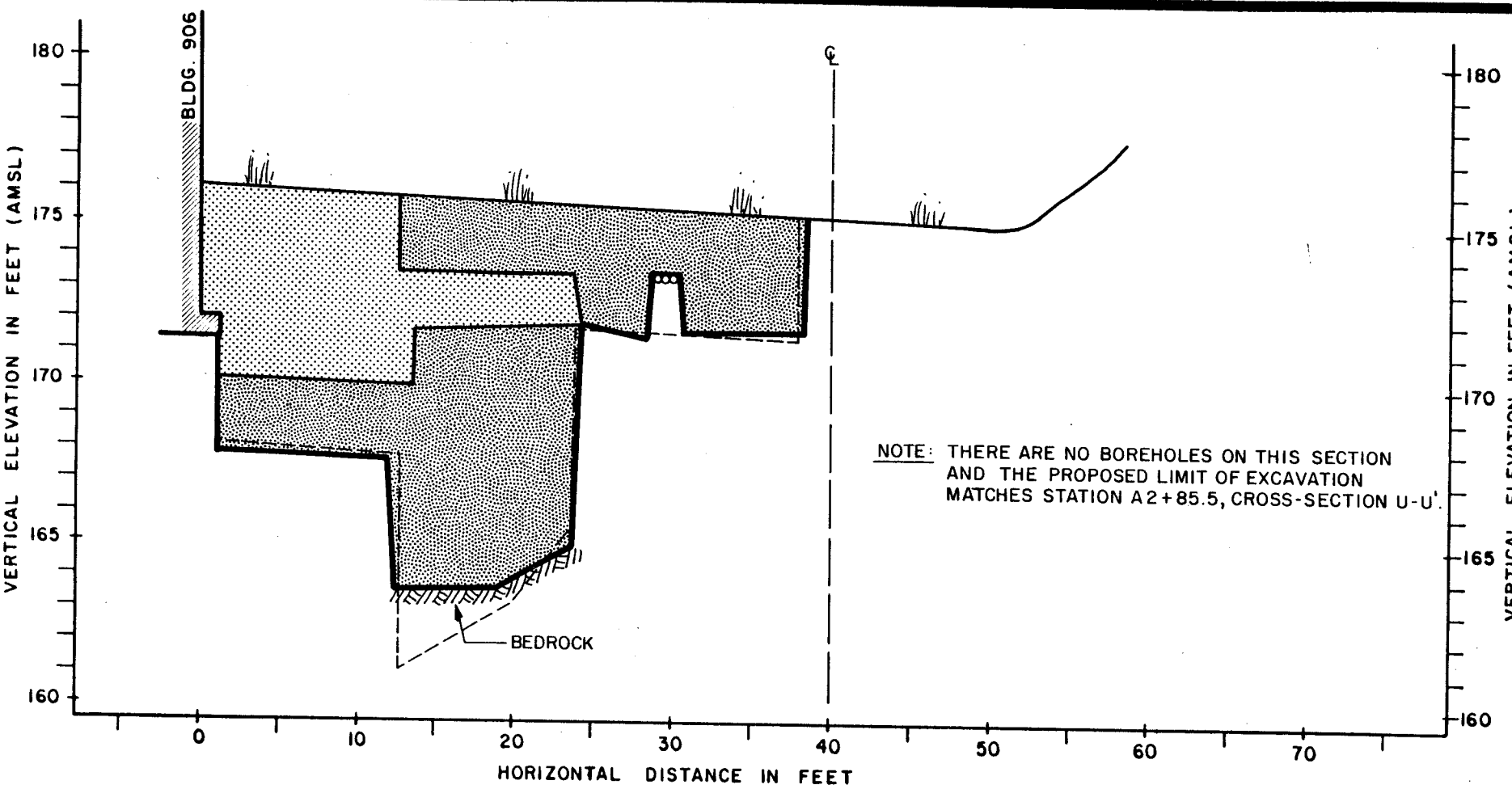


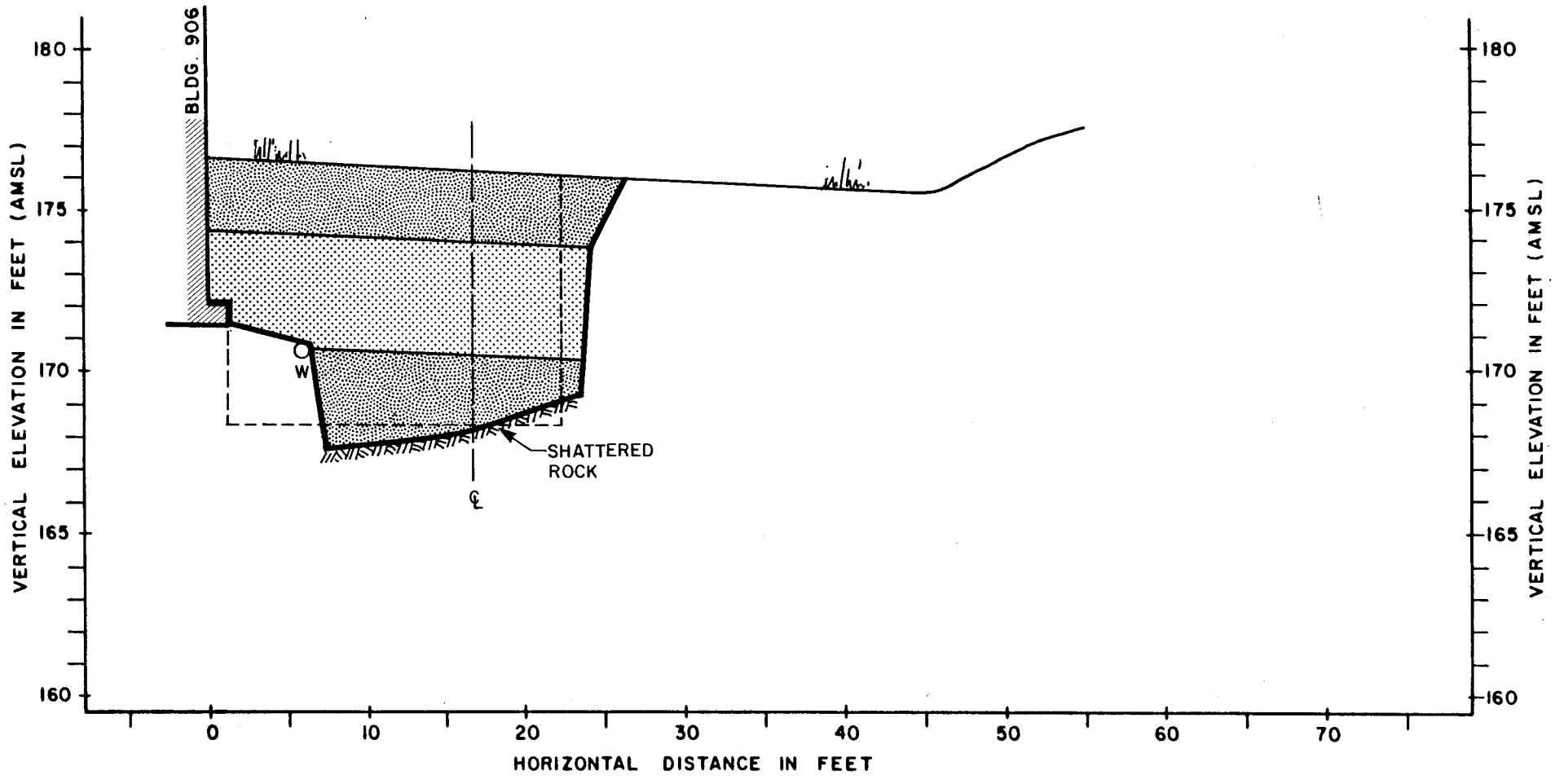
figure 28

STATION A 2+92
AS CONSTRUCTED
CROSS-SECTION V - V'

IBM Corporation

CRA

1315-13/1/84



LEGEND

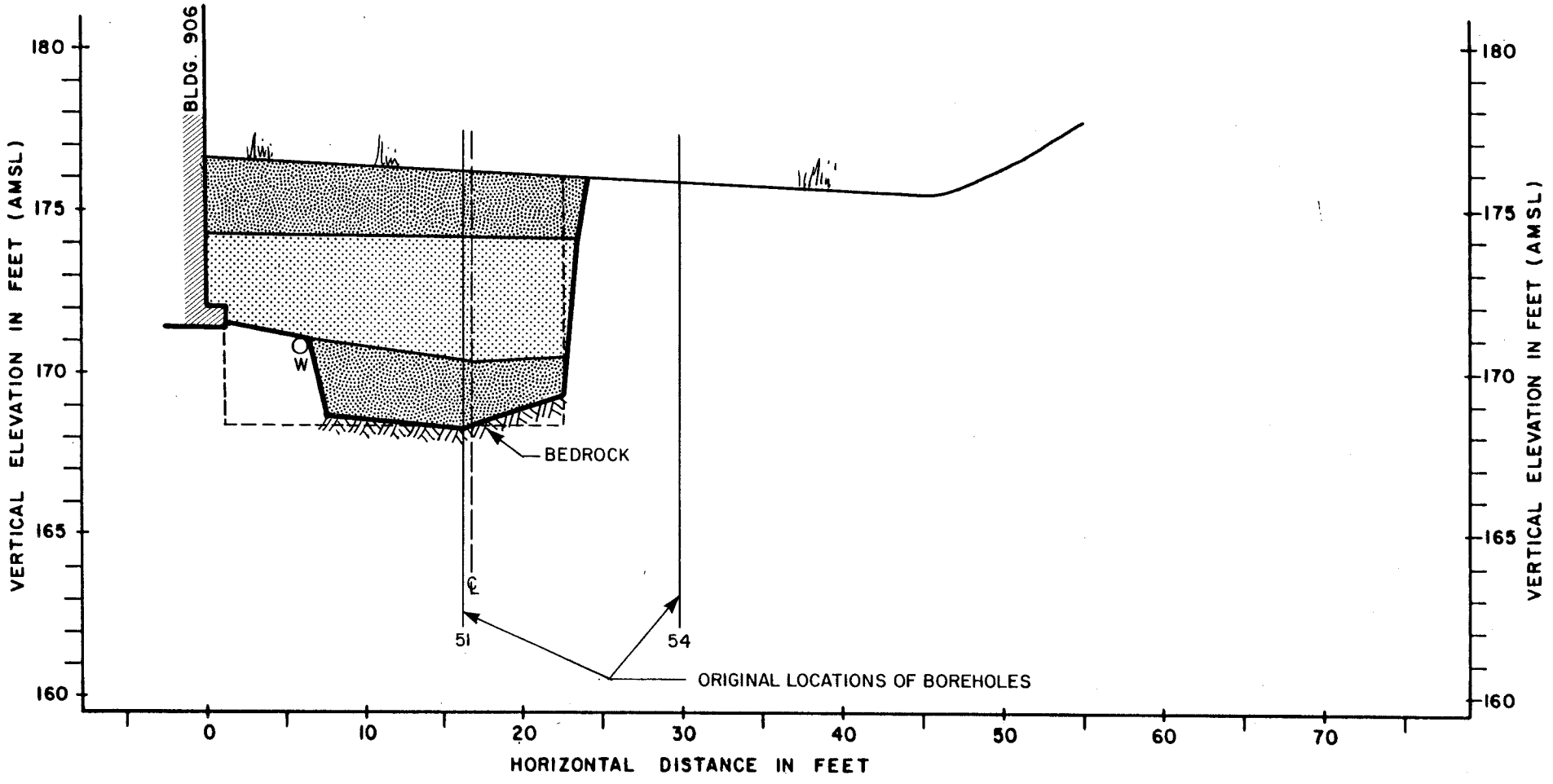
- EXTENT OF SOILS EXCAVATED AND DISPOSED BY SECURE LANDFILL
- EXTENT OF CLEAN SOIL EXCAVATED AND REPLACED
- ----- LIMIT OF SOILS WITH CHEMICAL PRESENCE ORIGINALLY PROPOSED FOR EXCAVATION
- O W EXISTING WATERMAIN
- ORIGINAL GROUND
- LIMIT OF SOILS EXCAVATED

figure 29

STATION B0+00
AS CONSTRUCTED
CROSS-SECTION AA-AA'
IBM Corporation

CRA

1315-13/1/84



LEGEND

EXTENT OF SOILS EXCAVATED AND DISPOSED BY SECURE LANDFILL

EXTENT OF CLEAN SOIL EXCAVATED AND REPLACED

----- LIMIT OF SOILS WITH CHEMICAL PRESENCE ORIGINALLY PROPOSED FOR EXCAVATION

O W EXISTING WATERMAIN

ORIGINAL GROUND

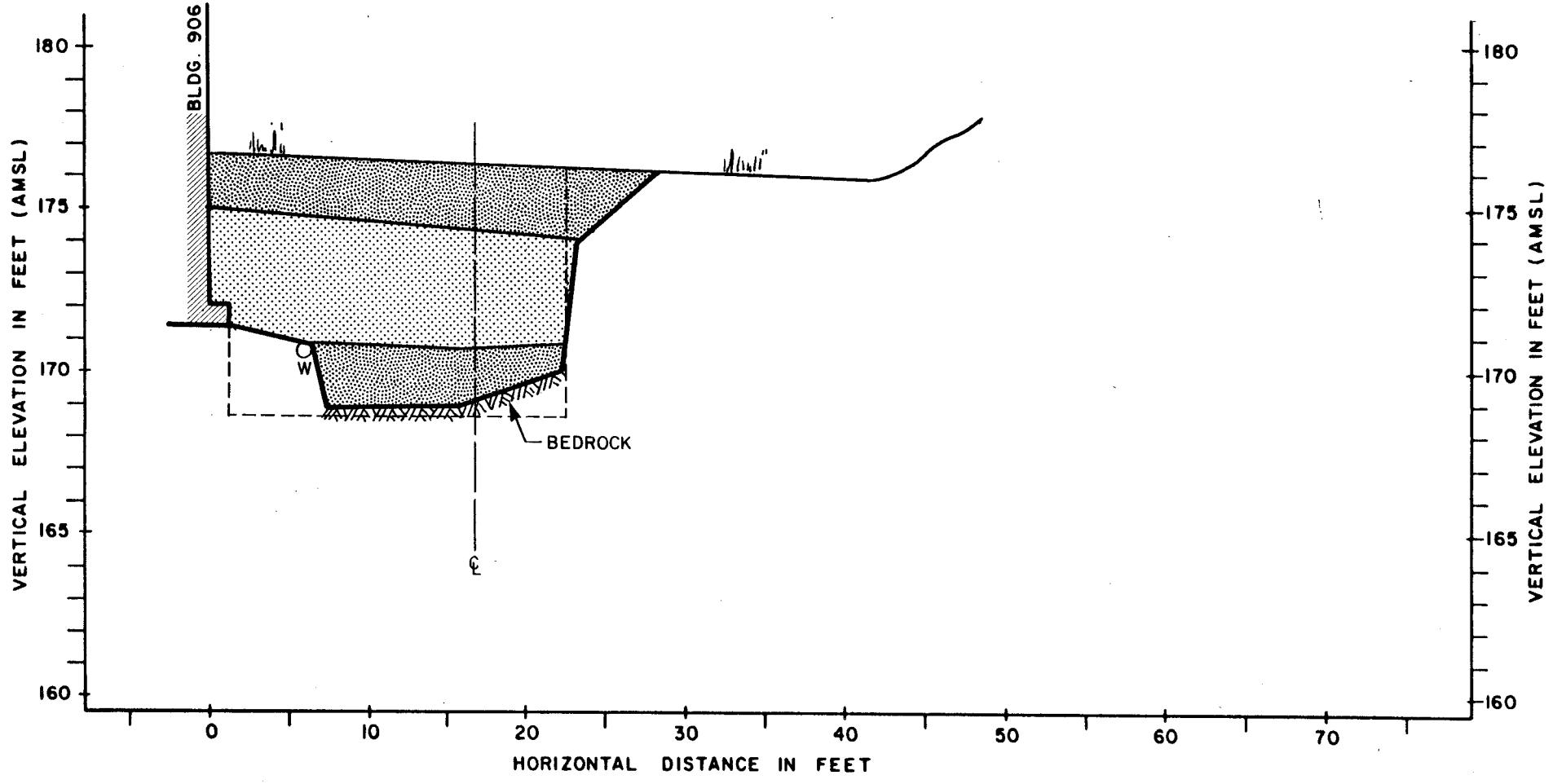
LIMIT OF SOILS EXCAVATED

figure 30

STATION B0+09.9
AS CONSTRUCTED
CROSS-SECTION BB-BB'
IBM Corporation

CRA

1315-13/1/84



LEGEND

EXTENT OF SOILS EXCAVATED AND DISPOSED BY SECURE LANDFILL

EXTENT OF CLEAN SOIL EXCAVATED AND REPLACED

----- LIMIT OF SOILS WITH CHEMICAL PRESENCE ORIGINALLY PROPOSED FOR EXCAVATION

OW EXISTING WATERMAIN

ORIGINAL GROUND

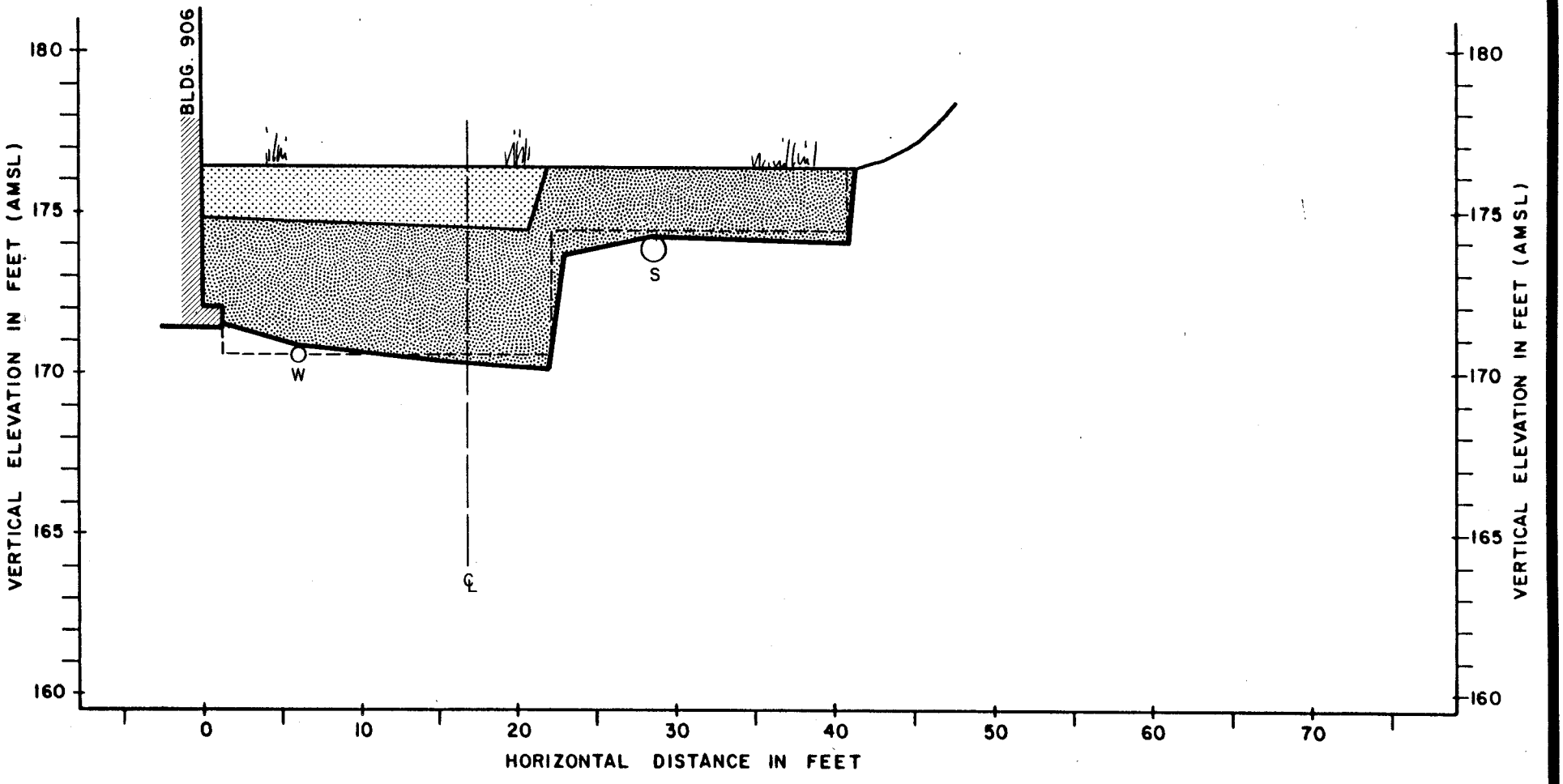
LIMIT OF SOILS EXCAVATED

figure 31

STATION B0+16.8
AS CONSTRUCTED
CROSS-SECTION CC-CC'
IBM, Corporation

CRA

1315-13/1/84



LEGEND

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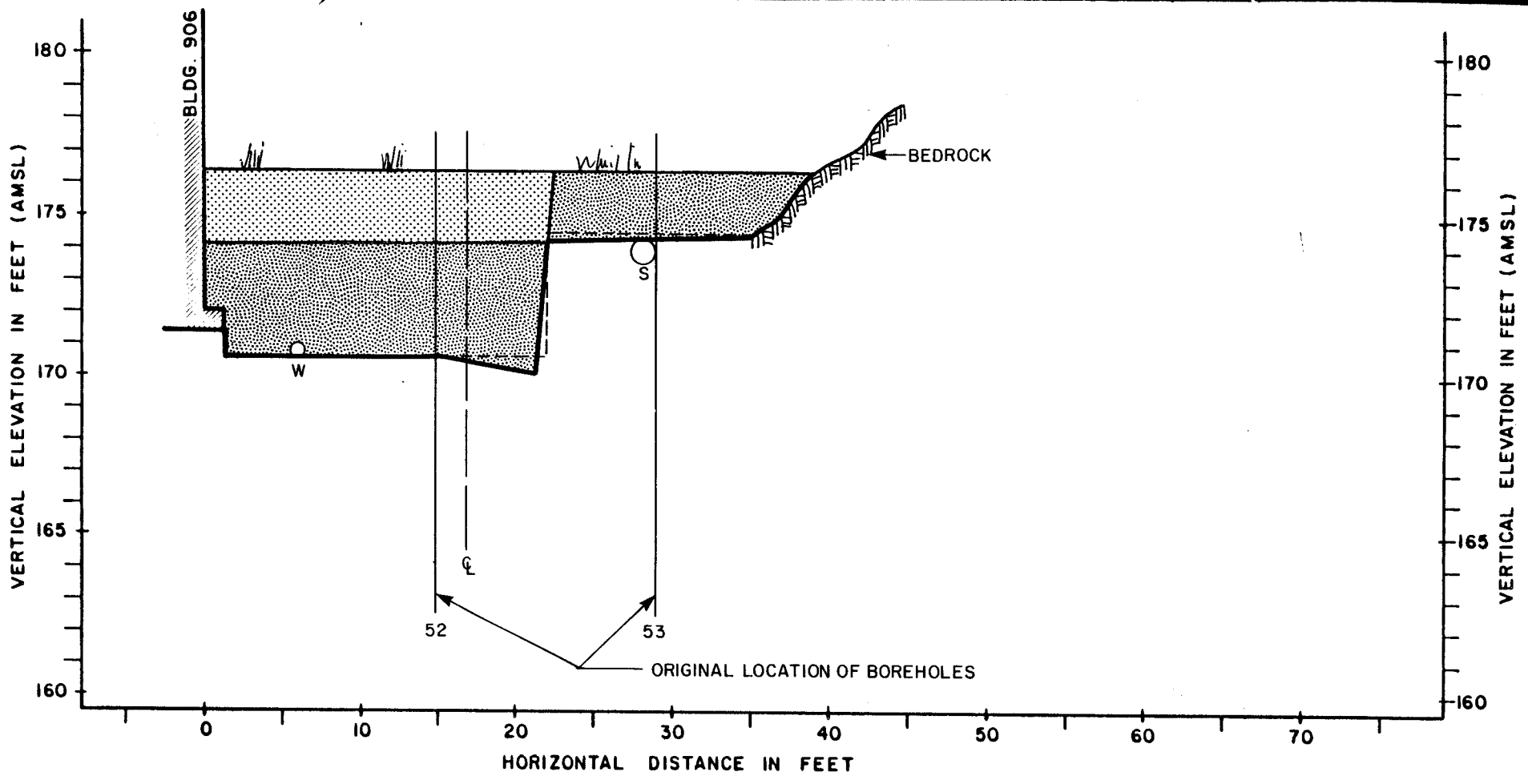
- EXTENT OF CLEAN SOIL EXCAVATED AND REPLACED
- ----- LIMIT OF SOILS WITH CHEMICAL PRESENCE ORIGINALLY PROPOSED FOR EXCAVATION
- W EXISTING WATERMAIN
- S EXISTING STORM SEWER
- ORIGINAL GROUND
- LIMIT OF SOILS EXCAVATED

