

# **NOTICE**

**All drawings located at the end of the document.**

ENVIRONMENTAL PROTECTION AGENCY  
REVIEW AND COMMENT  
TECHNICAL MEMORANDUM (TM)8 - REVISED PHASE II RFI/RI WORK PLAN  
(BEDROCK)  
OPERABLE UNIT 2, MAY, 1993

GENERAL COMMENTS

1. The basic approach outlined in the revised flow diagrams you submitted after our March 31, 1993, meeting are acceptable, with the exception that inability to develop a well says nothing about exposure pathways; it simply means no viable sample can be obtained from that location. The investigation must then be terminated or a contingency activated. We encourage you to proceed with the field program outlined using this logic to guide field decisions.

Response: An integral part of the Revised Bedrock Work Plan and associated contingency plan (currently being developed) is the evaluation of the permeability of LHSU units. One of the basic assumptions being tested in the work plan is that the LHSU is not a complete exposure pathway because LHSU unit permeabilities are too low to allow migration of contaminants, if present, to human receptors, or to allow development of an on-site domestic water supply within the LHSU. The inability to develop wells due to the low permeability of the surrounding screened LHSU units is evidence that the permeability of the units is too low for them to serve as a LHSU exposure pathway. Figures ES-1 and 1-4 illustrate the decision process for evaluation of data from the entire Revised Bedrock Work Plan field program. As such, the decision point "can groundwater samples be collected from LHSU units?" addresses the data obtained from all of the LHSU wells installed during the field program, not just one location. If the preponderance of evidence from the field program indicates that groundwater samples cannot be collected from LHSU units due to low permeability, then the conclusion that these units do not act as exposure pathways is defensible. If the preponderance of evidence indicates otherwise or is inconclusive, then the decision path must lead downward, potentially invoking the contingency plan and additional actions.

2. I would like to reiterate two points made at our meeting. First, the existence or absence of risk as calculated using exposure pathways is not the sole factor in determining the need for action. ARARs are still a consideration. The logic used to guide the investigation cannot therefore be based entirely on the perceived need to support a quantitative risk assessment for the lower HSU. Second, the ability of the lower HSU to support domestic water use is not relevant to the decisions being made at this stage of the process. If lower HSU contamination is identified, contrary to assumed conditions, the quantity question can be dealt with in the design of contingent actions. Lateral extent of contamination may be an issue, regardless of the aquifer's ability to supply domestic users. Numerous portions of the text will require revision to reflect these points, and to be consistent with the revised flow diagrams.

Response: The text of TM-8 has been revised to reflect the revised flow diagrams.

3. Further, it must be made absolutely clear that the plan outlined here is designed to confirm certain assumptions about conditions in the lower HSU. These assumptions should be defined prominently and explicitly in Tech Memo 8. This must be coupled with a commitment to develop and execute contingency actions should conditions diverge from those assumed. This plan should be under development, and must be completed as soon as possible to facilitate prompt action if deviations are detected. Within Tech Memo 8, it must be clearly indicated when and how the contingency plan will be activated.

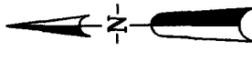
Response: The text of TM-8 has been revised to clarify the expected/assumed conditions, and to indicate that the contingency plan will be invoked if the results of the field program do not confirm those expected/assumed conditions. The contingency plan is currently being developed and will be submitted to EPA and CDH for review in May 1993.

4. One final point, consideration should be given to adding one monitoring well east of wells 3487 and 2887, or justification for not doing so provided. These wells show low levels of organics in LHSU siltstones or sandstones, which may be crossgradient from the southeast trenches. It does not appear existing wells will intercept releases from this area into the localized and thin saturated intervals.

Response: The contamination detected in wells 2887 and 3487 occurred as one time detections at very low levels near the method detection limits. The lack of consistent and previous and/or subsequent detections of contamination in these wells suggests the possibility that the observed contamination is related to laboratory and/or field sampling artifacts. Investigation locations WC-1 and WC-6 specified in the Revised Bedrock Work Plan were selected to test areas with the greatest potential for contamination based on the presence of identified UHSU groundwater plume hotspot areas and the close proximity of LHSU sandstones to those UHSU areas. The area east of wells 2887 and 3487 exhibits relatively low levels of contamination in the UHSU (see Figure 1-25), has a relatively thin saturated zone in the alluvium, and appears to have a substantial thickness of claystone separating the UHSU from LHSU sandstone and siltstone units [see cross-sections BV-BV' and BX-BX', Figures 1-19 and 1-21(b), respectively]. Given these factors and the low concentrations and sporadic nature of the detections in wells 2887 and 3487, we do not believe an additional well is warranted in this area. The OU2 RFI/RI Report will discuss the sporadic nature of these detections.

**EXPLANATION**

- PRE-1990 BEDROCK MONITORING WELL
- PRE-1990 ALLUVIAL MONITORING WELL
- ▲ PRE-1986 MONITORING WELL
- HISTORICAL BOREHOLE
- INDIVIDUAL HAZARDOUS SUBSTANCE SITE LOCATION
- APPROXIMATE BOUNDARY OF OU-2 AREA