figure 32

STATION B0+17.8
AS CONSTRUCTED
CROSS-SECTION DD-DD'
IBM Corporation

CRA

1315 - 13/1/84



LEGEND

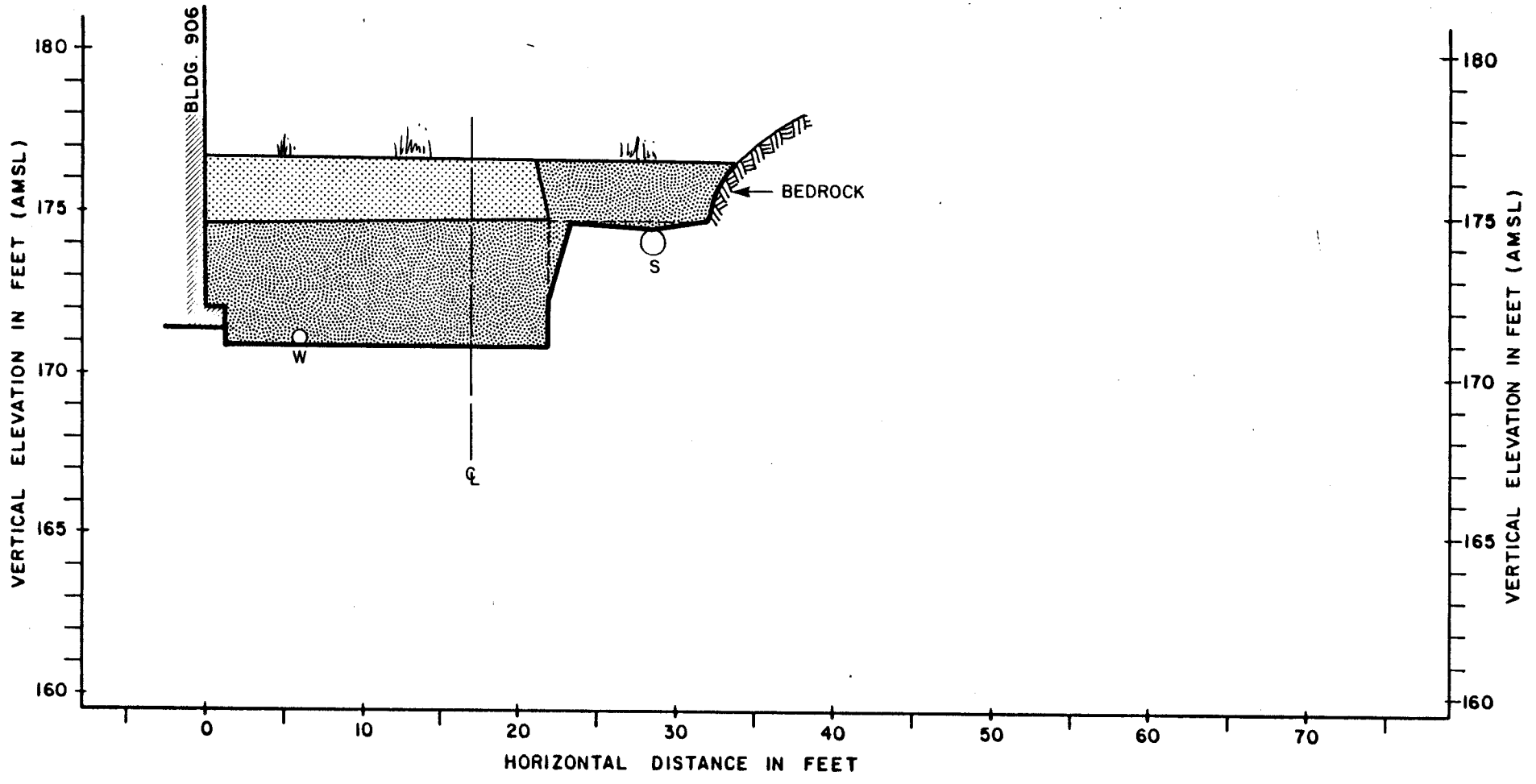
- EXTENT OF SOILS EXCAVATED AND DISPOSED BY SECURE LANDFILL
- EXTENT OF CLEAN SOIL EXCAVATED AND REPLACED
- ----- LIMIT OF SOILS WITH CHEMICAL PRESENCE ORIGINALLY PROPOSED FOR EXCAVATION
- W EXISTING WATERMAIN
- S EXISTING STORM SEWER
- ORIGINAL GROUND
- LIMIT OF SOILS EXCAVATED

figure 33

STATION BO+25.5
AS CONSTRUCTED
CROSS-SECTION EE-EE'
IBM Corporation

CRA

1315-13/1/84



LEGEND

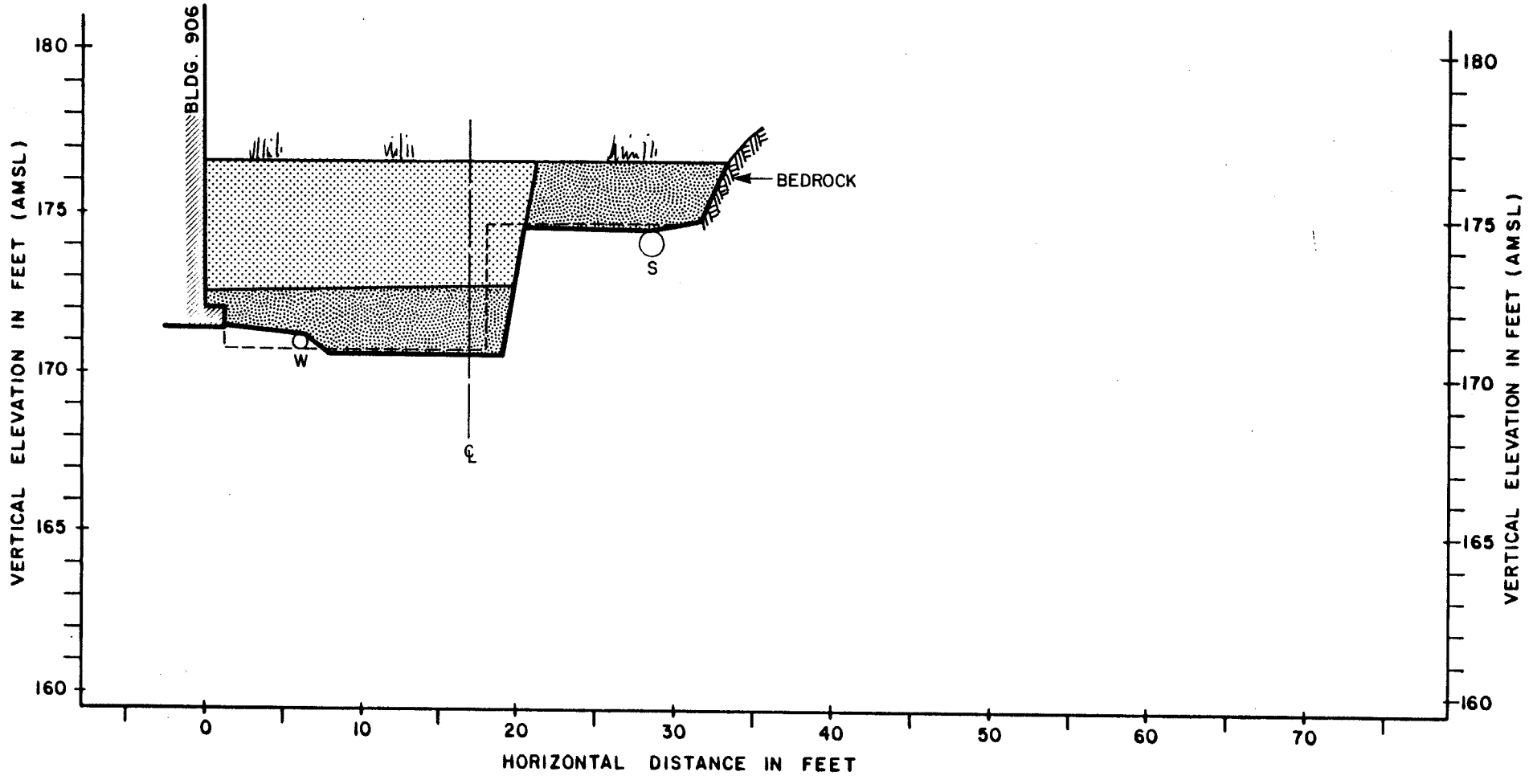
- EXTENT OF SOILS EXCAVATED AND DISPOSED BY SECURE LANDFILL
- EXTENT OF CLEAN SOIL EXCAVATED AND REPLACED
- ----- LIMIT OF SOILS WITH CHEMICAL PRESENCE ORIGINALLY PROPOSED FOR EXCAVATION
- O W EXISTING WATERMAIN
- O S EXISTING STORM SEWER
- ORIGINAL GROUND
- LIMIT OF SOILS EXCAVATED

figure 34

STATION BO+35.7
AS CONSTRUCTED
CROSS-SECTION FF-FF'
IBM Corporation

CRA

1315-13/1/84



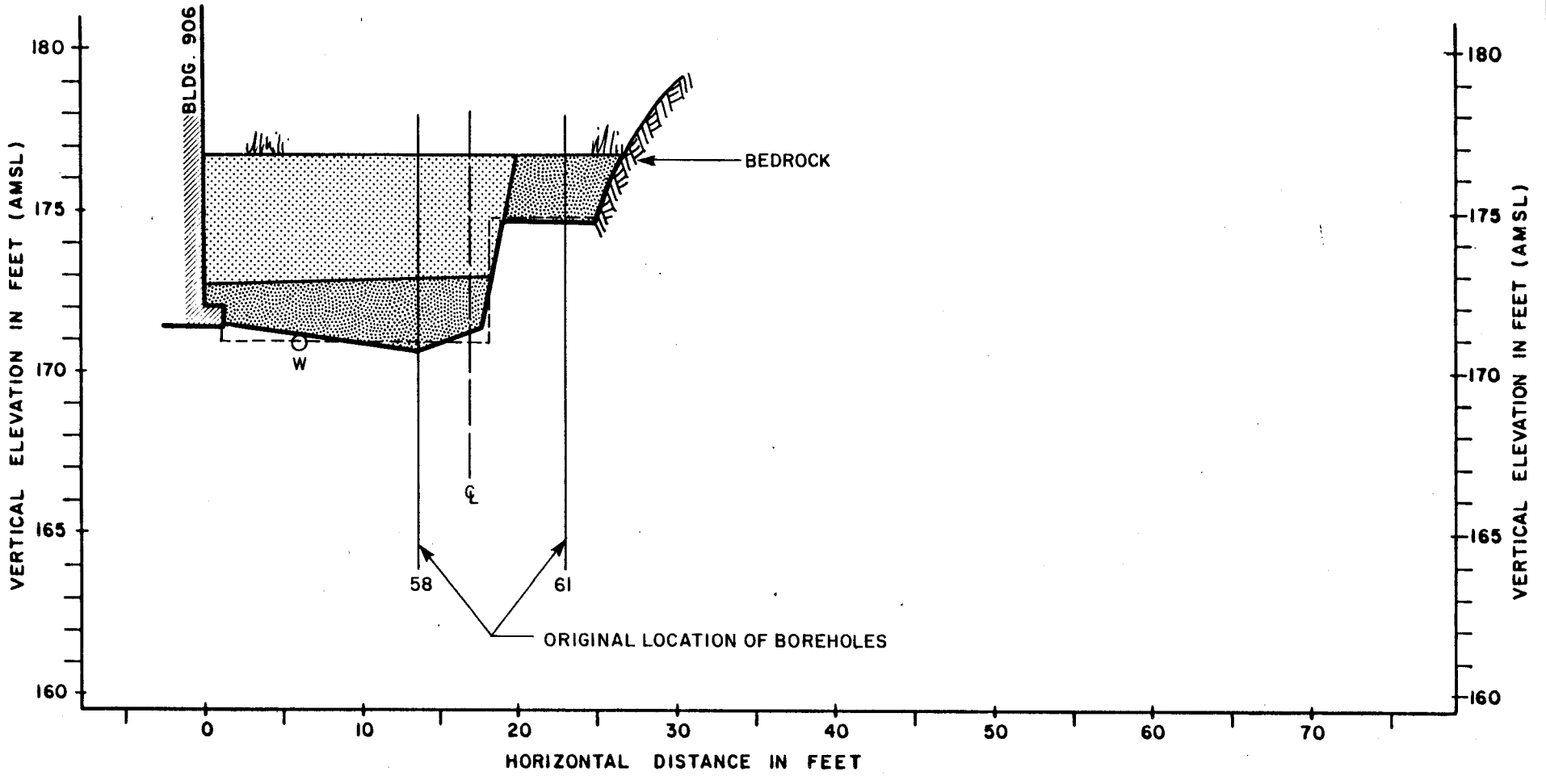
LEGEND

- EXTENT OF SOILS EXCAVATED AND DISPOSED BY SECURE LANDFILL
- EXTENT OF CLEAN SOIL EXCAVATED AND REPLACED
- ----- LIMIT OF SOILS WITH CHEMICAL PRESENCE ORIGINALLY PROPOSED FOR EXCAVATION
- W EXISTING WATERMAIN
- S EXISTING STORM SEWER
- ORIGINAL GROUND
- LIMIT OF SOILS EXCAVATED

figure 35

STATION BO+36.7
AS CONSTRUCTED
CROSS-SECTION GG-GG'
IBM Corporation

CRA



LEGEND

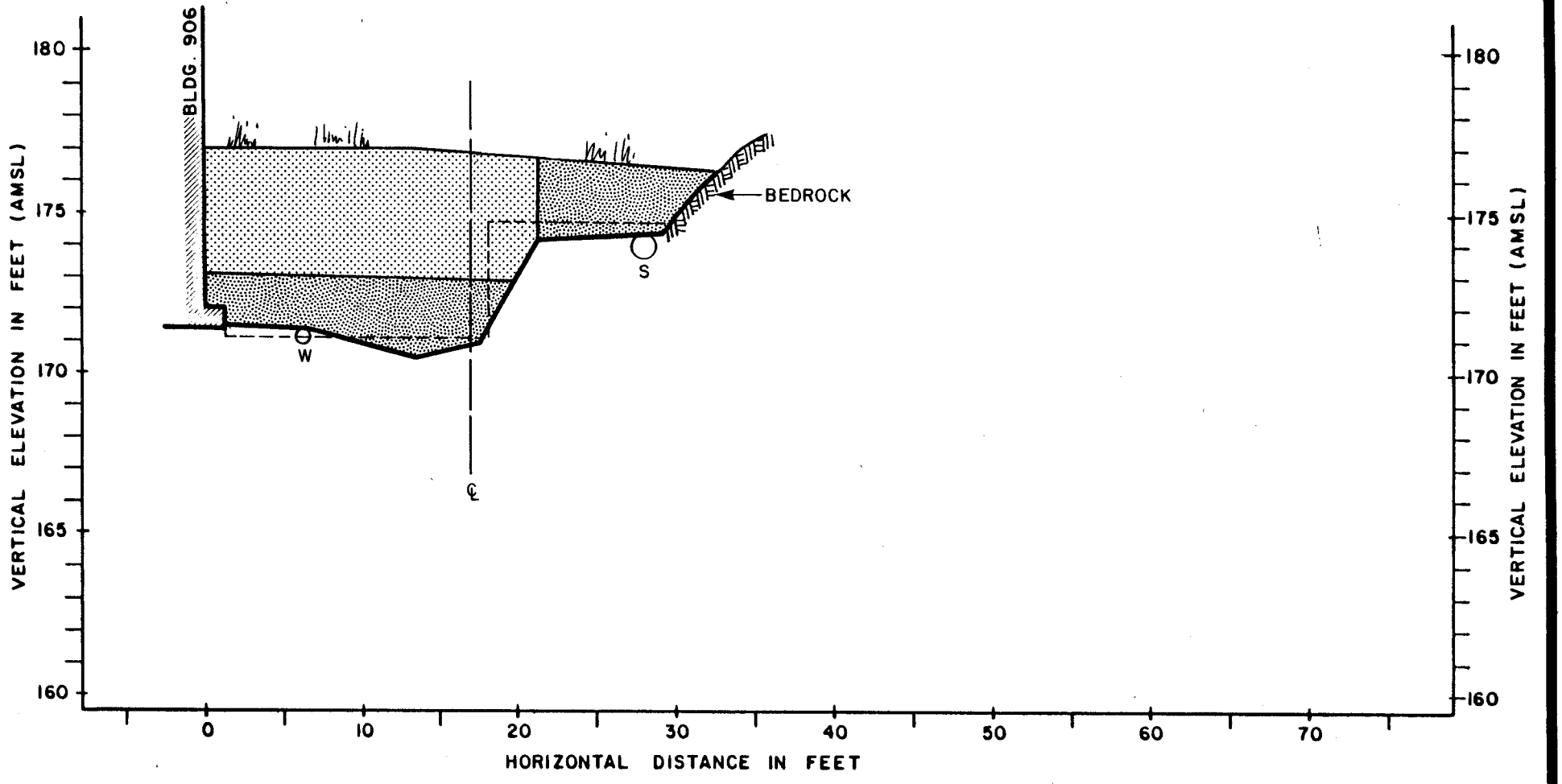
- EXTENT OF SOILS EXCAVATED AND DISPOSED BY SECURE LANDFILL
- EXTENT OF CLEAN SOIL EXCAVATED AND REPLACED
- ----- LIMIT OF SOILS WITH CHEMICAL PRESENCE ORIGINALLY PROPOSED FOR EXCAVATION
- W EXISTING WATERMAIN
- S EXISTING STORM SEWER
- ORIGINAL GROUND
- LIMIT OF SOILS EXCAVATED

figure 36

STATION B0+50.2
AS CONSTRUCTED
CROSS-SECTION HH-HH'
IBM Corporation

CRA

1315-13/1/84



LEGEND

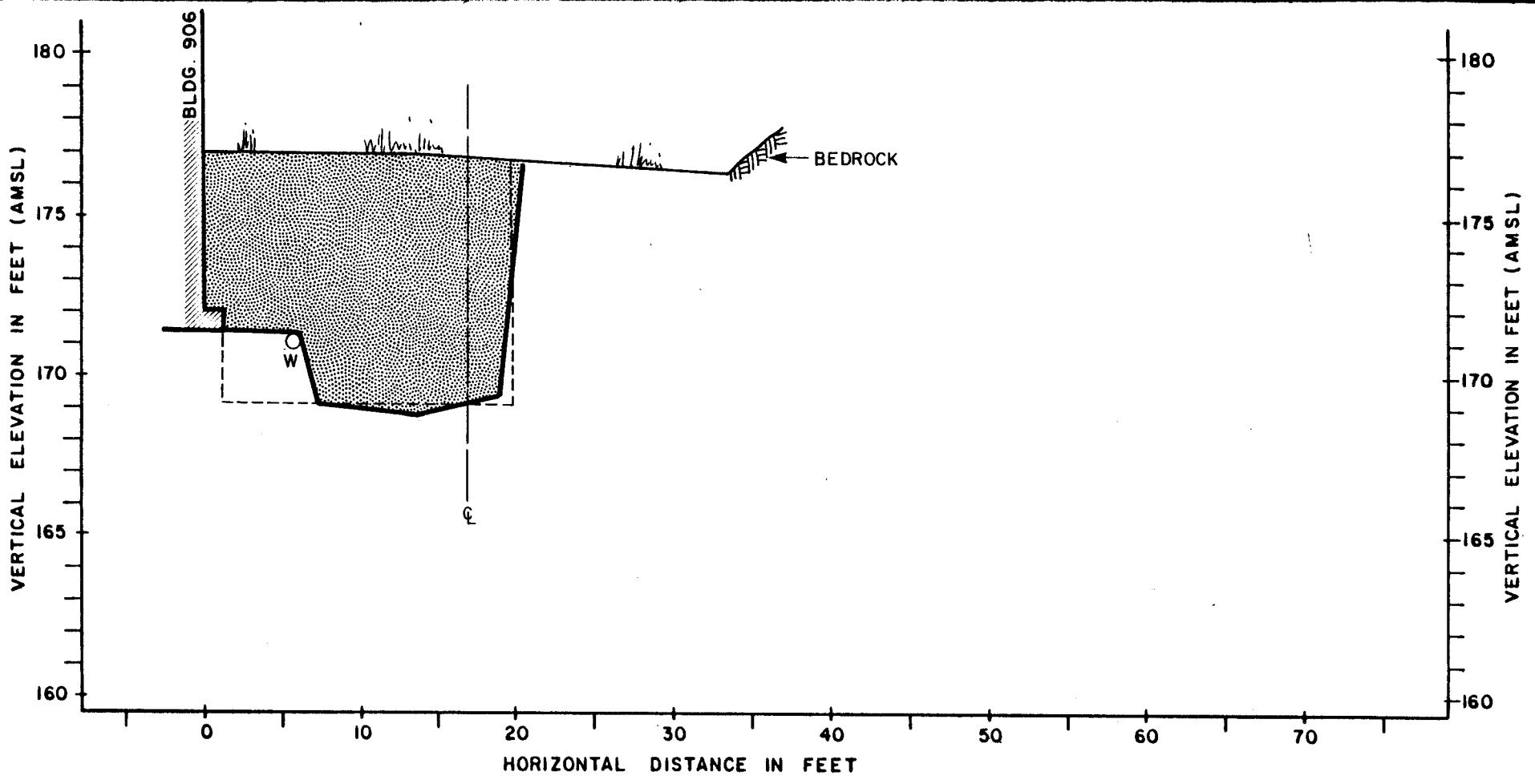
- EXTENT OF SOILS EXCAVATED AND DISPOSED BY SECURE LANDFILL
- EXTENT OF CLEAN SOIL EXCAVATED AND REPLACED
- ----- LIMIT OF SOILS WITH CHEMICAL PRESENCE ORIGINALLY PROPOSED FOR EXCAVATION
- W EXISTING WATERMAIN
- S EXISTING STORM SEWER
- ORIGINAL GROUND
- LIMIT OF SOILS EXCAVATED

figure 37

STATION B0+60.2
AS CONSTRUCTED
CROSS-SECTION II-II'
IBM Corporation

CRA

1315-13/1/84



LEGEND

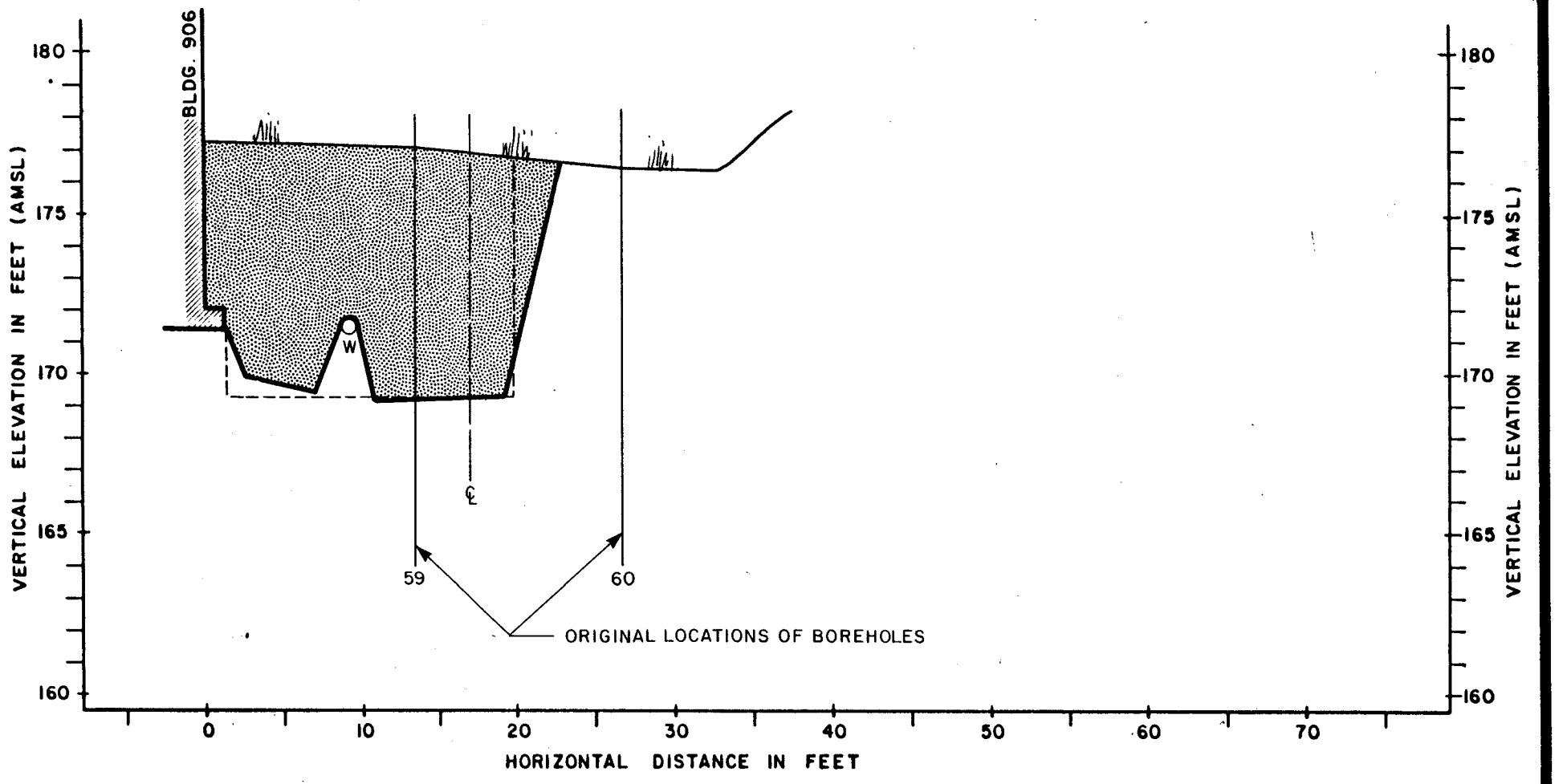
- EXTENT OF SOILS EXCAVATED AND DISPOSED BY SECURE LANDFILL
- N.A. EXTENT OF CLEAN SOIL EXCAVATED AND REPLACED
- ----- LIMIT OF SOILS WITH CHEMICAL PRESENCE ORIGINALLY PROPOSED FOR EXCAVATION
- OW EXISTING WATERMAIN
- ORIGINAL GROUND
- LIMIT OF SOILS EXCAVATED

figure 38

STATION B0+61.7
AS CONSTRUCTED
CROSS-SECTION JJ-JJ'
IBM Corporation

CRA

1315-13/1/84



LEGEND

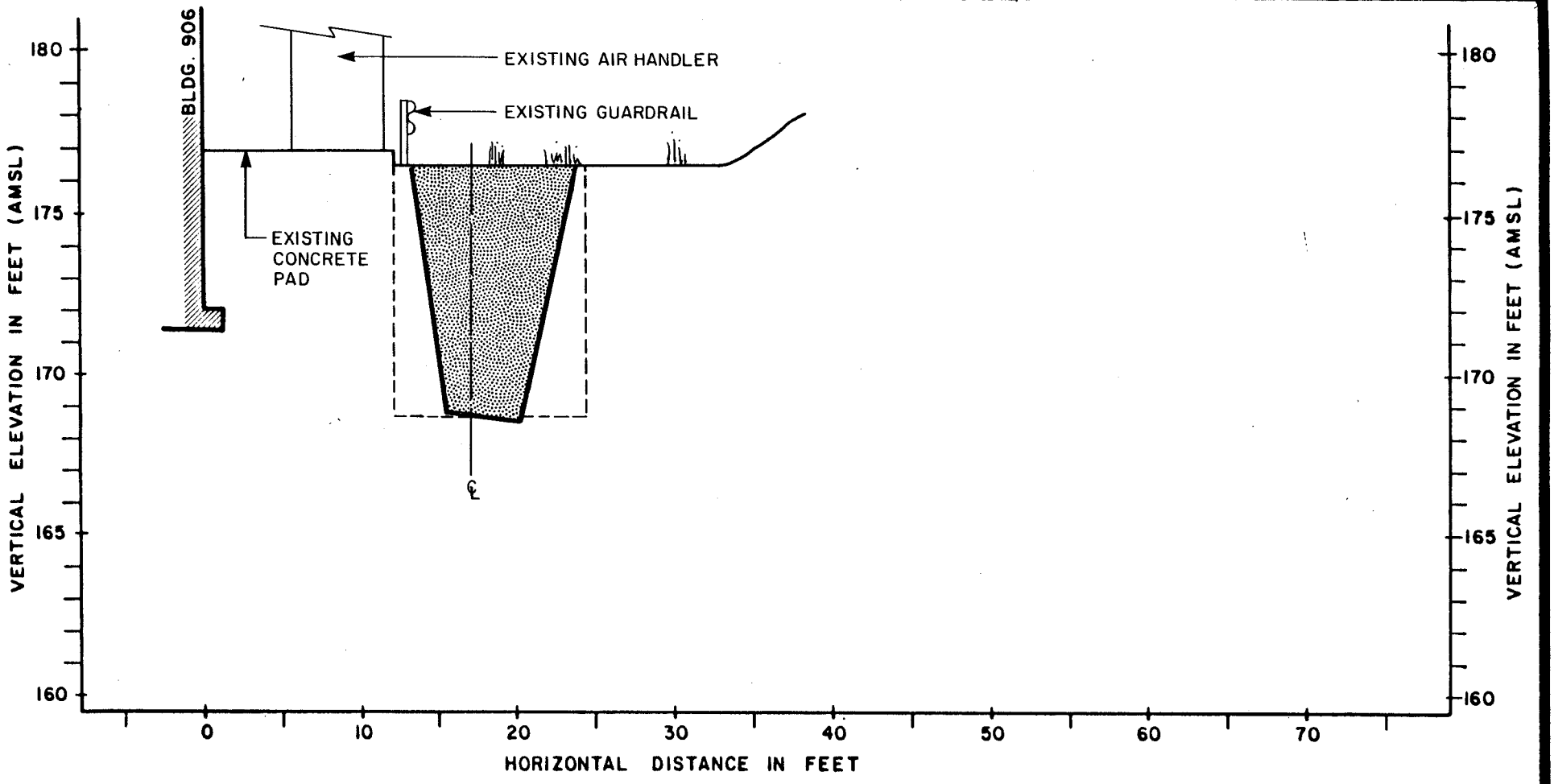
- EXTENT OF SOILS EXCAVATED AND DISPOSED BY SECURE LANDFILL
- N.A. EXTENT OF CLEAN SOIL EXCAVATED AND REPLACED
- ----- LIMIT OF SOILS WITH CHEMICAL PRESENCE ORIGINALLY PROPOSED FOR EXCAVATION
- OW EXISTING WATERMAIN
- ORIGINAL GROUND
- LIMIT OF SOILS EXCAVATED

figure 39

STATION B0+73.3
AS CONSTRUCTED
CROSS-SECTION KK-KK'
IBM Corporation

CRA

1315-13/1/84



LEGEND

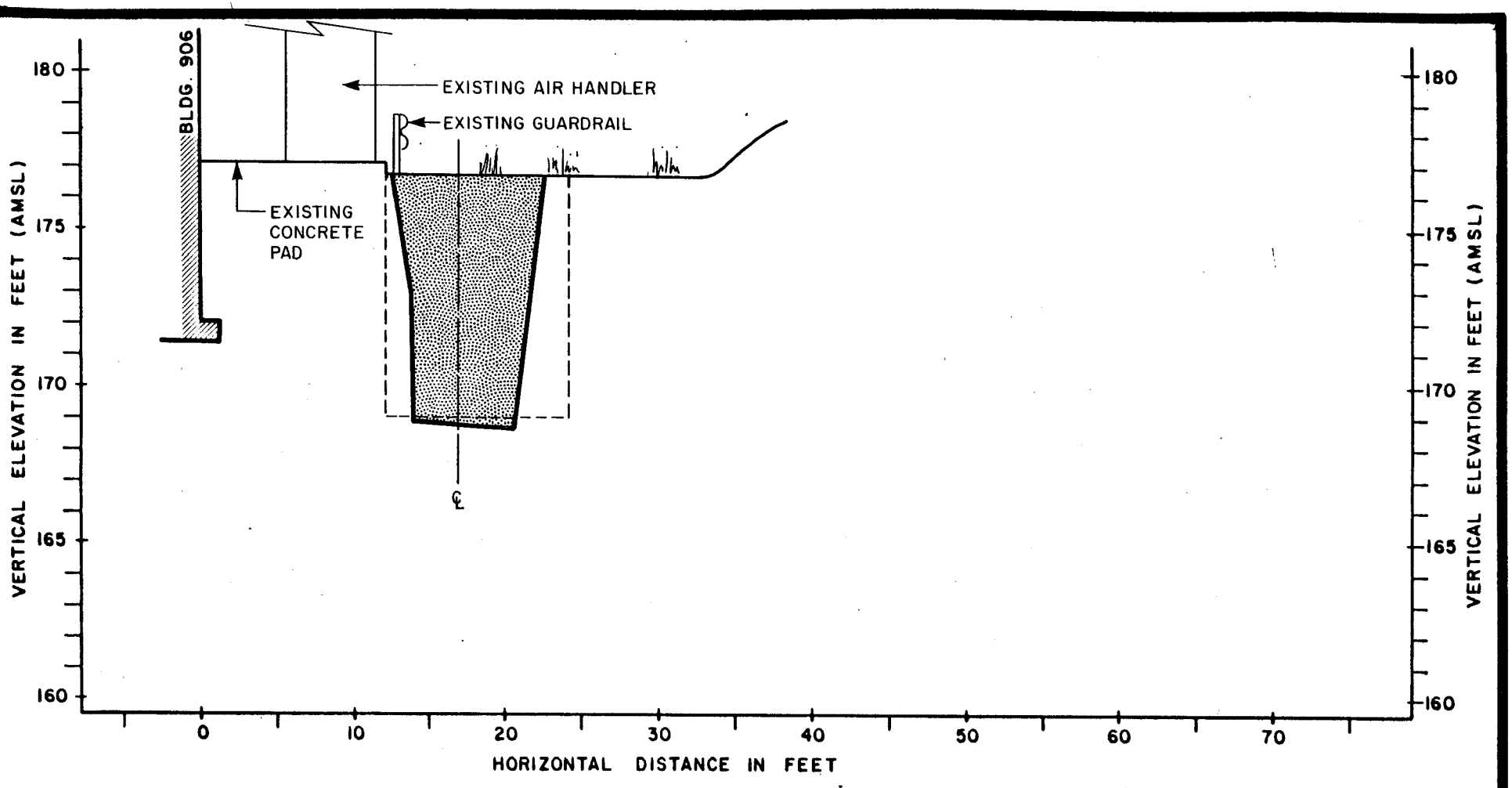
- EXTENT OF SOILS EXCAVATED AND DISPOSED BY SECURE LANDFILL
- N.A. EXTENT OF CLEAN SOIL EXCAVATED AND REPLACED
- ----- LIMIT OF SOILS WITH CHEMICAL PRESENCE ORIGINALLY PROPOSED FOR EXCAVATION
- ORIGINAL GROUND
- LIMIT OF SOILS EXCAVATED

figure 40

STATION B0+78.0
AS CONSTRUCTED
CROSS-SECTION LL-LL'
IBM Corporation

CRA

1315-13/1/84



LEGEND

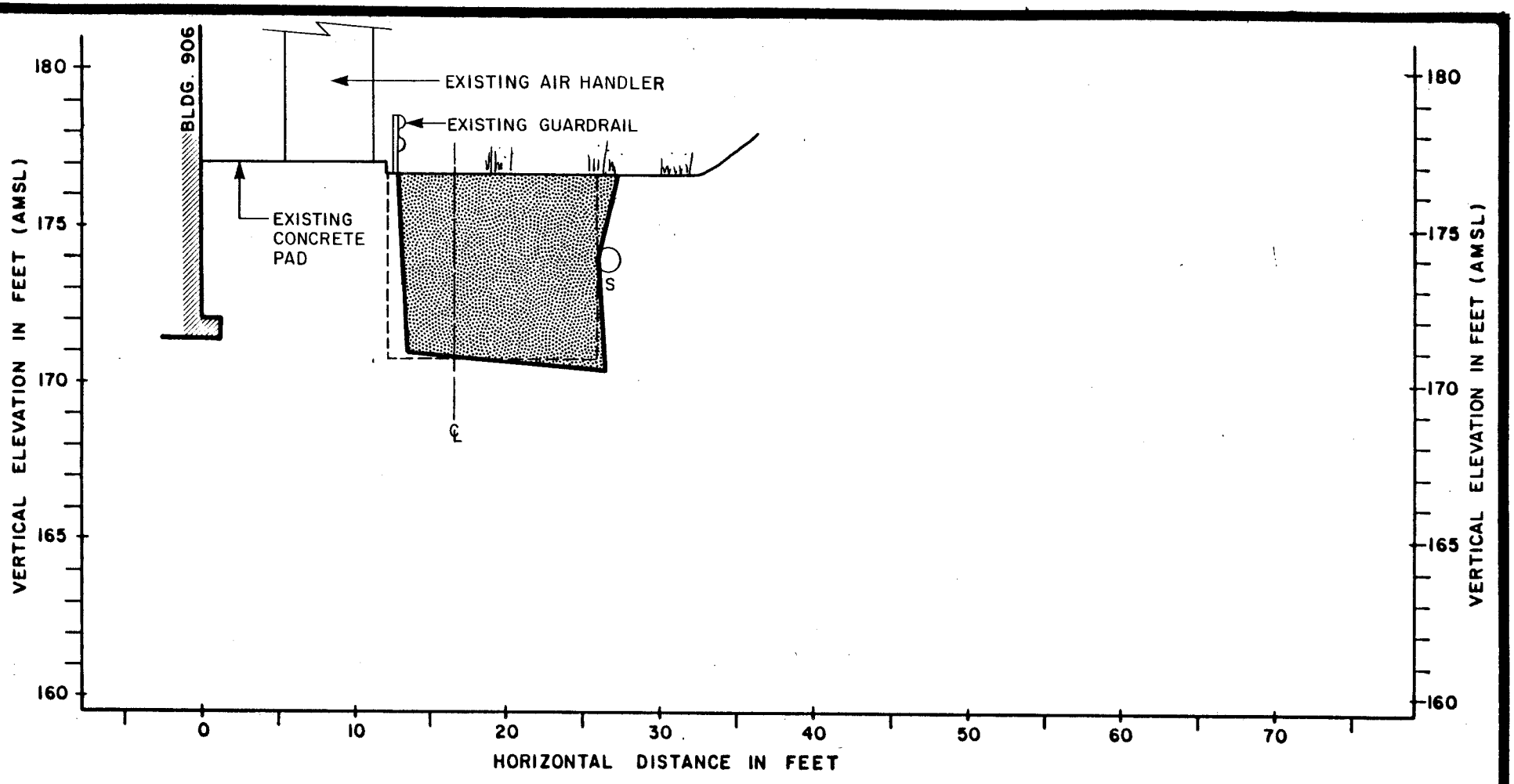
- EXTENT OF SOILS EXCAVATED AND DISPOSED BY SECURE LANDFILL
- N.A. EXTENT OF CLEAN SOIL EXCAVATED AND REPLACED
- ----- LIMIT OF SOILS WITH CHEMICAL PRESENCE ORIGINALLY PROPOSED FOR EXCAVATION
- ORIGINAL GROUND
- LIMIT OF SOILS EXCAVATED

figure 41

STATION B0+98.6
AS CONSTRUCTED
CROSS-SECTION MM-MM'
IBM Corporation

CRA

1315-13/1/84



LEGEND

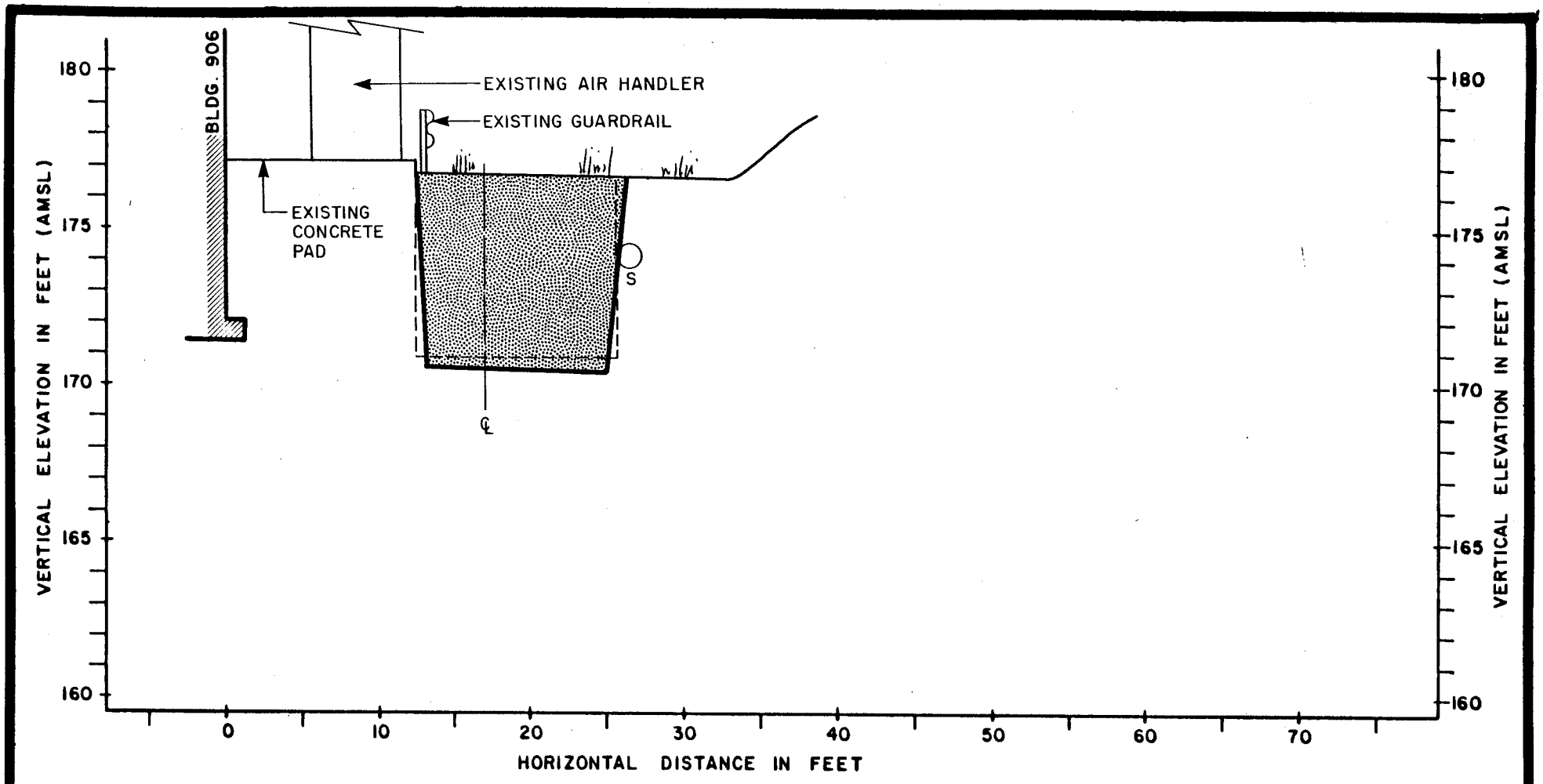
- EXTENT OF SOILS EXCAVATED AND DISPOSED BY SECURE LANDFILL
- N.A. EXTENT OF CLEAN SOIL EXCAVATED AND REPLACED
- ----- LIMIT OF SOILS WITH CHEMICAL PRESENCE ORIGINALLY PROPOSED FOR EXCAVATION
- ○ S EXISTING STORM SEWER
- ORIGINAL GROUND
- LIMIT OF SOILS EXCAVATED

figure 42

STATION B0+99.8
AS CONSTRUCTED
CROSS-SECTION NN-NN'
IBM Corporation

CRA

1315-13/1/84



LEGEND

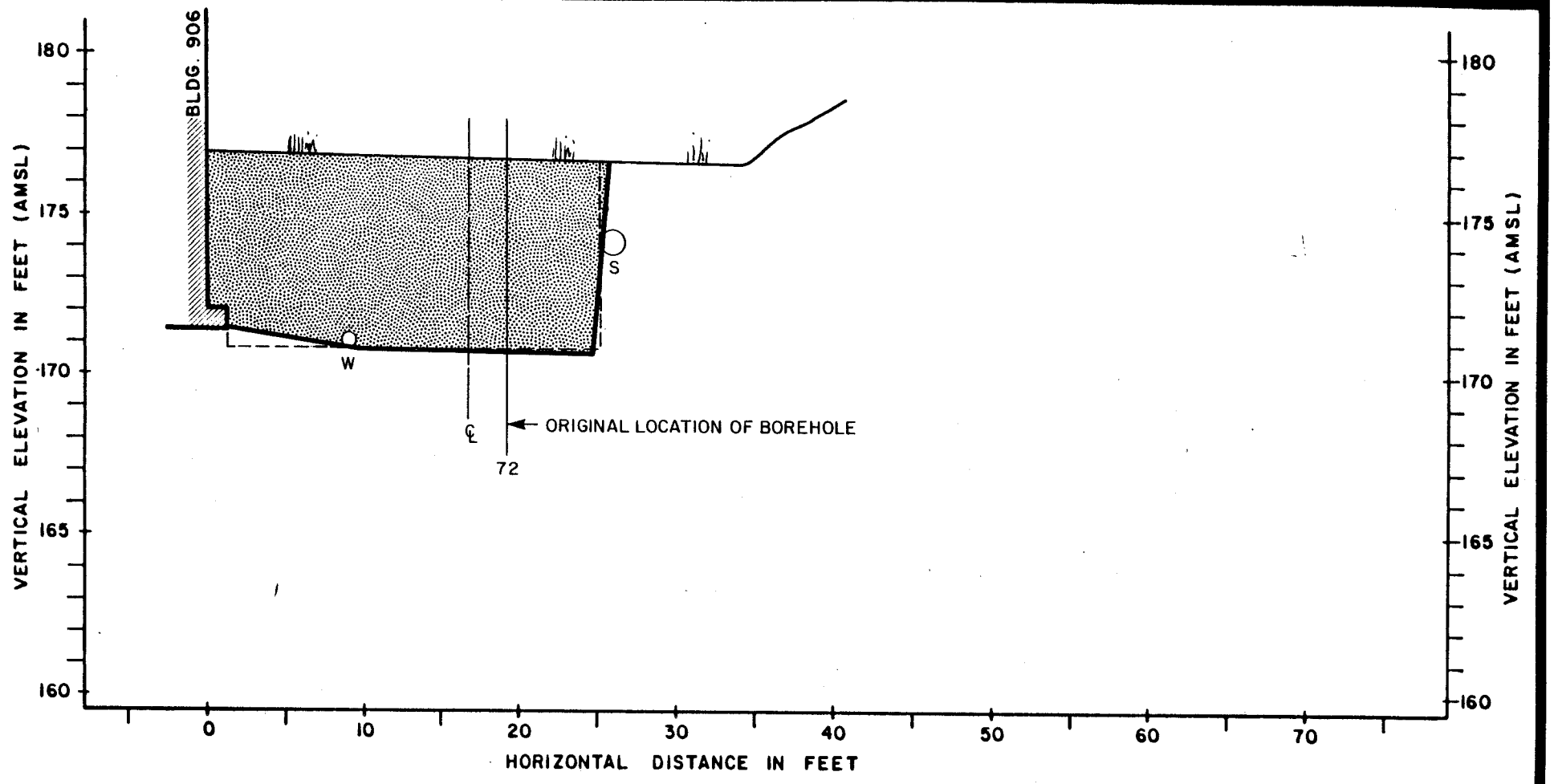
- EXTENT OF SOILS EXCAVATED AND DISPOSED BY SECURE LANDFILL
- N.A. EXTENT OF CLEAN SOIL EXCAVATED AND REPLACED
- ----- LIMIT OF SOILS WITH CHEMICAL PRESENCE ORIGINALLY PROPOSED FOR EXCAVATION
- S EXISTING STORM SEWER
- ORIGINAL GROUND
- LIMIT OF SOILS EXCAVATED

figure 43

STATION B1+22.2
AS CONSTRUCTED
CROSS-SECTION 00-00'
IBM Corporation

CRA

1315-13/1/84



LEGEND

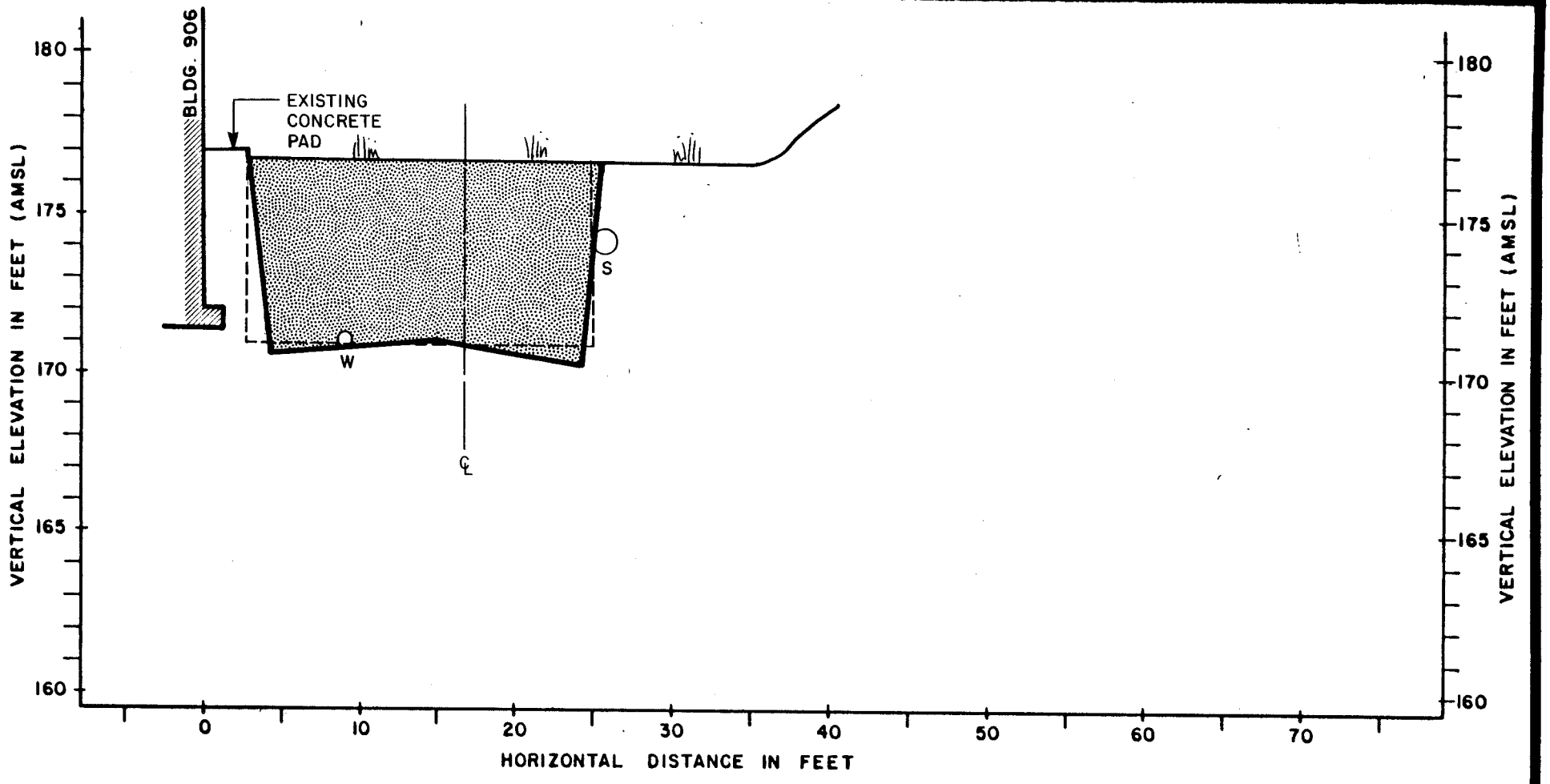
- EXTENT OF SOILS EXCAVATED AND DISPOSED BY SECURE LANDFILL
- N.A. EXTENT OF CLEAN SOIL EXCAVATED AND REPLACED
- ----- LIMIT OF SOILS WITH CHEMICAL PRESENCE ORIGINALLY PROPOSED FOR EXCAVATION
- W EXISTING WATERMAIN
- S EXISTING STORM SEWER
- ORIGINAL GROUND
- LIMIT OF SOILS EXCAVATED

figure 44

STATION B1+27.5
AS CONSTRUCTED
CROSS-SECTION PP-PP'
IBM Corporation

CRA

1315-13/1/84



LEGEND

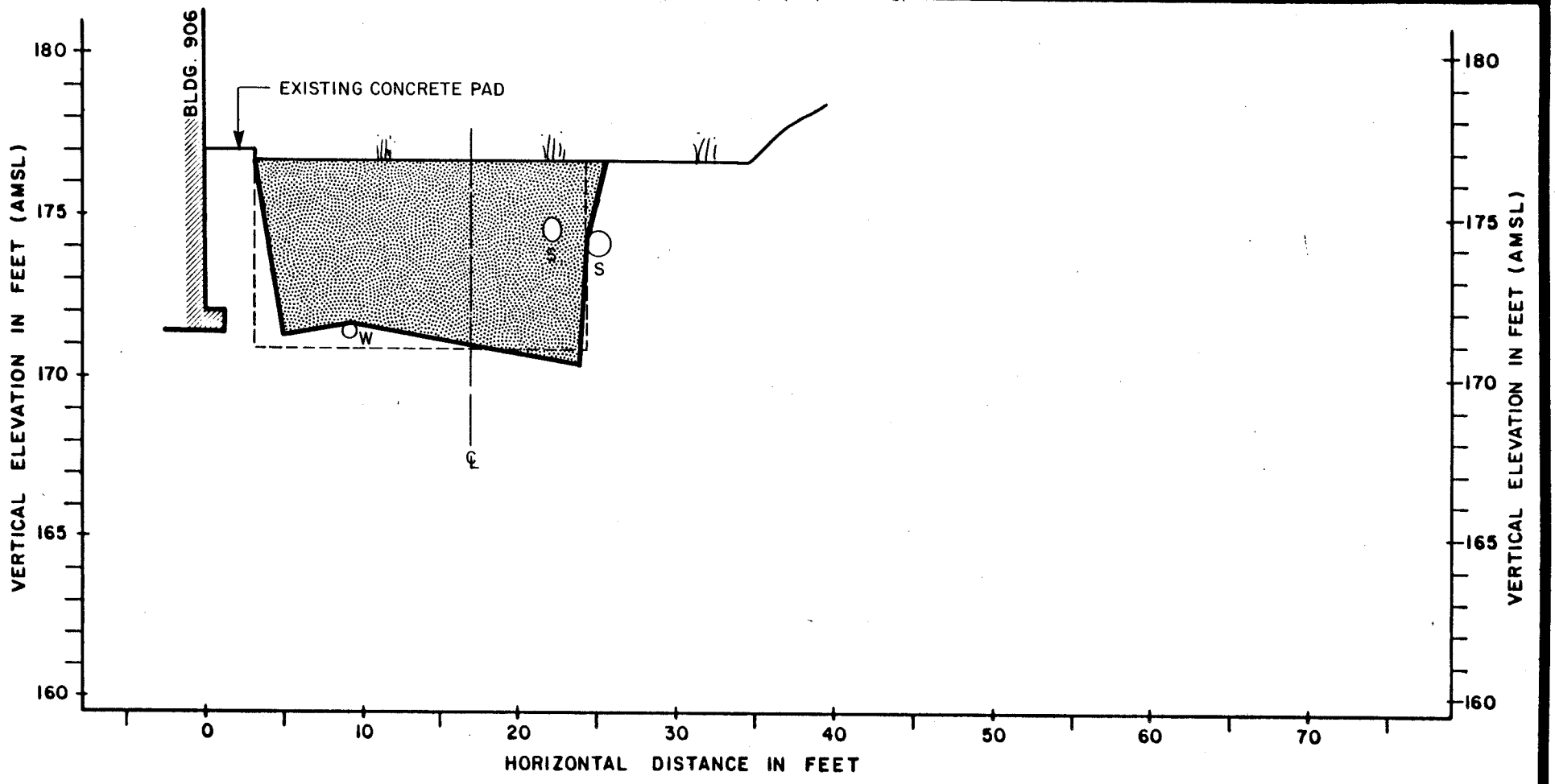
- EXTENT OF SOILS EXCAVATED AND DISPOSED BY SECURE LANDFILL
- N.A. EXTENT OF CLEAN SOIL EXCAVATED AND REPLACED
- ----- LIMIT OF SOILS WITH CHEMICAL PRESENCE ORIGINALLY PROPOSED FOR EXCAVATION
- W EXISTING WATERMAIN
- S EXISTING STORM SEWER
- ORIGINAL GROUND
- LIMIT OF SOILS EXCAVATED

figure 45

STATION B1+33.1
AS CONSTRUCTED
CROSS-SECTION QQ-QQ'
IBM Corporation

CRA

1315-13/1/84



LEGEND

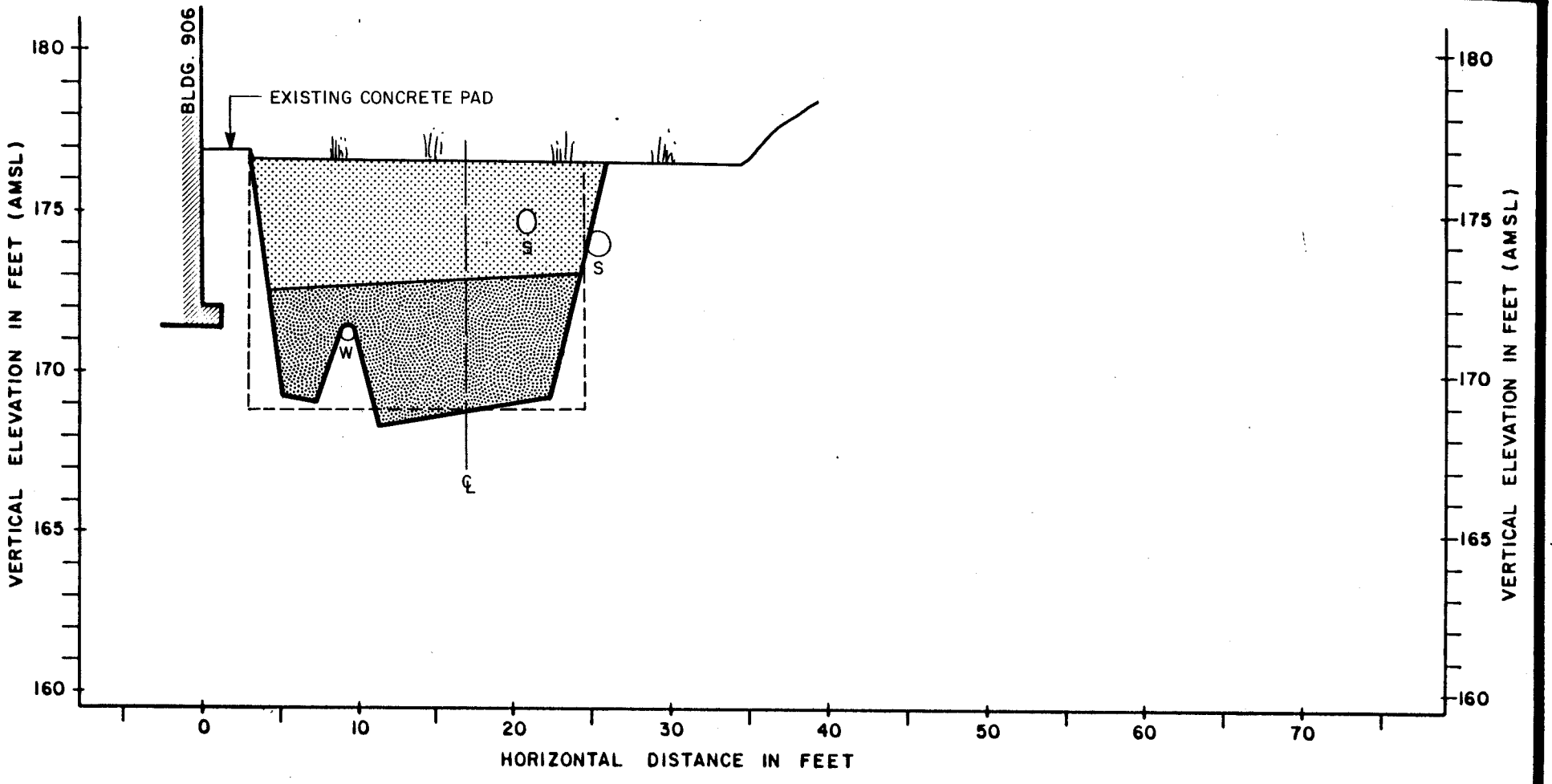
- EXTENT OF SOILS EXCAVATED AND DISPOSED BY SECURE LANDFILL
- N.A. EXTENT OF CLEAN SOIL EXCAVATED AND REPLACED
- ----- LIMIT OF SOILS WITH CHEMICAL PRESENCE ORIGINALLY PROPOSED FOR EXCAVATION
- O W EXISTING WATERMAIN
- O S EXISTING STORM SEWER
- ORIGINAL GROUND
- LIMIT OF SOILS EXCAVATED

figure 46

STATION B1+43.8
AS CONSTRUCTED
CROSS-SECTION RR-RR'
IBM Corporation

CRA

1315-13/1/84



LEGEND

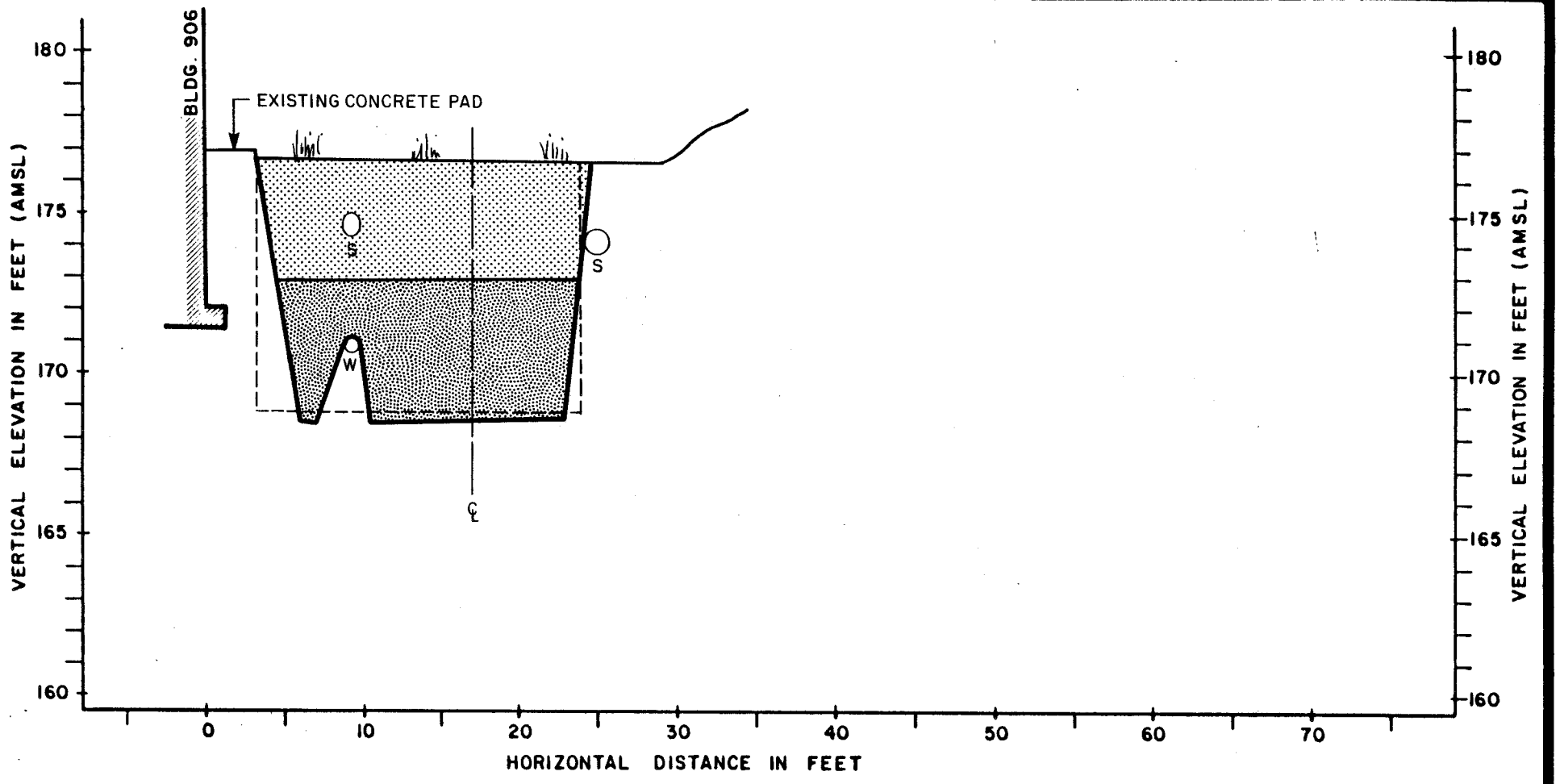
- EXTENT OF SOILS EXCAVATED AND DISPOSED BY SECURE LANDFILL
- EXTENT OF CLEAN SOIL EXCAVATED AND REPLACED
- ----- LIMIT OF SOILS WITH CHEMICAL PRESENCE ORIGINALLY PROPOSED FOR EXCAVATION
- W EXISTING WATERMAIN
- S EXISTING STORM SEWER
- ORIGINAL GROUND
- LIMIT OF SOILS EXCAVATED

figure 47

STATION B1+44.9
AS CONSTRUCTED
CROSS-SECTION SS-SS'
IBM Corporation

CRA

1315-13/1/84



LEGEND

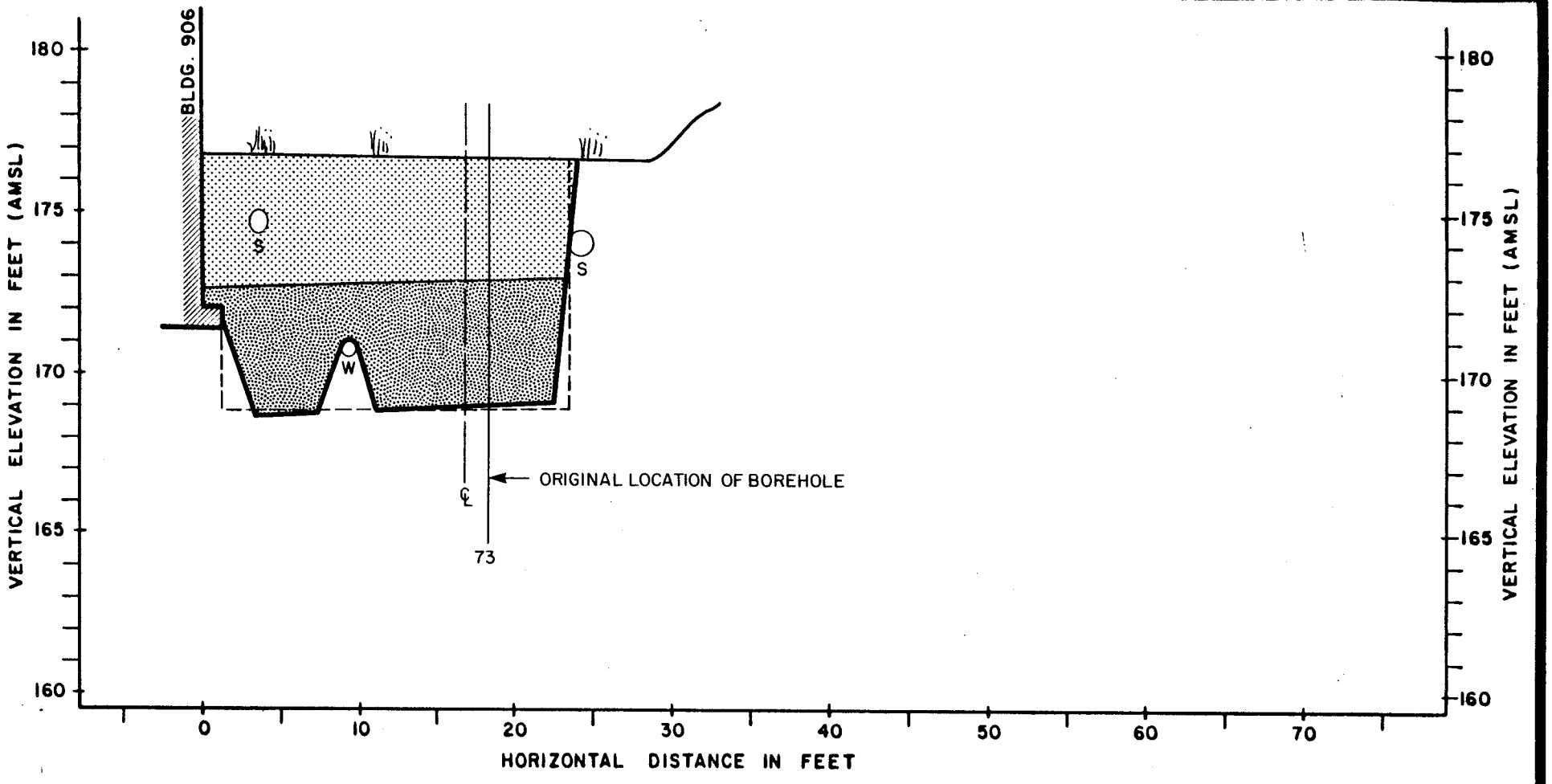
- EXTENT OF SOILS EXCAVATED AND DISPOSED BY SECURE LANDFILL
- EXTENT OF CLEAN SOIL EXCAVATED AND REPLACED
- ----- LIMIT OF SOILS WITH CHEMICAL PRESENCE ORIGINALLY PROPOSED FOR EXCAVATION
- O W EXISTING WATERMAIN
- O S EXISTING STORM SEWER
- ORIGINAL GROUND
- LIMIT OF SOILS EXCAVATED

figure 48

STATION B1+53.5
AS CONSTRUCTED
CROSS-SECTION TT-TT'
IBM Corporation

CRA

1315-13/1/84



LEGEND

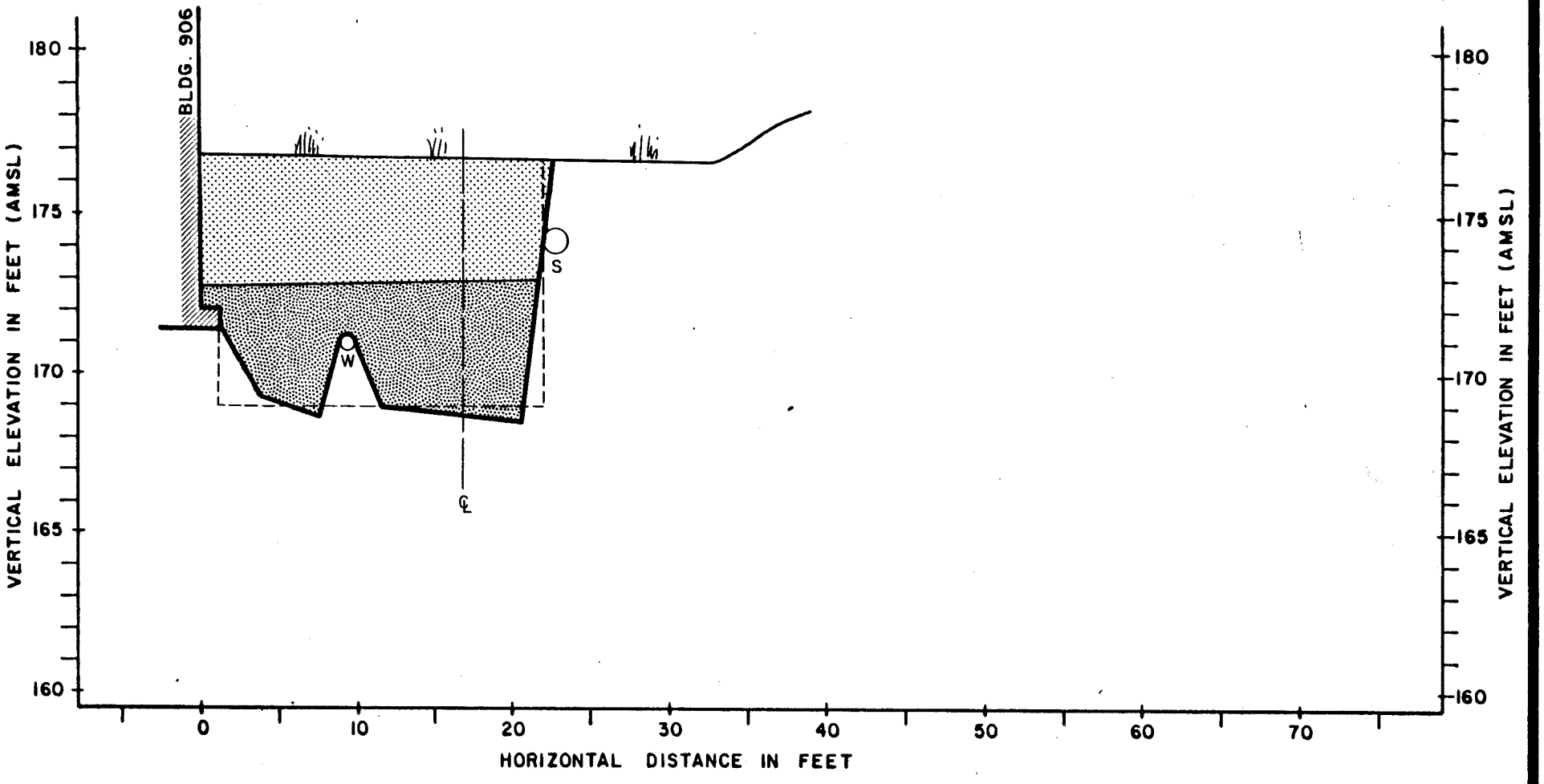
- EXTENT OF SOILS EXCAVATED AND DISPOSED BY SECURE LANDFILL
- EXTENT OF CLEAN SOIL EXCAVATED AND REPLACED
- ----- LIMIT OF SOILS WITH CHEMICAL PRESENCE ORIGINALLY PROPOSED FOR EXCAVATION
- O W EXISTING WATERMAIN
- O S EXISTING STORM SEWER
- ORIGINAL GROUND
- LIMIT OF SOILS EXCAVATED

figure 49

STATION B1+61.0
AS CONSTRUCTED
CROSS-SECTION UU-UU'
IBM Corporation

CRA

1315-13/1/84



LEGEND

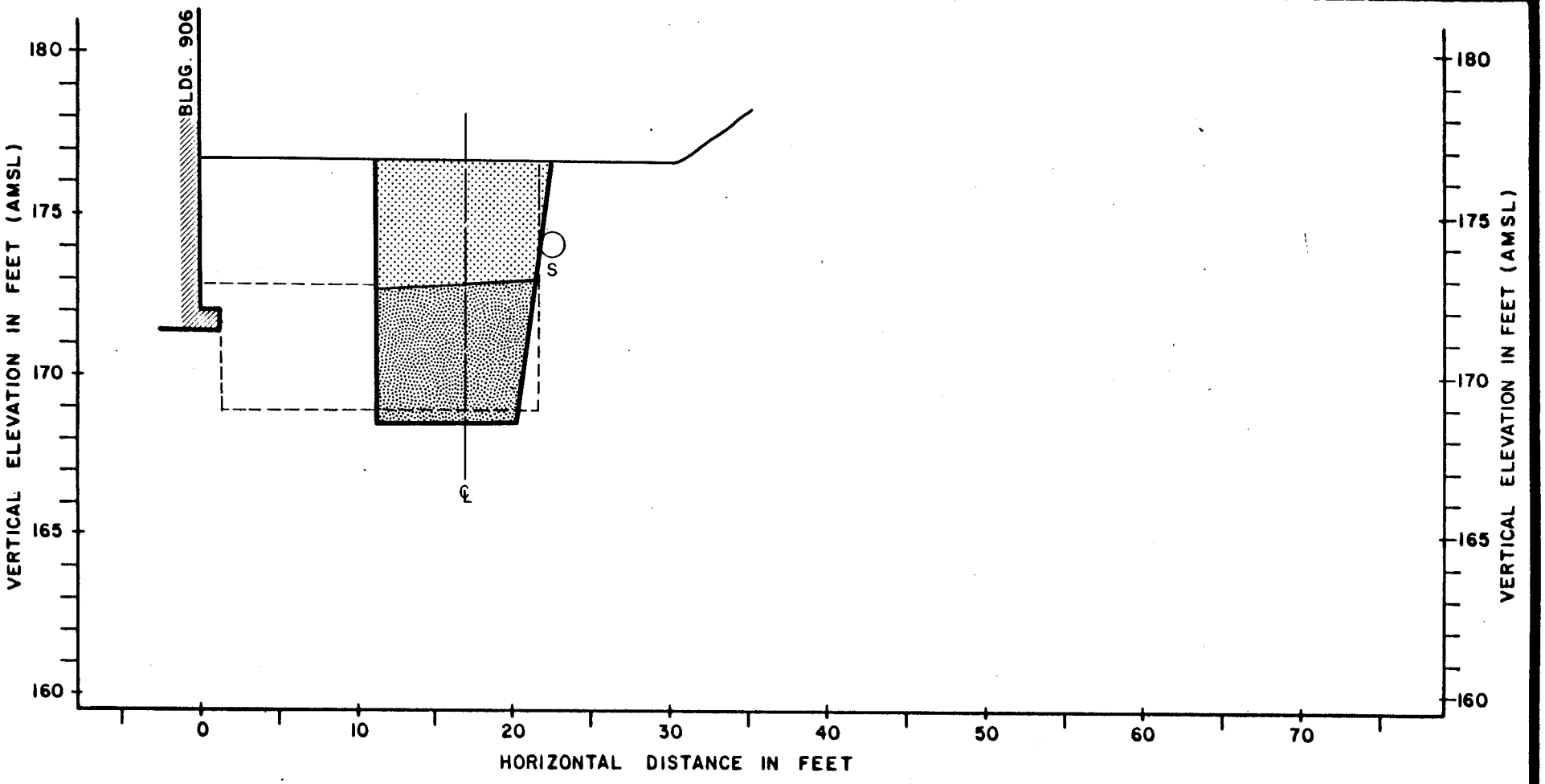
- EXTENT OF SOILS EXCAVATED AND DISPOSED BY SECURE LANDFILL
- EXTENT OF CLEAN SOIL EXCAVATED AND REPLACED
- ----- LIMIT OF SOILS WITH CHEMICAL PRESENCE ORIGINALLY PROPOSED FOR EXCAVATION
- W EXISTING WATERMAIN
- S EXISTING STORM SEWER
- ORIGINAL GROUND
- LIMIT OF SOILS EXCAVATED

figure 50

STATION B1+91.9
AS CONSTRUCTED
CROSS-SECTION VV-VV'
IBM Corporation

CRA

1315-13/1/84



LEGEND

EXTENT OF SOILS EXCAVATED AND DISPOSED BY SECURE LANDFILL

EXTENT OF CLEAN SOIL EXCAVATED AND REPLACED

----- LIMIT OF SOILS WITH CHEMICAL PRESENCE ORIGINALLY PROPOSED FOR EXCAVATION

S EXISTING STORM SEWER

ORIGINAL GROUND

LIMIT OF SOILS EXCAVATED

figure 51

STATION B2+01.1
AS CONSTRUCTED
CROSS-SECTION WW-WW'
IBM Corporation

CRA

1315-13/1/84

representative and the site safety officer deemed the power lines a potential safety hazard and prohibited excavation equipment from working beneath or directly adjacent to them. Consequently, depths of excavation were less than designed in these area.

(iii) Six-Inch Diameter Watermain

A 6-inch diameter watermain traversed the site on both the north and west sides of the building. The main was known to have been in existence for in excess of 20 years and its degree of structural integrity was uncertain. Site soils beneath the main and throughout much of the site are composed of fine sands which appeared to have an angle of natural repose no less than 45 degrees. In addition, to servicing Building 906 and other IBM facilities, the main provided the only service to at least two other industries in the area. Because of the large potential for structural damage and/or rupture, excavation of soils beneath or immediately adjacent to the watermain was not attempted.

iii) Utility Conduits

A set of three 3-inch diameter PVC utility conduits existed under the site north of Building 906. The conduits contain communication lines to Building 906 and other IBM facilities. Because of the potential for severe disturbance to IBM operations in the event of conduit breakage, soils were not excavated immediately below the conduits.

Table 2 and Table 3 provide the as constructed excavation end area calculations for the "A" Sections and "B" Sections respectively. The tables provide volumes for soils excavated and disposed off-site, excavated and reused as backfill, total soil excavation, and the soils originally intended for excavation but left in place for reasons provided above.

4.2.4 Excavation and Backfill Methodology

Prior to the commencement of excavation, the areal limits of the extent of

TABLE 2

AS CONSTRUCTED END AREA CALCULATIONS

"A SECTIONS"

CROSS-SECTION	STATION	DISTANCE	DOUBLE DISTANCE	(A) MEAN DISTANCE	SOILS DISPOSED (B) END AREA (FT^2)	SOILS DISPOSED A x B ÷ 27 VOLUME (C.Y.)	SOILS REPLACED (C) END AREA (FT^2)	SOILS REPLACED A x C ÷ 27 VOLUME (C.Y.)	TOTAL SOILS (D) END AREA (FT^2)	TOTAL SOILS A x D ÷ 27 VOLUME (C.Y.)	SOILS UNDEREXCAVATED (E) END AREA (FT^2)	SOILS UNDEREXCAVATED A x E ÷ 27 VOLUME (C.Y.)
		0										
A-A'	0+00.0	4.8	4.8	2.40	84.14	7.48	--	--	84.14	7.48	26.52	2.36
B-B'	0+04.8	10.5	15.3	7.65	75.59	21.41	--	--	75.59	21.41	22.05	6.25
C-C'	0+15.3	4.0	14.5	7.25	97.49	26.18	--	--	97.49	26.18	4.46	1.20
D-D'	0+19.3	4.4	8.4	4.20	74.25	11.15	--	--	74.25	11.55	18.15	2.82
E-E'	0+23.7	13.7	18.1	9.05	188.05	63.03	--	--	188.05	63.03	79.38	26.61
F-F'	0+37.4	26.4	40.1	20.05	229.31	170.28	--	--	229.31	170.28	91.63	68.04
G-G'	0+63.8	25.7	52.1	26.05	205.97	198.72	--	--	205.97	198.72	21.34	20.59
H-H'	0+89.5	18.0	43.7	21.85	179.92	145.60	400.64	324.22	580.56	469.82	3.40	2.75
I-I'	1+07.5	14.3	32.3	16.15	224.71	134.41	214.34	128.21	439.05	262.62	62.19	37.20
J-J'	1+21.8	14.1	28.4	14.20	290.80	152.94	20.51	10.79	311.31	163.73	26.59	13.98
K-K'	1+35.9	14.3	28.4	14.20	47.40	24.93	--	--	47.40	24.93	--	--
L-L'	1+50.2	16.6	30.9	15.45	89.28	51.09	61.82	35.37	151.10	86.46	0.50	0.28
M-M'	1+66.8	15.5	32.1	16.05	70.71	42.03	--	--	70.71	42.03	1.36	0.81
N-N'	1+82.3	13.0	28.5	14.25	77.89	41.11	--	--	77.89	41.11	1.88	0.99
O-O'	1+95.3	18.0	31.0	15.50	78.94	45.32	52.83	30.33	131.77	75.65	24.85	14.27
P-P'	2+13.3	12.9	30.9	15.45	195.52	111.88	76.66	43.87	272.18	155.75	56.18	32.15
Q-Q'	2+26.2	15.0	27.9	13.95	354.13	182.97	33.33	17.22	387.46	200.19	32.38	16.73
R-R'	2+41.2	15.3	30.3	15.15	283.27	158.95	169.28	94.98	452.55	253.93	32.94	18.48
S-S'	2+56.5	14.7	30.0	15.00	170.33	94.63	98.29	54.61	268.62	149.24	Nil	--
T-T'	2+71.2	14.3	29.0	14.50	204.79	109.98	62.21	33.41	267.00	143.39	30.95	16.62
U-U'	2+85.5	6.5	20.8	10.40	217.14	83.64	104.58	40.28	321.72	123.92	3.32	1.28
V-V'	2+92.0	2.6	9.1	4.55	188.72	31.80	114.54	19.30	303.26	51.10	3.17	0.53
End of Ex-cavation	2+94.6	0	2.6	1.3	0	0	0	0	0	0	0	0
						1909.93		832.59		2742.52		283.94

TABLE 3

AS CONSTRUCTED END AREA CALCULATIONS

"B SECTIONS"

CROSS-SECTION	STATION	DISTANCE	DOUBLE DISTANCE	(A) MEAN DISTANCE	SOILS DISPOSED (B) END AREA (FT^2)	SOILS DISPOSED A x B ÷ 27 VOLUME (C.Y.)	SOILS REPLACED (C) END AREA (FT^2)	SOILS REPLACED A x C ÷ 27 VOLUME (C.Y.)	TOTAL SOILS (D) END AREA (FT^2)	TOTAL SOILS A x D ÷ 27 VOLUME (C.Y.)	SOILS UNDEREXCAVATED (E) END AREA (FT^2)	SOILS UNDEREXCAVATED A x E ÷ 27 VOLUME (C.Y.)
		0										
AA-AA'	0+00		9.9	4.95	97.72	17.92	81.72	14.98	179.44	32.90	12.61	2.31
		9.9										
BB-BB'	0+09.9		16.8	8.40	84.99	26.44	83.71	26.04	168.70	52.48	11.56	3.60
		6.9										
CC-CC'	0+16.8		7.9	3.95	78.24	11.45	84.59	12.38	162.83	23.83	9.57	1.40
		1.0										
DD-DD'	0+17.8		8.7	4.35	139.25	22.43	40.87	6.58	180.12	29.01	3.40	0.55
		7.7										
EE-EE'	0+25.5		17.9	8.95	114.20	37.86	50.05	16.59	164.25	54.45	0.53	0.18
		10.2										
FF-FF'	0+35.7		11.2	5.60	114.47	23.74	41.44	8.59	155.91	32.33	--	--
		1.0										
GG-GG'	0+36.7		14.5	7.25	59.79	16.05	84.19	22.61	143.98	38.66	3.31	0.89
		13.5										
HH-HH'	0+50.2		23.5	11.75	54.51	23.72	77.13	33.57	131.64	57.29	2.72	1.18
		10.0										
II-II'	0+60.2		11.5	5.75	59.32	12.63	84.75	18.05	144.07	30.68	1.76	0.37
		1.5										
JJ-JJ'	0+61.7		13.1	6.55	142.22	34.50	--	--	142.22	34.50	13.49	3.27
		11.6										
KK-KK'	0+73.3		16.3	8.15	156.82	47.34	--	--	156.82	47.34	6.14	1.85
		4.7										
LL-LL'	0+78.0		25.3	12.65	63.22	29.62	--	--	63.22	29.62	5.56	2.60
		20.6										
MM-MM'	0+98.6		21.8	10.90	66.98	27.04	--	--	66.98	27.04	0.24	0.10
		1.2										
NN-NN'	0+99.8		23.6	11.80	82.26	35.95	--	--	82.26	35.95	2.16	0.94
		22.4										
OO-OO'	1+22.2		27.7	13.85	83.54	42.85	--	--	83.54	42.85	1.05	0.54
		5.3										
PP-PP'	1+27.5		10.9	5.45	151.98	30.68	--	--	151.98	30.68	2.92	0.59
		5.6										
QQ-QQ'	1+33.1		16.3	8.15	137.26	41.43	--	--	137.26	41.43	1.12	0.34
		10.7										
RR-RR'	1+43.8		11.8	5.90	119.58	26.13	--	--	119.58	26.13	8.60	1.88
		1.1										
SS-SS'	1+44.9		9.7	4.85	72.64	13.05	83.09	14.93	155.73	27.98	8.08	1.45
		8.6										
TT-TT'	1+53.5		16.1	8.05	77.25	23.03	78.12	23.29	155.37	46.32	4.39	1.31
		7.5										
UU-UU'	1+61.0		38.4	19.20	82.61	58.74	96.29	68.47	178.90	127.21	0.95	0.68
		30.9										
VV-VV'	1+91.9		40.1	20.05	74.49	55.32	89.31	66.32	163.80	121.64	2.53	1.88
		9.2										
WW-WW'	2+01.1		9.2	4.60	42.41	7.23	43.69	7.44	86.10	14.67	37.62	6.41
		0										
TOTALS						665.15		339.84		1004.99		34.32

excavation were laid out by placing spray paint lines on the surficial asphalt. The areal limits of excavation for each borehole were defined as the mid-points between adjacent boreholes. A plan view of these limits is provided in Figure 52. Analytical data for each borehole were assumed typical for all soils over the excavation unit at each depth interval. Ground elevations were then surveyed using a dumpy level and surveyors rod.

Following the layout of excavation limits, an International D7E tilt blade dozer was used to break up the asphalt. A Case Drott 35D track backhoe equipped with a wide ditch bucket then excavated the broken asphalt and placed this material into a lined and sealed tractor/trailer unit. Photographs 20 and 21 illustrate these pieces of equipment.

As excavation continued, soils deemed suitable for reuse as backfill were stockpiled adjacent to the excavation and soils designated for disposal were placed in the lined tractor/trailer unit.

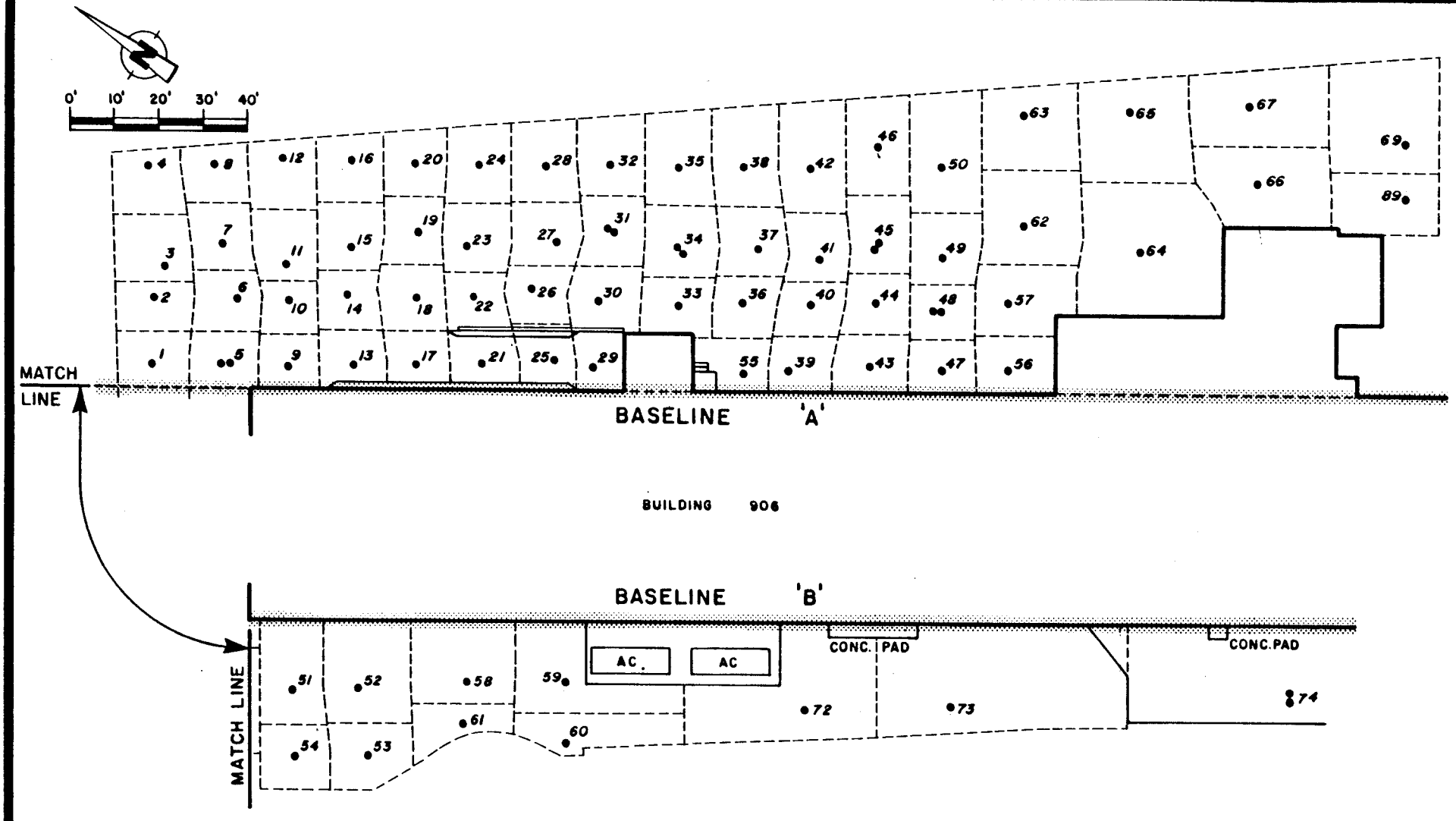


figure 52

EXCAVATION UNIT
AREAL LIMITS
IBM Corporation

CRA

1315-13/1/84

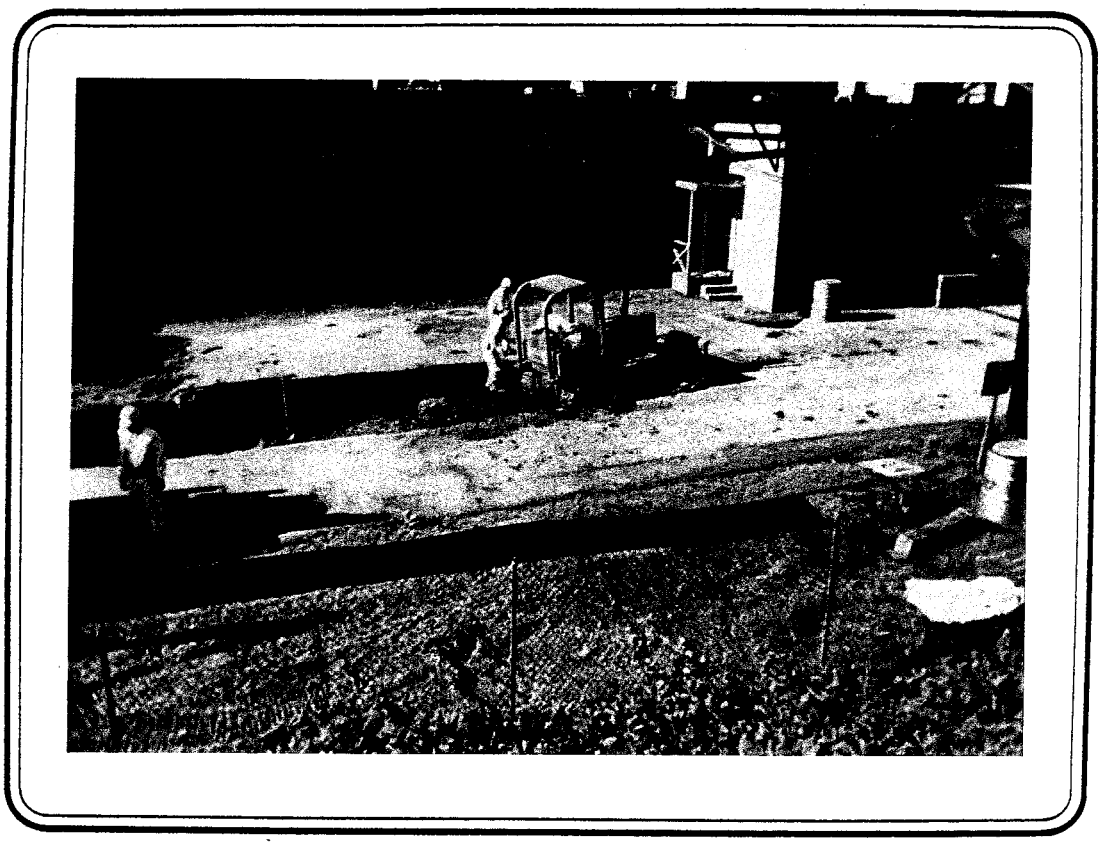


PHOTO 20
D7E TILT BLADE DOZER BACKFILLING EXCAVATION

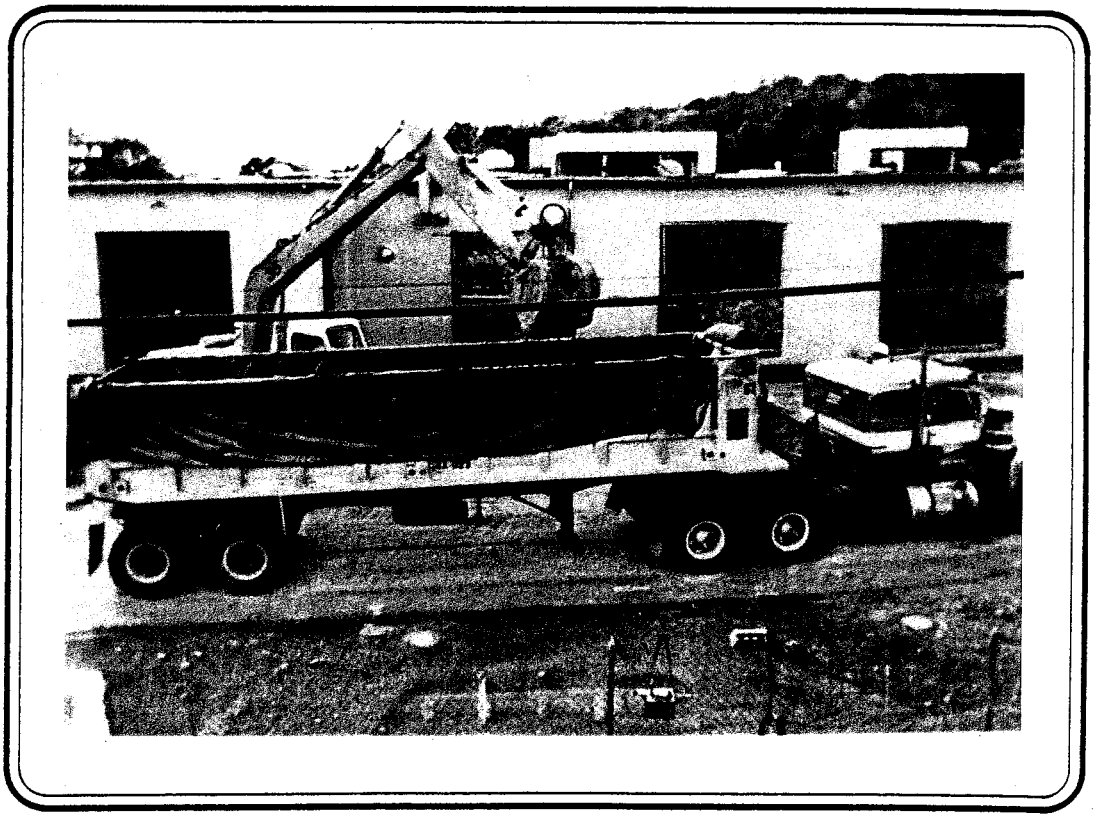


PHOTO 21
CASE 35D BACKHOE PLACING EXCAVATED MATERIAL
INTO LINED AND SEALED TRACTOR/TRAILER UNIT

The backhoe bucket, following excavation of soils designated for disposal, was decontaminated prior to handling soils that were to be reused as backfill. Decontamination was accomplished with a high pressure, hot water washer. Wash fluids were collected in a 55-gallon drum and were mixed with and absorbed by the final load of soil shipped form the site each day for secure landfill disposal.

Air monitoring was conducted throughout the duration of the excavation for explosivity and organic vapor concentrations. The air monitoring program is discussed in Section 4.4.3.

Field surveys were conducted throughout the duration of the excavation and elevations taken at each clean/dirty interface and at the bottom of the excavation.

Following completion of excavation, a polyliner was placed on the sides of the slopes to prevent mixing of clean soils from the completed excavation with adjacent soils designated for disposal. Soils that were designated for reuse as backfill, which had

previously been excavated and stockpiled adjacent to the excavation, were then pushed into the excavation. Additional off-site granular material stockpiled in the adjacent parking lot was brought on-site to complete the backfilling of the excavation. The D7E dozer was used to push the material into the excavation in approximately 1-foot lifts. A Case 680E rubber tire backhoe equipped with a hydraulic vibratory compactor was used to compact the backfill to a minimum density of 90% Standard Proctor. Photograph 22 illustrates this piece of equipment.

A layer, approximately 6-inches to 8-inches thick, of #4 stone was then placed as a base for future asphalt reinstatement.

Each excavation was expeditiously backfilled and at no time were excavations left open overnight with the exception of the foundation supports which are addressed in Section 4.2.5.

Photographs 23, 24, 25 and 26 illustrate some of the excavation process.

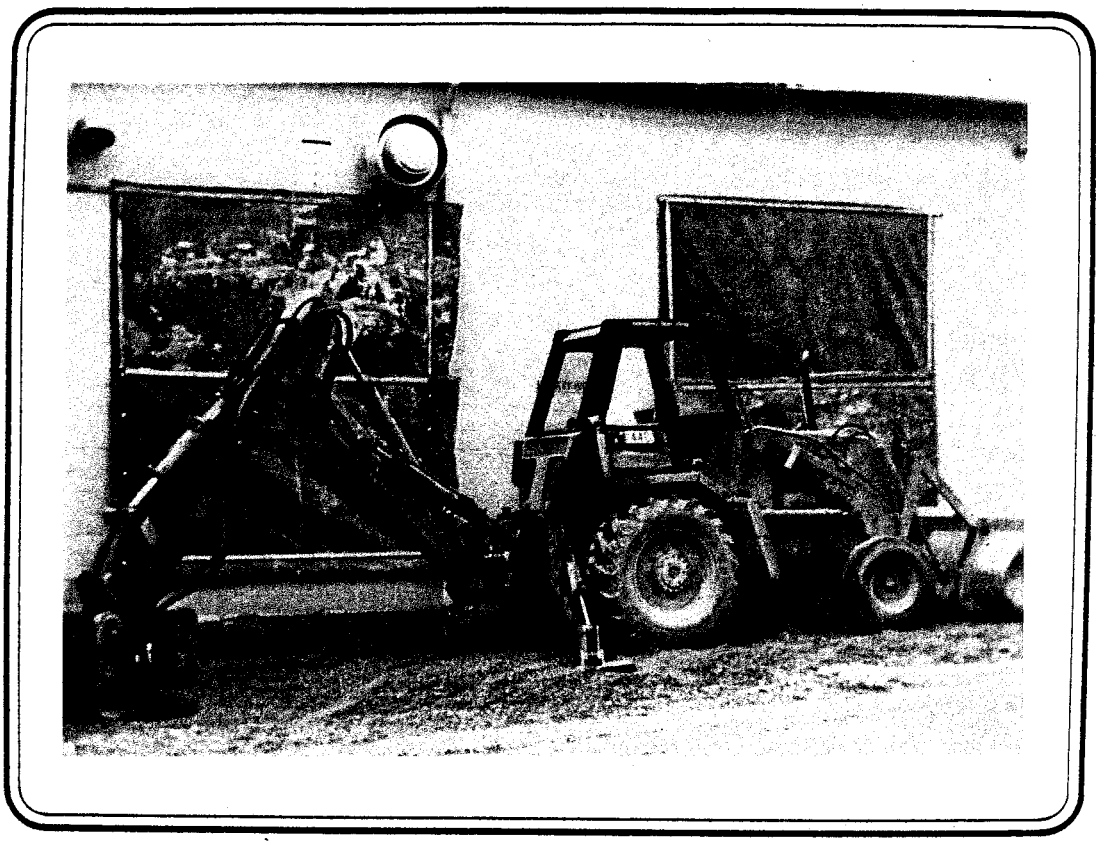


PHOTO 22
CASE 680E RUBBER TIRE COMBINATION FRONT END LOADER
AND BACKHOE EQUIPPED WITH VIBRATORY COMPACTOR

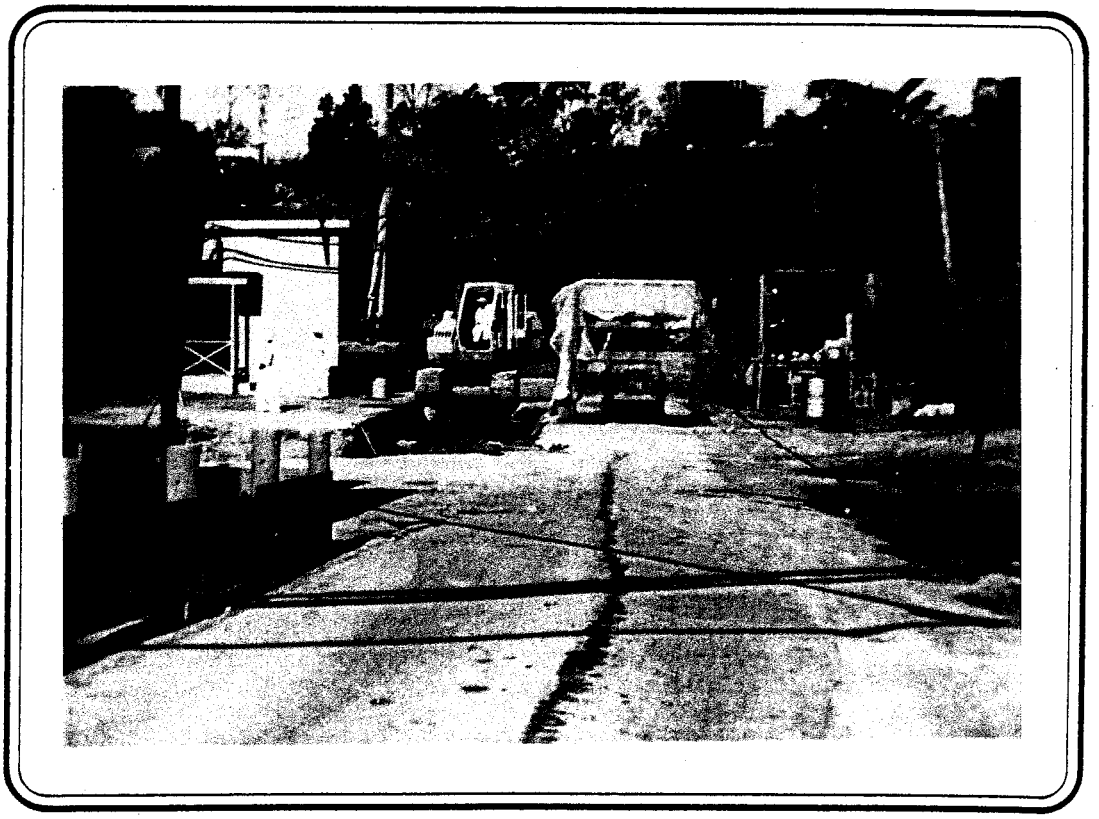


PHOTO 23
TYPICAL EXCAVATING OPERATION

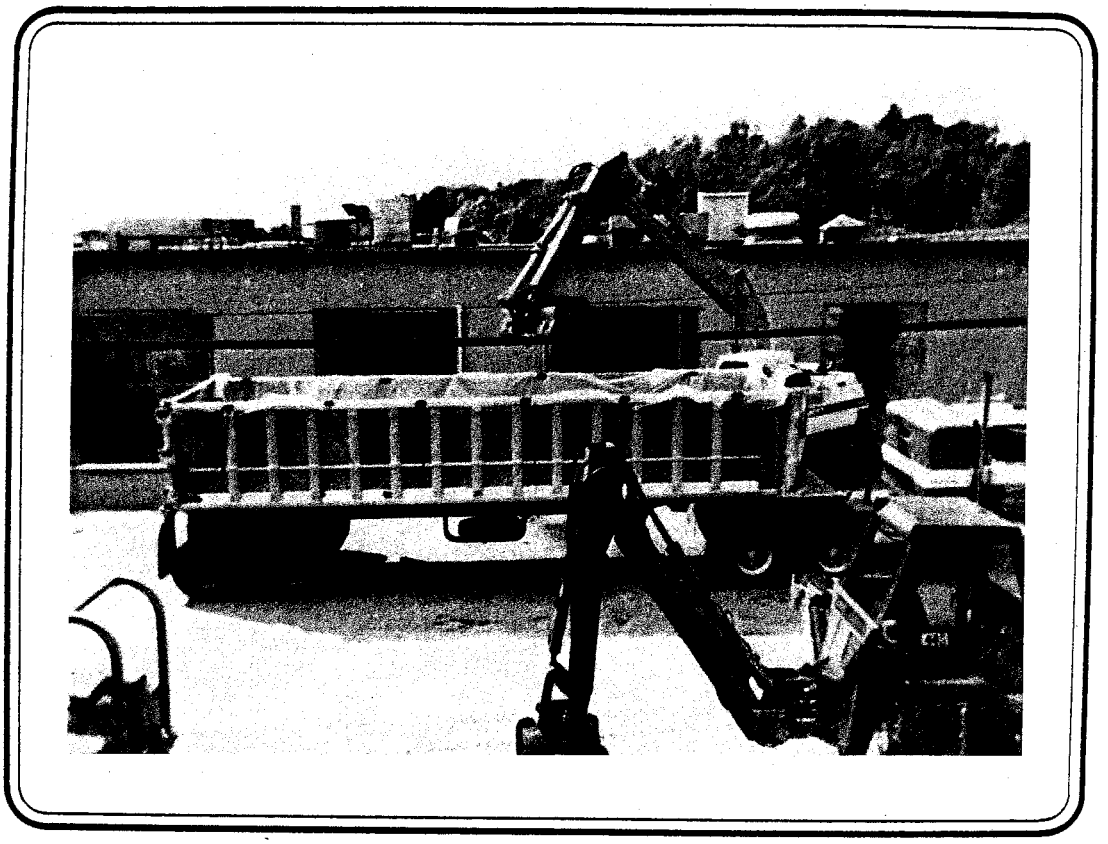


PHOTO 24
TYPICAL EXCAVATING OPERATION

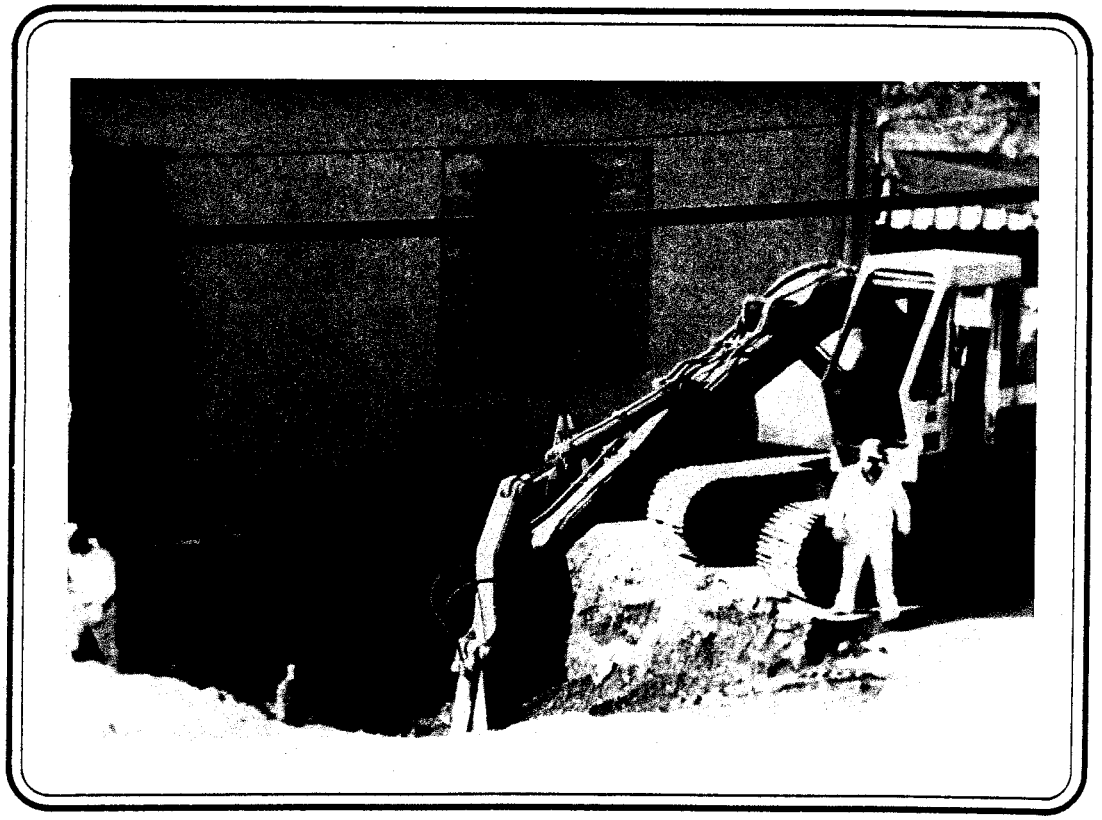


PHOTO 25
EXCAVATING AT NORTHERLY CORNER OF BUILDING
IN THE VICINITY OF BOREHOLE 13

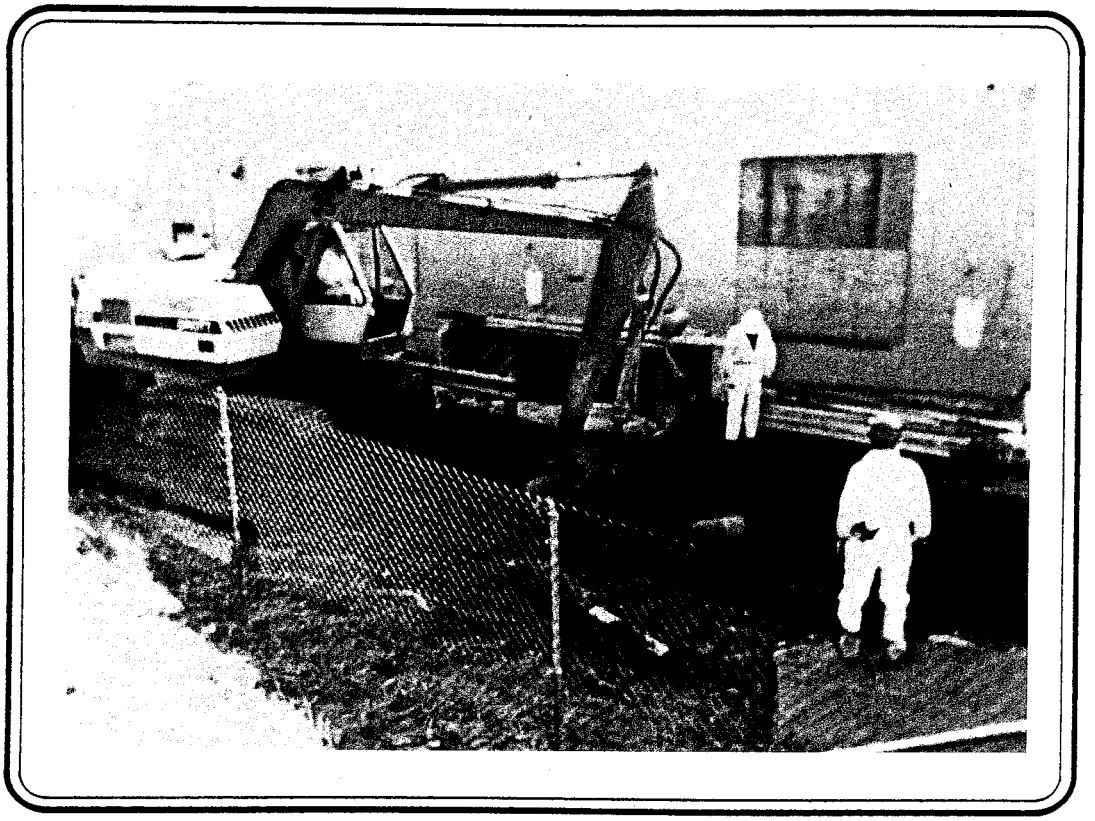


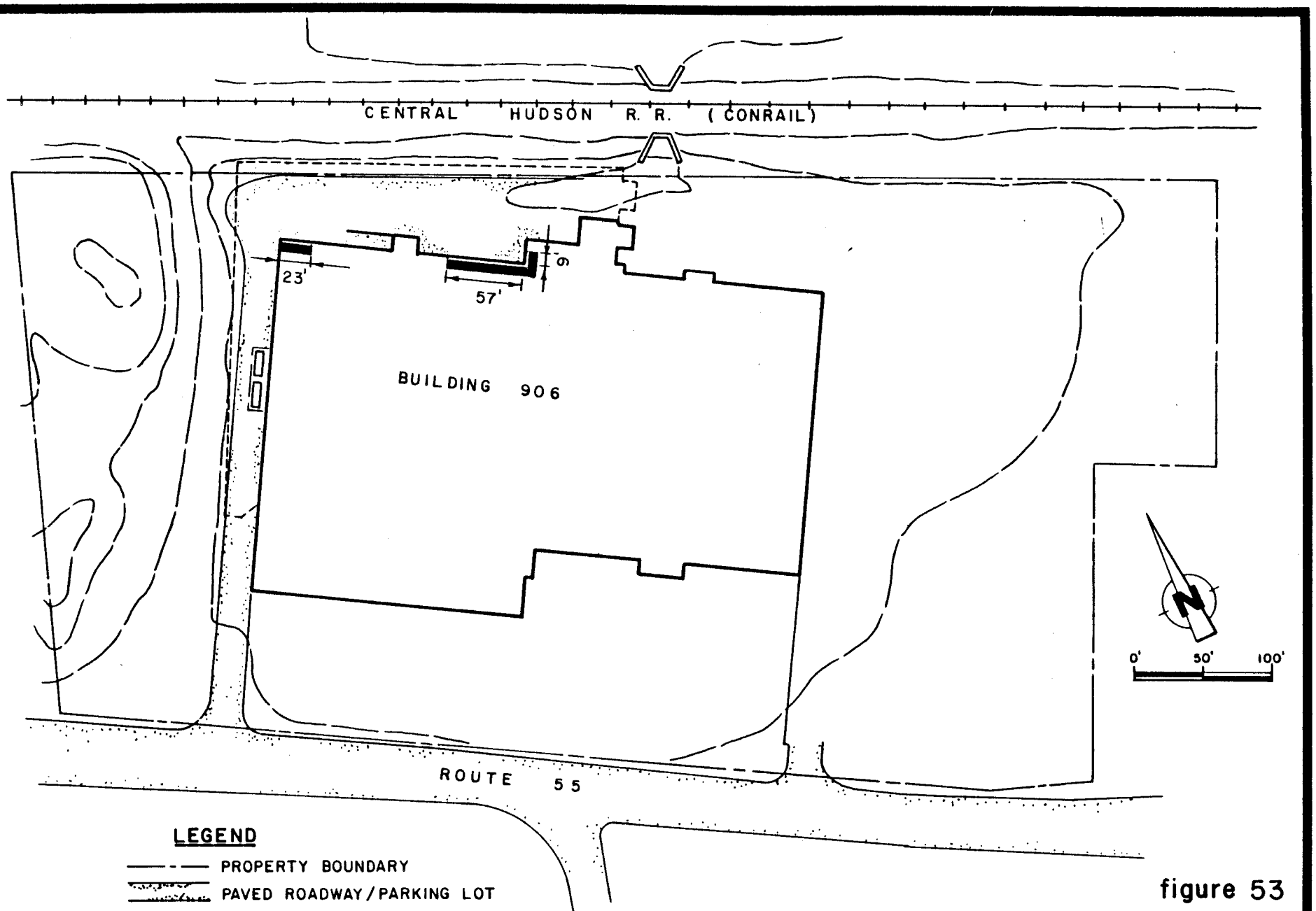
PHOTO 26
EXCAVATING AT THE WESTERLY SIDE OF BUILDING 906.
NOTICE THE RESTRICTED AREA OF OPERATION.

4.2.5 FOUNDATION SUPPORTS

During the period October 11 to October 15, 1983, Schnabel Foundation Company, a sub-contractor to SCC, installed a total of 80 lineal feet of foundation wall support at locations detailed on Figure 53.

A total of 8 concrete piers approximately 3-feet by 4-feet in section were placed from the base of the building footing to bedrock at an approximate spacing of 5 feet. Five of these piers were placed at the easterly loading dock on the north wall of Building 906 at an average depth of 12 feet and three piers were placed at the northwest corner of Building 906 at an average depth of 9 feet. Approximately 80 cubic yards of concrete was used in the pier construction.

Initially, at each pier location the backhoe excavated soil from existing ground to the level of the bottom of the building footing. The soil under the footing was hand excavated and slip forms measuring 3-feet by 4-feet in section and constructed of construction grade 2-inch by 12-inch lumber were



CRA

figure 53

AS CONSTRUCTED FOUNDATION SUPPORT

IBM Corporation

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installed. The soil inside and beneath the form was removed by hand, the slip form lowered, and another section of form added to the top of the first. This sequence continued until bedrock was reached. Upon completion of the slip form to bedrock, concrete was poured in place. Following a one day curing period, dry cement was packed between the bottom of the footing and the top of the poured concrete pier by means of a wooden dowel and hammer. Once the concrete had cured for a period of 7 days, the soils between and adjacent to the piers were excavated and replaced by clean compacted off-site fill.

Photographs 27, 28, 29 30 and 31 illustrate portions of the technique employed. During pier construction, particular care was given to monitoring air quality within the excavated areas.

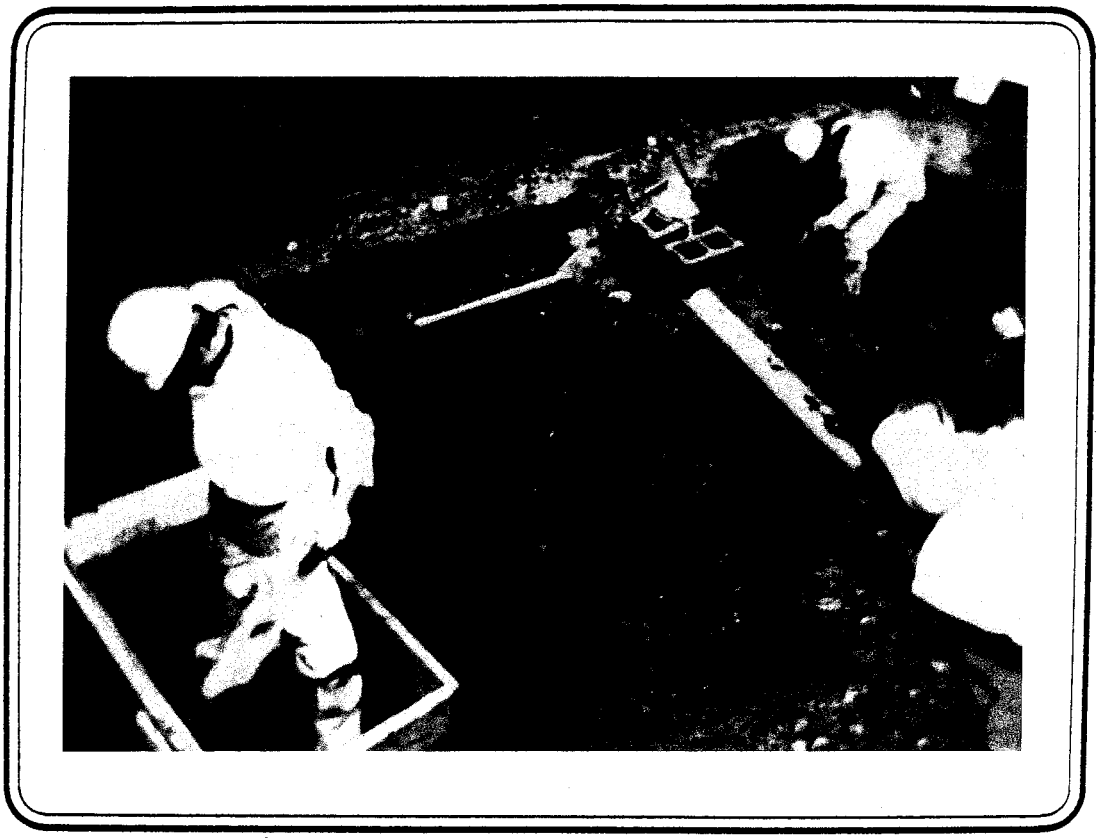

PHOTO 27
FOOTING SUPPORT CONSTRUCTION UTILIZING
HAND DUG WOOD FRAME SLIP FORMS

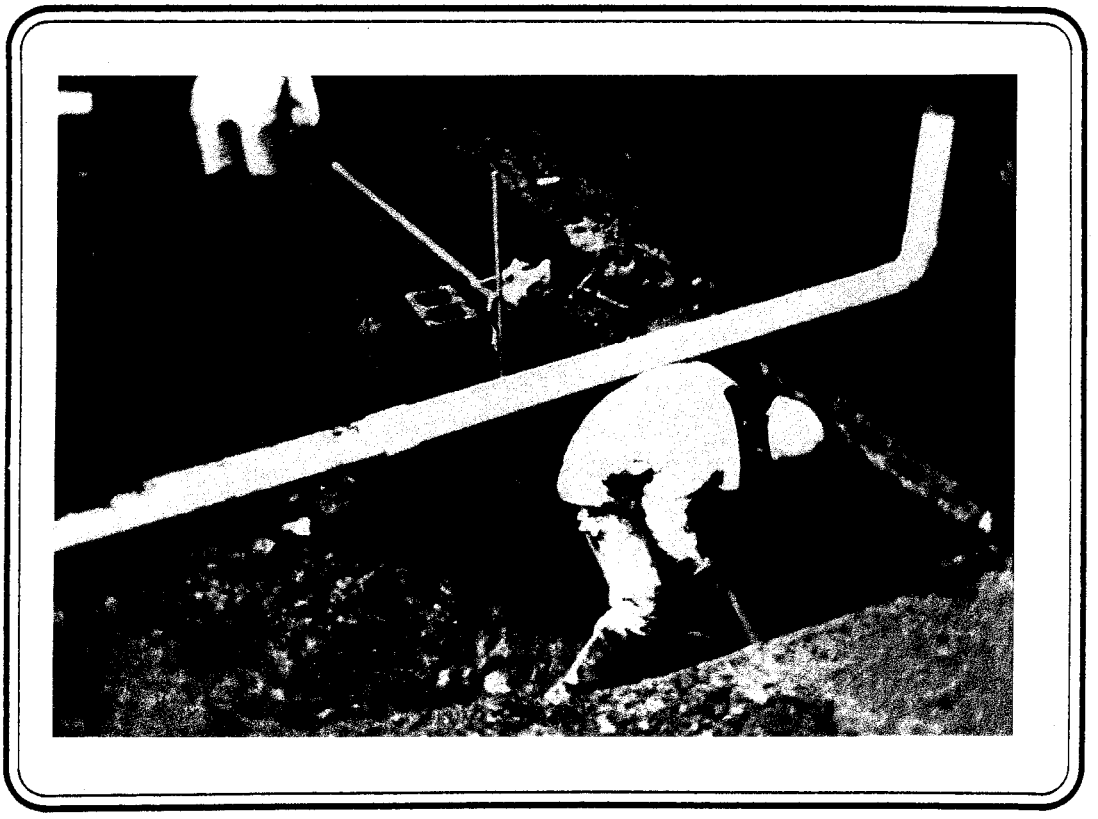

PHOTO 28
FOOTING SUPPORT CONSTRUCTION UTILIZING
HAND DUG WOOD FRAME SLIP FORMS

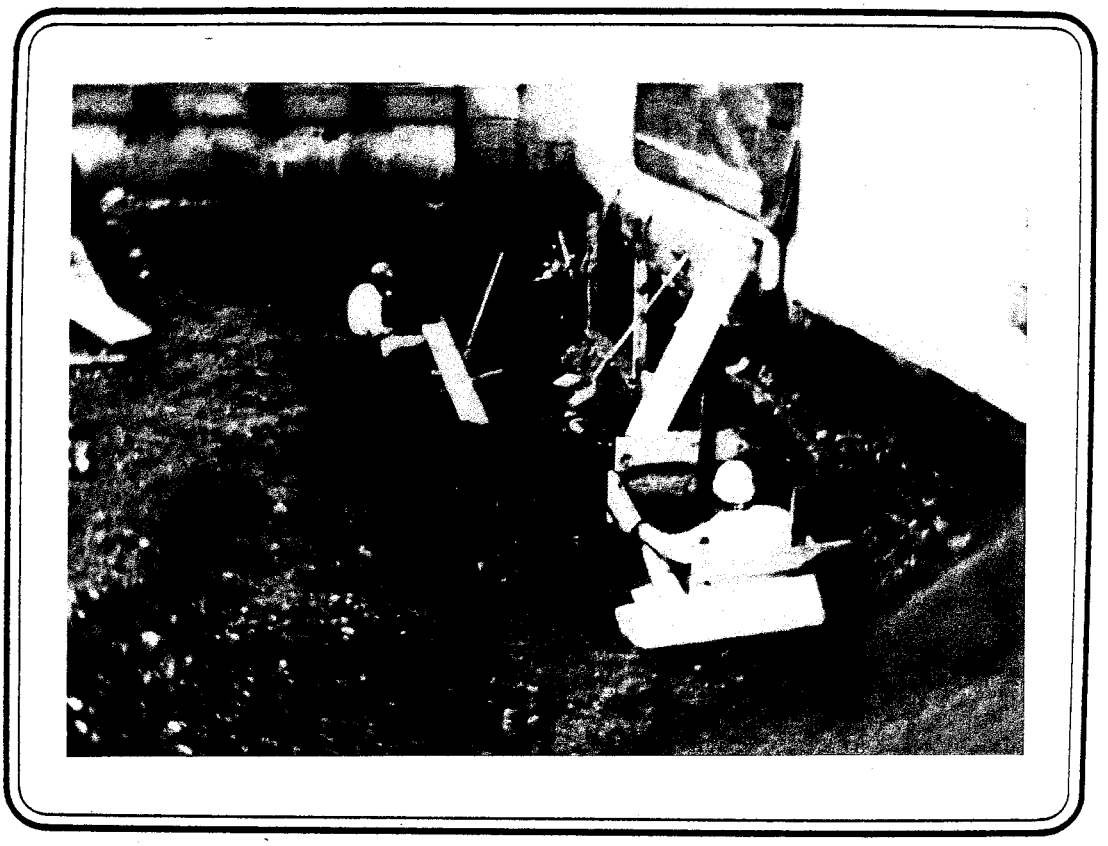

PHOTO 29
FOOTING SUPPORT CONSTRUCTION UTILIZING
HAND DUG WOOD FRAME SLIP FORMS

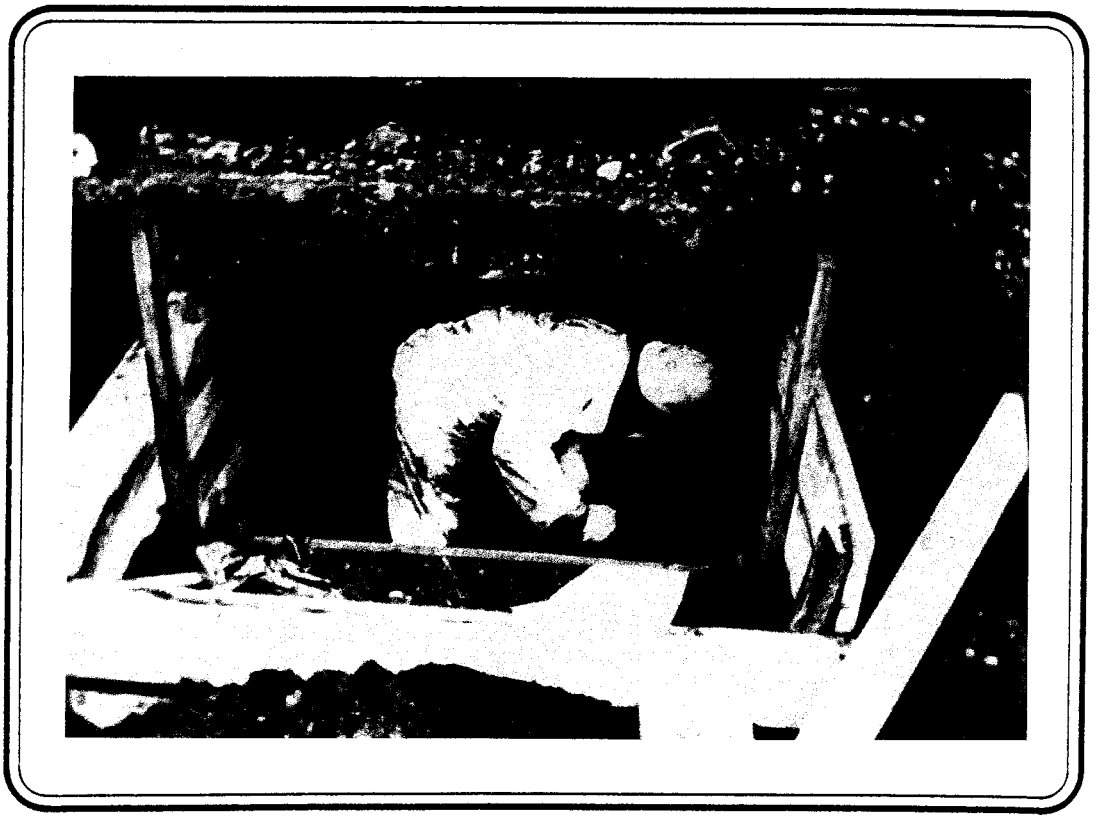

PHOTO 30
FOOTING SUPPORT CONSTRUCTION UTILIZING
HAND DUG WOOD FRAME SLIP FORMS

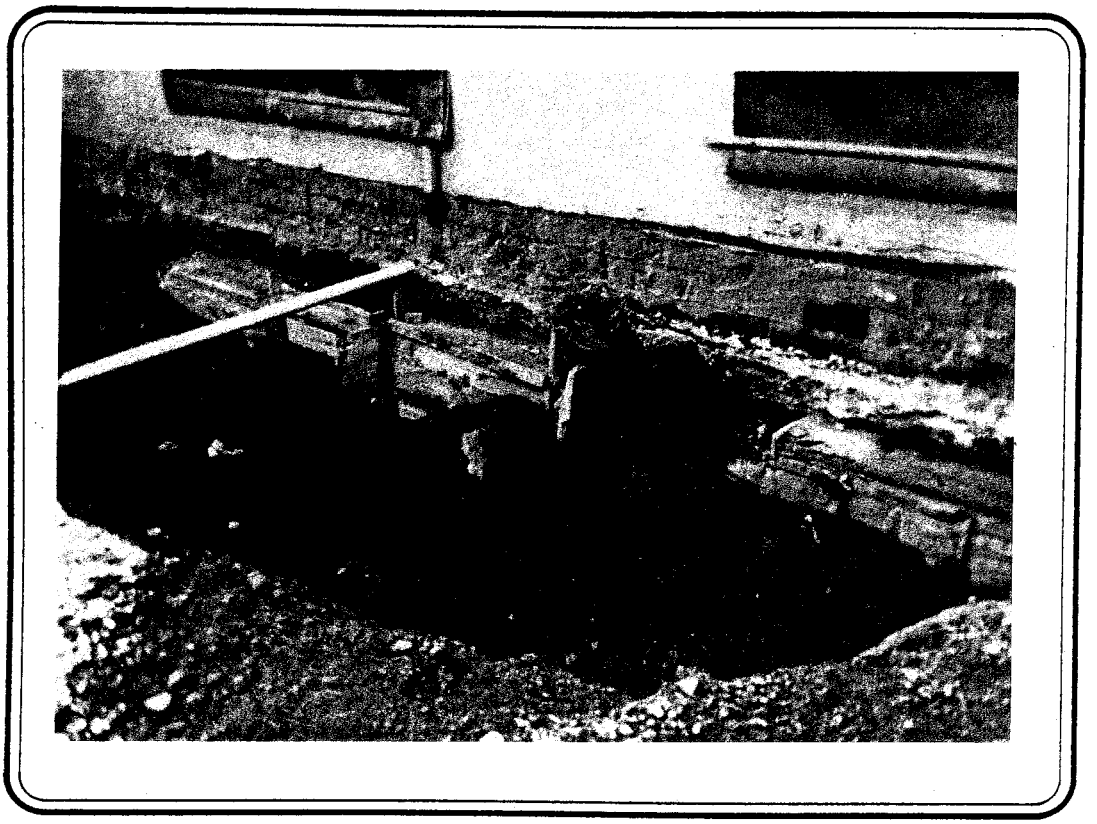

PHOTO 31
FOUNDATION SUPPORT PIERS COMPLETE

4.3 DISPOSAL

4.3.1 General

All transportation and disposal of soils by off-site secure landfilling occurred during the period September 21 to October 21, 1983. A total of 3,198.29 tons of soil were disposed at SCA's Model City, N.Y. permitted facility during this period. Table 4 provides a chronology of soil shipments from the site.

4.3.2 Transportation

All soils excavated for off-site disposal were transported by tractor/trailer units with lined boxes and sealed tailgates. All trucks were securely tarped prior to leaving site. As an extra measure of safety in addition to the bolting mechanism, a security chain was also attached and tightened to each tailgate. Photograph 32 illustrates the measures employed to secure each truck tailgate. During transport of soils, each truck strictly adhered to the routes previously approved by IBM.

TABLE 4

SUMMARY OF SHIPMENTS OF SOIL FOR DISPOSAL

LOAD NUMBER	DATE	POUNDS SHIPPED	TOTAL DAILY POUNDS SHIPPED	TONS SHIPPED	TOTAL DAILY TONS SHIPPED	TONS SHIPPED TO DATE
1	September 21/83	18,700		9.39		9.39
2	September 21/83	13,760		6.88		16.27
3	September 21/83	36,620		18.31		34.58
4	September 21/83	25,980		12.99		47.57
5	September 21/83	22,260		11.13		58.70
6	September 21/83	29,920	147,320	14.96	73.66	73.66
7	September 22/83	48,260		24.13		97.79
8	September 22/83	34,800		17.40		115.19
9	September 22/83	34,520		17.26		132.45
10	September 22/83	33,580		16.79		149.24
11	September 22/83	31,160		15.58		164.82
12	September 22/83	37,780	220,100	18.89	110.05	183.71
13	September 23/83	42,160		21.08		204.79
14	September 23/83	35,560		17.78		222.57
15	September 23/83	48,600		24.30		246.87
16	September 23/83	40,780		20.39		267.26
17	September 23/83	37,060		18.53		285.79
18	September 23/83	37,160	241,320	18.58	120.66	304.37
19	September 24/83	45,060		22.53		326.90
20	September 24/83	46,200		23.10		350.00
21	September 24/83	38,480		19.24		369.24
22	September 24/83	45,320		22.66		391.90
23	September 24/83	53,420		26.71		418.61
24	September 24/83	33,600	262,080	16.80	131.04	435.41
25	September 26/83	38,820		19.41		454.82
26	September 26/83	41,920		20.96		475.78
27	September 26/83	39,620		19.81		495.59
28	September 26/83	42,500		21.25		516.84

TABLE 4 (Cont'd)

SUMMARY OF SHIPMENTS OF SOIL FOR DISPOSAL

LOAD NUMBER	DATE	POUNDS SHIPPED	TOTAL DAILY POUNDS SHIPPED	TONS SHIPPED	TOTAL DAILY TONS SHIPPED	TONS SHIPPED TO DATE
29	September 26/83	31,880		15.94		532.78
30	September 26/83	33,280	228,020	16.64	114.01	549.42
31	September 27/83	46,620		23.31		572.73
32	September 27/83	34,360		17.18		589.91
33	September 27/83	38,360		19.18		609.09
34	September 27/83	43,060		21.53		630.62
35	September 27/83	39,060		19.53		650.15
36	September 27/83	43,260		21.63		671.78
37	September 27/83	44,160		22.08		693.86
38	September 27/83	39,700		19.85		713.71
39	September 27/83	28,940		14.47		728.18
40	September 27/83	45,620	403,140	22.81	201.57	750.99
41	September 28/83	43,560		21.78		772.77
42	September 28/83	36,820		18.41		791.18
43	September 28/83	44,660		22.33		813.51
44	September 28/83	38,620		19.31		832.82
45	September 28/83	43,520		21.76		854.58
46	September 28/83	48,400		24.20		878.78
47	September 28/83	30,900		15.45		894.23
48	September 28/83	36,040		18.02		912.25
49	September 28/83	35,640		17.82		930.07
50	September 28/83	31,520	389,680	15.76	194.84	945.83
51	September 29/83	36,560		18.28		964.11
52	September 29/83	49,660		24.83		988.94
53	September 29/83	44,660		22.33		1,011.27
54	September 29/83	30,900		15.45		1,026.72
55	September 29/83	36,340		18.17		1,044.89
56	September 29/83	33,600		16.80		1,061.69

TABLE 4 (Cont'd)

SUMMARY OF SHIPMENTS OF SOIL FOR DISPOSAL

LOAD NUMBER	DATE	POUNDS SHIPPED	TOTAL DAILY POUNDS SHIPPED	TONS SHIPPED	TOTAL DAILY TONS SHIPPED	TONS SHIPPED TO DATE
57	September 29/83	40,500		20.25		1,081.94
58	September 29/83	35,480		17.74		1,099.68
59	September 29/83	32,100		16.05		1,115.73
60	September 29/83	35,540	375,340	17.77	187.67	1,133.50
61	September 30/83	38,720		19.36		1,152.86
62	September 30/83	32,120		16.06		1,168.92
63	September 30/83	33,500		16.75		1,185.67
64	September 30/83	36,120		18.06		1,203.73
65	September 30/83	39,080		19.54		1,223.27
66	September 30/83	24,920		12.46		1,235.73
67	September 30/83	33,900	238,360	16.95	119.18	1,252.68
68	October 3/83	39,580		19.79		1,272.47
69	October 3/83	43,600		21.80		1,294.27
70	October 3/83	36,720		18.36		1,312.63
71	October 3/83	43,340		21.67		1,334.30
72	October 3/83	55,160		27.58		1,361.88
73	October 3/83	37,500		18.75		1,380.63
74	October 3/83	41,980	297,880	20.99	148.94	1,401.62
75	October 4/83	30,760		15.38		1,417.00
76	October 4/83	38,940		19.47		1,436.47
77	October 4/83	42,520		21.26		1,457.73
78	October 4/83	35,600		17.80		1,475.53
79	October 4/83	38,840		19.42		1,494.95
80	October 4/83	43,280		21.64		1,516.59
81	October 4/83	39,940		19.97		1,536.56
82	October 4/83	43,240	313,120	21.62	156.56	1,558.18
83	October 5/83	43,760		21.88		1,580.06
84	October 5/83	36,640		18.32		1,598.38

TABLE 4 (Cont'd)

SUMMARY OF SHIPMENTS OF SOIL FOR DISPOSAL

LOAD NUMBER	DATE	POUNDS SHIPPED	TOTAL DAILY POUNDS SHIPPED	TONS SHIPPED	TOTAL DAILY TONS SHIPPED	TONS SHIPPED TO DATE
85	October 5/83	41,560		20.78		1,619.16
86	October 5/83	44,360		22.18		1,641.34
87	October 5/83	46,700		23.35		1,664.69
88	October 5/83	45,380	258,400	22.69	129.20	1,687.38
89	October 6/83	48,048		24.02		1,711.40
90	October 6/83	42,400		21.20		1,732.60
91	October 6/83	50,860		25.43		1,758.03
92	October 6/83	46,620		23.31		1,781.34
93	October 6/83	43,940		21.97		1,803.31
94	October 6/83	44,840		22.42		1,825.73
95	October 6/83	43,780	320,488	21.89	160.24	1,847.62
96	October 7/83	45,180		22.59		1,870.21
97	October 7/83	47,720		23.86		1,894.07
98	October 7/83	34,960		17.48		1,911.55
99	October 7/83	32,800		16.40		1,927.95
100	October 7/83	51,640	212,300	25.82	106.15	1,953.77
101	October 11/83	37,460		18.73		1,972.50
102	October 11/83	42,760		21.38		1,993.88
103	October 11/83	43,280		21.64		2,015.52
104	October 11/83	50,860		25.43		2,040.95
105	October 11/83	41,060	215,420	20.53	107.71	2,061.48
106	October 12/83	43,100		21.55		2,083.03
107	October 12/83	42,020		21.01		2,104.04
108	October 12/83	41,820		20.91		2,124.95
109	October 12/83	42,980		21.49		2,146.44
110	October 12/83	47,420		23.71		2,170.15
111	October 12/83	43,380		21.69		2,191.84
112	October 12/83	43,940		21.97		2,213.81

TABLE 4 (Cont'd)

SUMMARY OF SHIPMENTS OF SOIL FOR DISPOSAL

LOAD NUMBER	DATE	POUNDS SHIPPED	TOTAL DAILY POUNDS SHIPPED	TONS SHIPPED	TOTAL DAILY TONS SHIPPED	TONS SHIPPED TO DATE
113	October 12/83	30,660	335,320	15.33	167.66	2,229.14
114	October 13/83	43,380		21.69		2,250.83
115	October 13/83	52,560		26.28		2,277.11
116	October 13/83	48,140		24.07		2,301.18
117	October 13/83	47,640		23.82		2,325.00
118	October 13/83	45,640		22.82		2,347.82
119	October 13/83	45,560		22.78		2,370.60
120	October 13/83	48,020		24.01		2,394.61
121	October 13/83	48,400	379,340	24.20	189.67	2,418.81
122	October 14/83	36,920		18.46		2,437.27
123	October 14/83	46,180		23.09		2,460.36
124	October 14/83	43,740		21.87		2,482.23
125	October 14/83	43,160		21.58		2,503.81
126	October 14/83	48,260		24.13		2,527.94
127	October 14/83	43,560		21.78		2,549.72
128	October 14/83	46,600	308,420	23.30	154.21	2,573,02
129	October 17/83	43,120		21.56		2,594.58
130	October 17/83	40,980		20.49		2,615.07
131	October 17/83	46,180		23.09		2,638.16
132	October 17/83	44,120		22.06		2,660.22
133	October 17/83	39,180		19.59		2,679.81
134	October 17/83	42,000	255,580	21.00	127.79	2,700.81
135	October 18/83	42,080		21.04		2,721.85
136	October 18/83	47,700		23.85		2,745.70
137	October 18/83	50,540		25.27		2,770.97
138	October 18/83	45,260		22.63		2,793.60
139	October 18/83	48,700		24.35		2,817.95
140	October 18/83	45,340		22.67		2,840.62

TABLE 4 (Cont'd)

SUMMARY OF SHIPMENTS OF SOIL FOR DISPOSAL

LOAD NUMBER	DATE	POUNDS SHIPPED	TOTAL DAILY POUNDS SHIPPED	TONS SHIPPED	TOTAL DAILY TONS SHIPPED	TONS SHIPPED TO DATE
141	October 18/83	39,560	319,180	19.78	159.59	2,860.40
142	October 19/83	46,260		23.13		2,883.53
143	October 19/83	45,080		22.54		2,906.07
144	October 19/83	48,460		24.23		2,930.30
145	October 19/83	47,600		23.80		2,954.10
146	October 19/83	44,320		22.16		2,976.26
147	October 19/83	42,260		21.13		2,997.39
148	October 19/83	37,880		18.94		3,016.33
149	October 19/83	41,600	353,460	20.80	176.73	3,037.13
150	October 20/83	44,860		22.43		3,059.56
151	October 20/83	43,100		21.55		3,081.11
152	October 20/83	43,060		21.53		3,102.64
153	October 20/83	53,360		26.68		3,129.32
154	October 20/83	43,920		21.96		3,151.28
155	October 20/83	51,020	279,320	25.51	139.66	3,176.79
156	October 21/83	43,000	43,000	21.50	21.50	3,198.29

PHOTO 32
APPLICATION OF CHAIN TO SECURE TAILGATE AS
A SECONDARY PRECAUTIONARY MEASURE

To expedite the off-site shipment of soils for disposal, each tractor normally pulled two trailers. At the beginning of the day one empty trailer was left at a staging area on the west side of the Mid Hudson bridge. The tractor would pull the other empty trailer to the site where it would be loaded. Following placement of tarps, the tractor would haul the loaded trailer to the staging area for temporary storage, and pull the remaining empty trailer back to the site. Following loading and tarping of the second trailer, the tractor would return to the staging area, hook up the other loaded trailer, and commence the journey to the Model City facility. A security guard was in attendance at the trailer staging area at all times that loaded trailers were present. All tractor/trailer units were weighed locally with an IBM representative present prior to leaving for Model City, N.Y.

4.3.3 Hazardous Waste Manifests

IBM was designated as the generator on this project and thus was responsible for completion of the Hazardous

Waste Manifests and Straight Bills of Lading. Photograph 33 illustrates these documents.

4.4 HEALTH AND SAFETY

4.4.1 Health and Safety Plan

A Health and Safety plan had been previously designed and is dicussed in Section 3.13. This design plan was subsequently modified to more appropriately fit site conditions. A copy of the amended Health and Safety Plan implemented for this project is contained in Appendix G.

4.4.2 Decontamination

The site was segregated into a "dirty", "buffer", and "clean" work zone as detailed on Figure 54. All personnel leaving the Dirty Zone were required to remove soiled clothing and rubber overboots in the Buffer Zone prior to entering the Clean Zone.

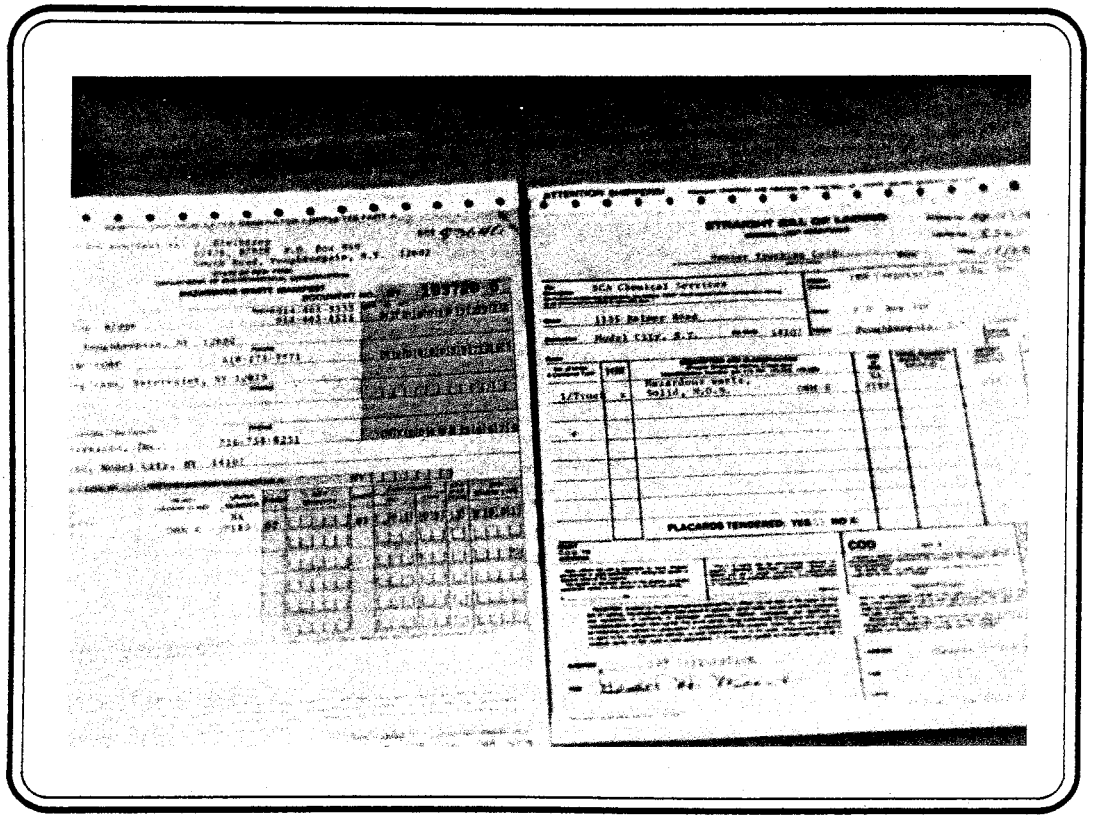

PHOTO 33
HAZARDOUS WASTE MANIFEST AND STRAIGHT
BILL OF LADING UTILIZED ON PROJECT

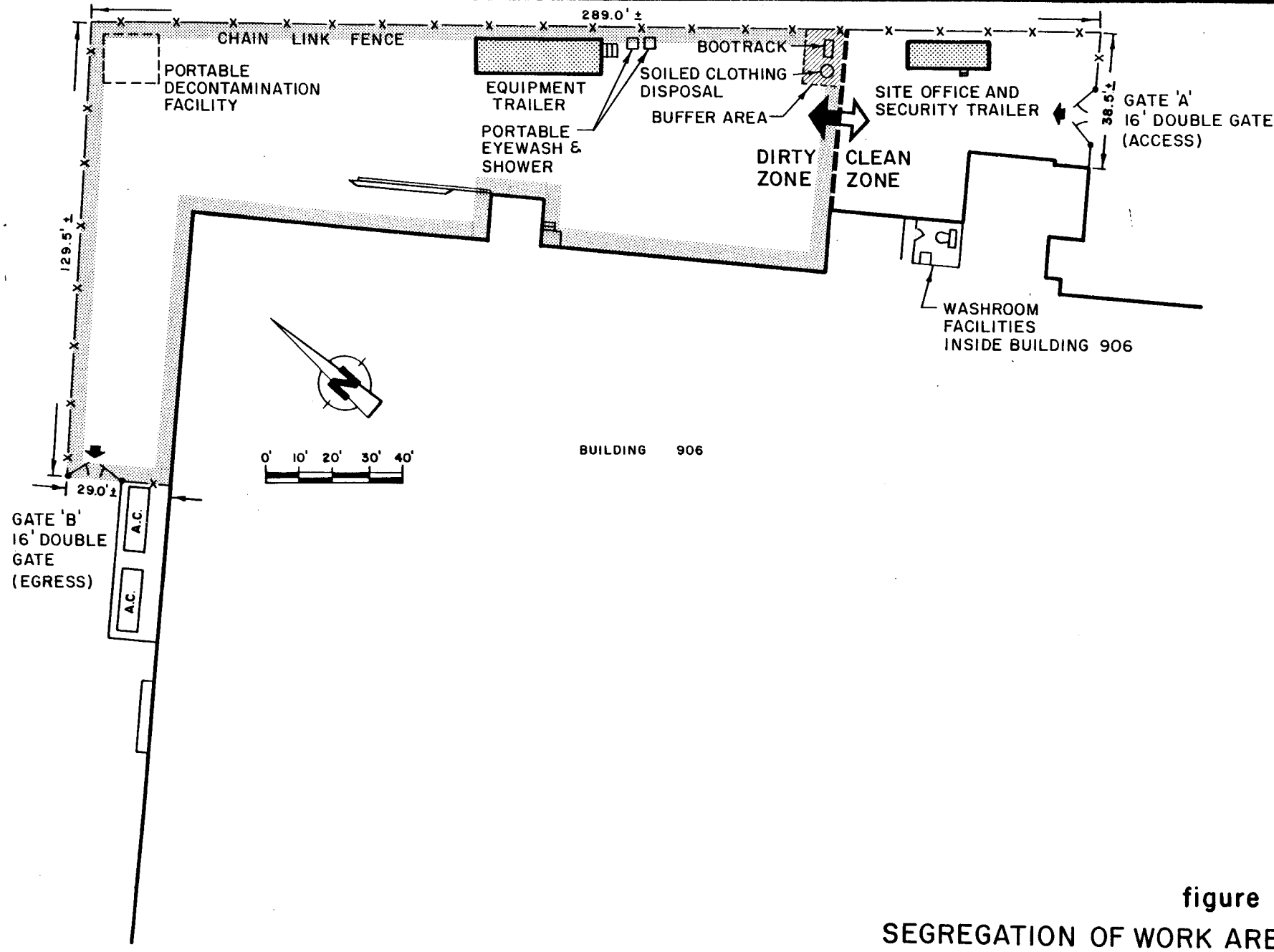

figure 54

SEGREGATION OF WORK AREAS

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A revised protocol for site equipment was implemented and stringently monitored by the Safety Officer and the IBM site representative. Transport vehicle movement routes within the duty zone were redesigned so that vehicles contacted only clean fill or asphalt. During excavation of soils designated for disposal, the backhoe operated on clean fill with only the bucket in contact with soils that were to be disposed. Prior to handling soils designated for reuse as backfill, the bucket was decontaminated with a high pressure hot water rinse. The rinse water was collected in overpack drums and co-disposed in the lined trailers with the soils designated for off-site disposal.

4.4.3 Ambient Air Monitoring

Explosivity and organic vapor concentration were monitored throughout the excavation phase of the remedial construction. The air monitoring sampling grid is illustrated on Figure 55.

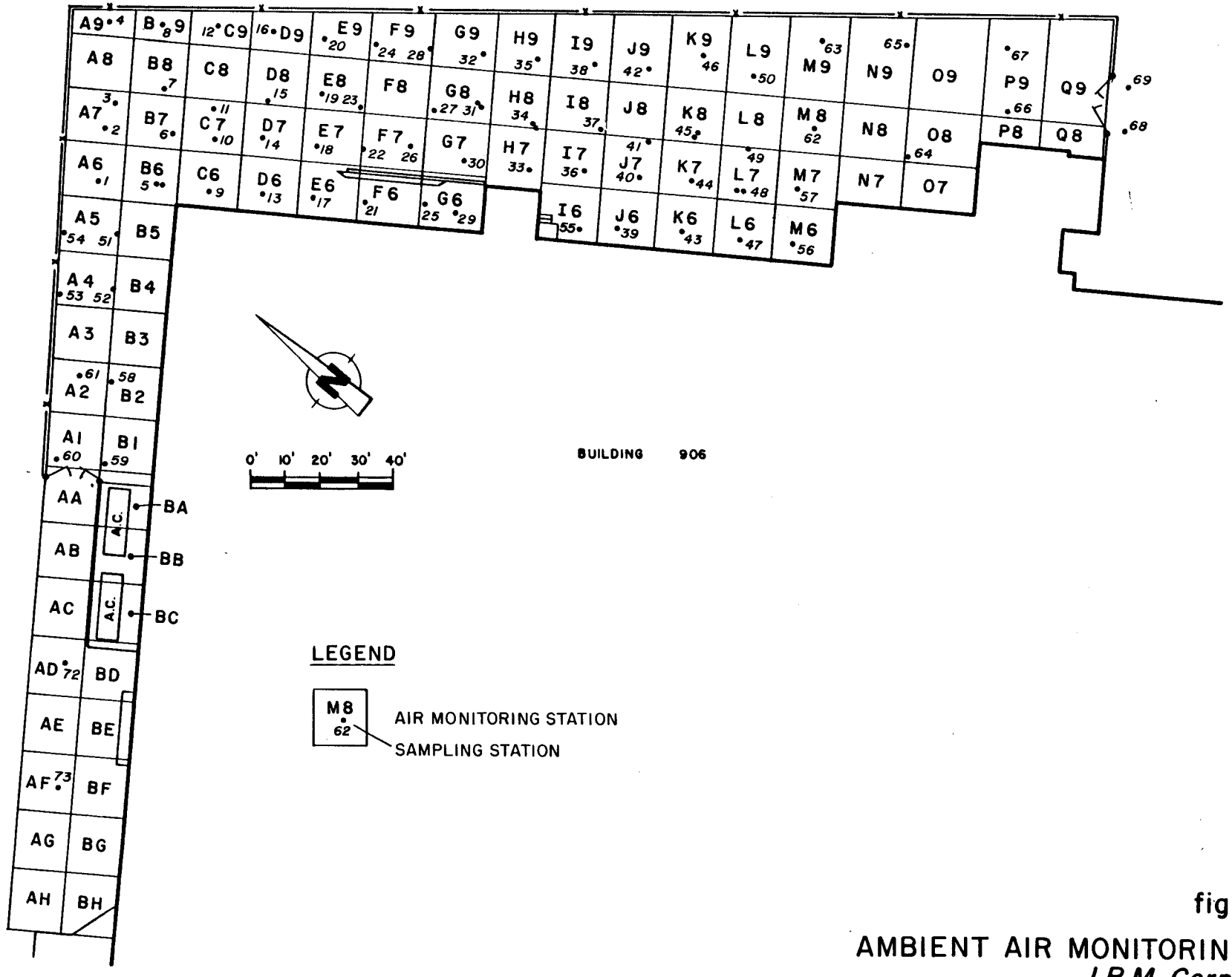

figure 55

AMBIENT AIR MONITORING GRID

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The majority of organic vapor concentration readings ranged between non-detected to 5 ppm. The highest recorded reading was 17 ppm monitored at Station 67 in the vicinity of borehole 30 on September 24. Positive explosivity readings were not detected over the course of the Project. Monitoring data as recorded on the Daily Air Monitoring Logs are presented in Appendix H.

Photographs 34, 35 and 36 illustrate the field ambient air monitoring activity.

4.4.4 Health and Safety Logs

A Health and Safety Log was maintained by the on-site Safety Officer and submitted daily to SCA/SCC/IBM. This log included weather, equipment on-site, personnel on-site and details of related health and safety incidents including safety meetings, safety infractions and major incidents which might hamper the project.

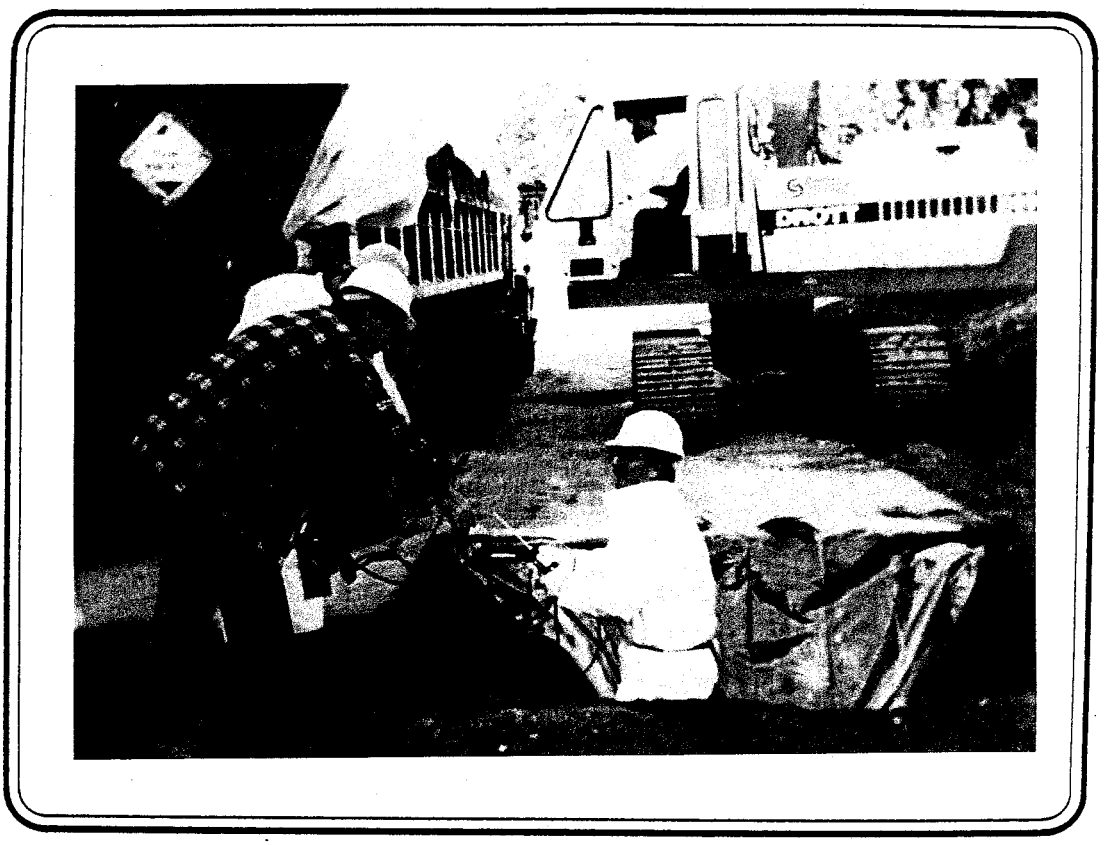

PHOTO 34
AIR MONITORING IN EXCAVATION. NOTE POLYLINER PLACEMENT IN EXCAVATION TO PREVENT CROSS-CONTAMINATION OF CLEAN BACKFILL FROM ADJACENT AREA.

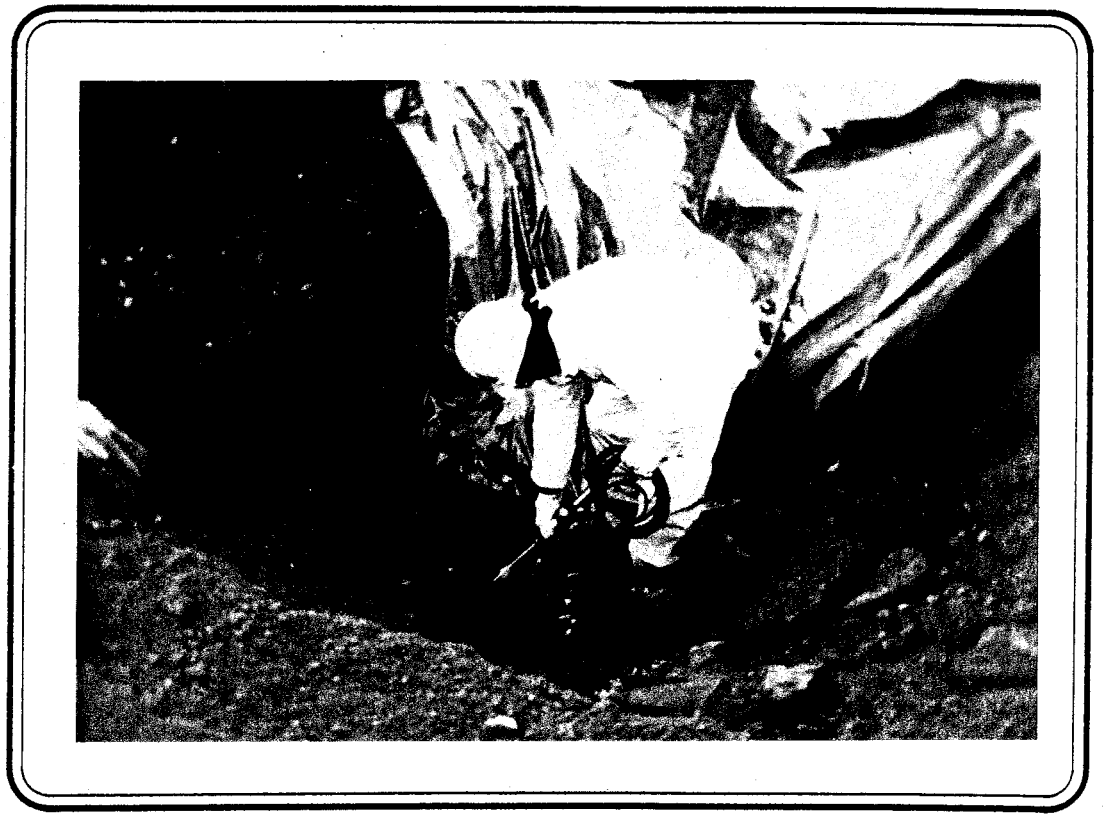

PHOTO 35
AIR MONITORING IN EXCAVATION

PHOTO 36
AIR MONITORING UNDER FOOTINGS OF BUILDING 906
PRIOR TO PLACEMENT OF SLIP FORMS

The only major incident recorded during the remedial action project was related to apparent odors within Building 906. Details of the incident, reproduced from the Health and Safety Report of September 28, 1983, are as follows:

"The nurse who works in building 906 was on site to report of people complaining of smells and headaches inside of the building at ±10:30 am. Engler went through the building with Tom Puls, IBM, and got no readings on the organic vapor photoionizer or the explosimeter. Glen Morrision, an Industrial Hygienist with IBM was on site at ±11:30 am. and took additional readings with his OVA and found no readings. Engler and Williams explained the site progress with him and he seemed satisfied that the work progress was not contributing to the smells in the building. It was however agreed that equipment and trucks when not active would have the engines shut down.

It was later discovered that the State Department of Highways was spraying weed killer beside the road on Route 55 beside building 906 and that this was probably the cause of the smells inside of the building."

The daily Health and Safety logs are presented in Appendix I.

4.4.5 Soil Record Samples

All soil record samples collected during the soil sampling phase of the project were shipped on October 21, 1983 to the SCA Model City, N.Y. facility for storage. The samples will ultimately be disposed by secure landfilling upon receipt by SCA from IBM of approval to discard. Chain of Custody for these samples is presented in Appendix J.

4.5 SECURITY

The IBM on-site representative was responsible for security and was assisted by the on-site safety officer on as required basis.

All on-site personnel and visitors directly associated with the remedial work were logged into the Daily Health and Safety Report by the Site Safety Officer.

The work site was secured with chain link fence and access and egress gates as illustrated in Figure 56.

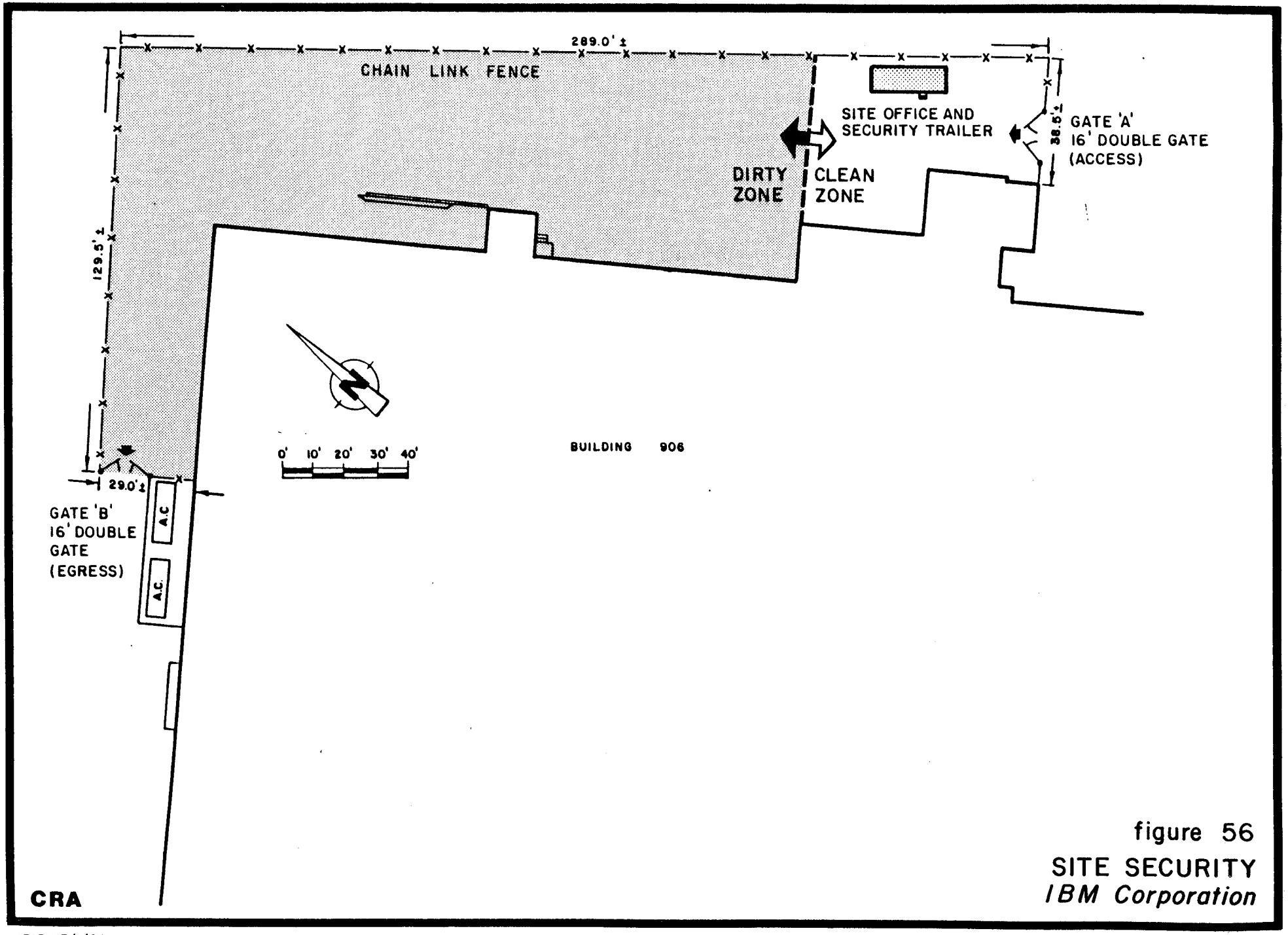

figure 56
SITE SECURITY
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The two gates were locked during non-working hours. Keys were given to on-site representatives for IBM/SCA/SCC/CRA and local authorities including the police and fire department and emergency response authorities.

During active working hours, the egress gate was kept locked at all times except to allow vehicles off the site. The access gate was kept chained and was monitored at all times to prevent entry to the work site by unauthorized vehicles or personnel.

4.6 RESTORATION AND DEMOBILIZATION

SCA/SCC commenced restoration and demobilization simultaneously during the period October 21, to October 28, 1983.

Prior to replacement of the asphalt base, SCC repaired and/or replaced all catchbasin tops, well tops, wet well tops and roof drains and placed and compacted 6 to 8 inches of #4 stone. SCC contracted a local construction firm to grade and compact the subbase and place asphalt over the entire area where excavation occurred. Following

the placement of the asphalt, granular material was spread, graded and compacted adjacent to the asphalt areas to match the existing asphalt grades and the original ground.

Also during this period, the following demobilization occured;

a) All construction equipment moved off-site;

b) Equipment storage trailer moved off-site;

c) Fencing removed;

d) The seven windows on the north wall of Building 906 were uncovered;

e) The roof overhang at the easterly loading dock replaced;

f) Removal of the site office trailer command post and disconnection of all utilities;

g) The parking lot where off-site clean material was kept was cleaned;

h) Exit physicals for all on-site personnel completed;

5.0 EFFECTIVENESS OF REMEDIAL ACTION

5.1 PERFORMANCE STANDARD

Based on the criteria for designating soils that would be excavated and disposed by off-site secure landfilling as discussed in Section 3.1, the remedial design specified the excavation and off-site disposal of 2,893.24 cubic yards of soil.

On the basis of analytical data developed from the soil sampling program, the mass of priority pollutant volatile organics contained in the 2893.24 cubic yards of soil specified for disposal is 19.48 pounds. This calculation is based on the assumption that the TVO concentration in each borehole sampling interval is the average TVO concentration for that interval over the areal extent of the excavation element. The areal configuration of excavation elements used in the TVO mass calculations is detailed on Figure 57. Appendix K presents the calculations for the derivation of the mass of TVO contained in the soils specified for excavation and off-site disposal.

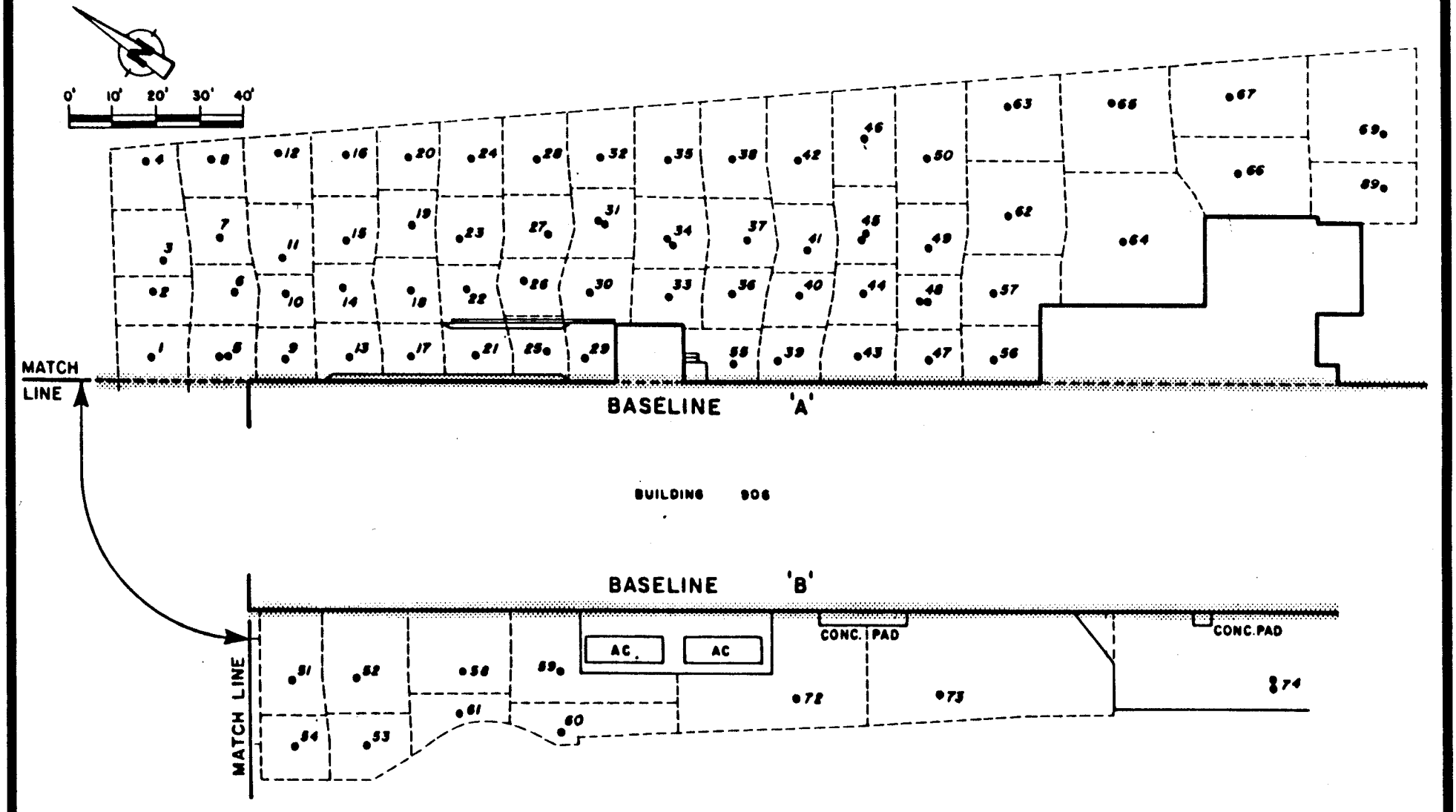

figure 57

AREAL LIMITS OF EXCAVATION ELEMENTS FOR TOTAL VOLATILE ORGANIC MASS CALCULATION

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5.2 EXCAVATION EFFECTIVENESS - BULK SOIL REMOVAL

As discussed in Section 4.3, a total of 2,575.08 cubic yards of soil were excavated and disposed by off-site secure landfilling. The effectiveness of the remedial program in terms of bulk soil removal is calculated to be 89.0 percent, as follows:

Effectiveness of Remedial Action (Bulk Soil Removal)

$$= \frac{\text{Volume of Soil Actually Disposed}}{\text{Volume of Soil Proposed to be Disposed}} \times 100$$

$$= \frac{2575.08}{2893.24} \times 100$$

$$= 89.0\%$$

Figure 58 details the areal extent of excavated soils.

5.3 EXCAVATION EFFECTIVENESS - TVO REMOVAL

The mass of TVO removed from the site in the 2,575.08 cubic yards actually excavated and disposed by secure landfilling is calculated to be 16.69 pounds. TVO removal calculations are contained in Appendix L.

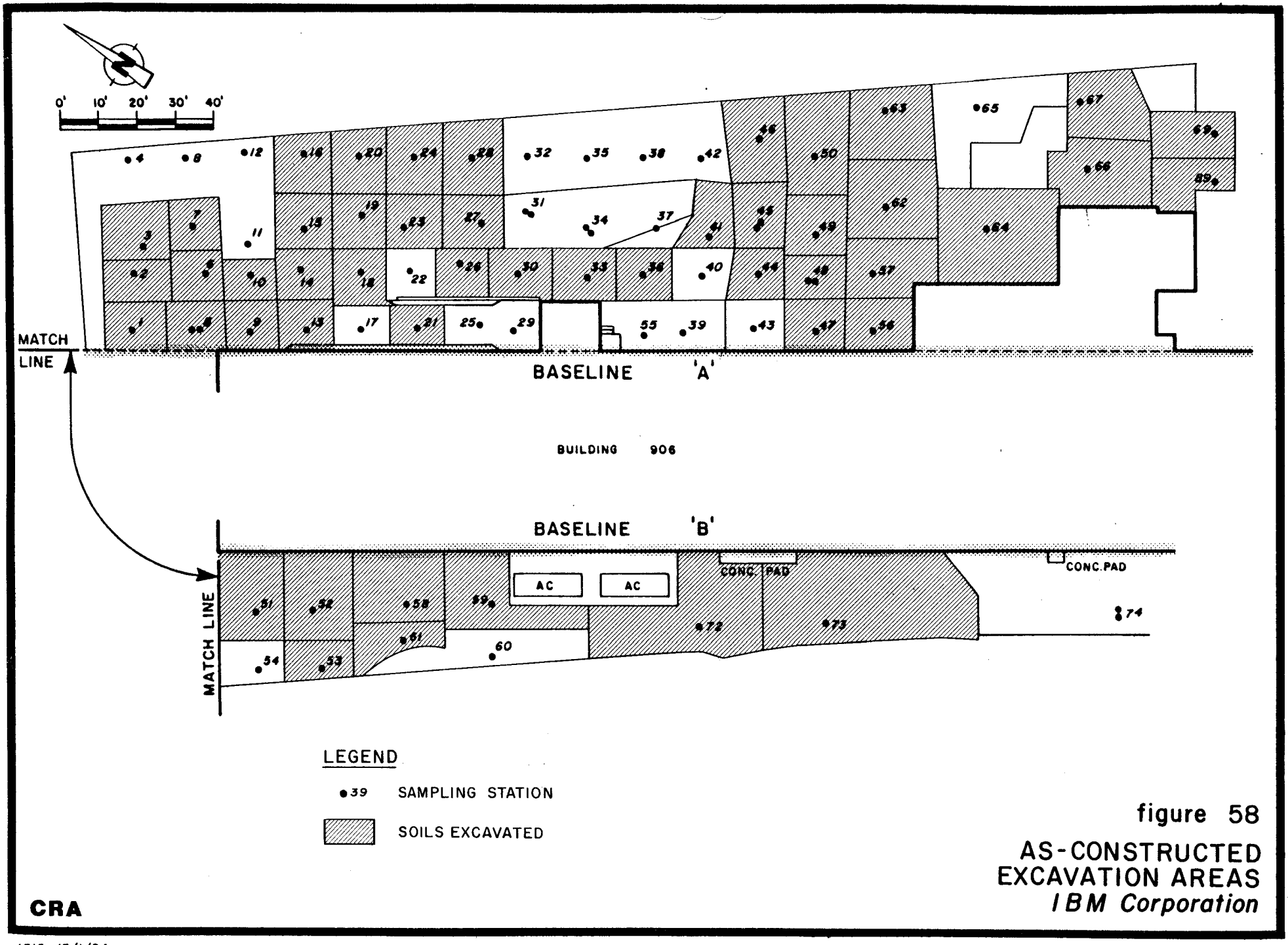

figure 58

AS-CONSTRUCTED EXCAVATION AREAS

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The effectiveness of the remedial program in terms of TVO removal is calculated to be 85.7 percent, as follows:

Effectiveness of Remedial Action (TVO Removal)

$$= \frac{\text{Mass of TVO Actually Disposed}}{\text{Mass of TVO Proposed for Disposal}} \times 100$$

$$= \frac{16.69}{19.48} \times 100$$

$$= 85.7\%$$

5.4 GENERAL REMEDIAL ACTION EFFECTIVENESS

The remedial action program as implemented was effective in the following non-quantitative areas:

i) Impacts upon on-site personnel and adjacent IBM facilities and staff were negligible during the remedial construction program. This is confirmed by ambient air monitoring conducted throughout the project and by the receipt of only one 3rd party complaint which was later determined to be

non-project related. The remedial action program was completed without incident not withstanding congested and constricted work areas replete with high voltage power lines and numerous underground services.

ii) Migration of organic chemicals from the remediation site was eliminated by the protocols established in the site Health and Safety Plan. Decontamination of both site personnel and equipment was completed prior to egress from site. All decontamination liquids and discarded soiled safety apparel and equipment resulting from excavation or sampling activities were disposed at a secure permitted off-site facility.

iii) The transport of 2575 cubic yards of soil from the Building 906 site to the SCA Model City facility was completed in an expeditious and efficient manner with no enroute incidents reported.

iv) The remedial construction was completed in a manner which caused minimal disruption or inconvenience to IBM operations within and adjacent to Building 906.

6.0 CONCLUSIONS

a) A remedial action program to remove and dispose of soils containing organic compounds was completed by IBM on property immediately adjacent to Building 906. The scope of the remedial action as implemented encompassed in excess of twice the area originally proposed by IBM for remedial construction.

b) In terms of criteria agreed to by the State of New York and IBM, the remedial action resulted in removal and disposal by off-site secure landfilling of 85.7 percent of the volatile organic compounds and 89 percent of the bulk soil originally stipulated for removal and disposal. During the course of remedial construction, a total of 2,575 cubic yards of soil were excavated, transported and disposed at the SCA Model City secure landfill facility.

Complete removal was not deemed feasible due to the potential high hazard posed by overhead high voltage power lines and underground services in localized portions of the site.

c) The remedial action was conducted in an efficient, expeditious and professional manner which resulted in a negligible adverse impact upon site personnel, adjacent

IBM facilities and staff, the general public, and the surrounding environment.

All of Which is Respectfully Submitted,

CONESTOGA-ROVERS & ASSOCIATES LIMITED

Richard G. Shepherd, P. Eng.

Wolfe Engler, C.E.T.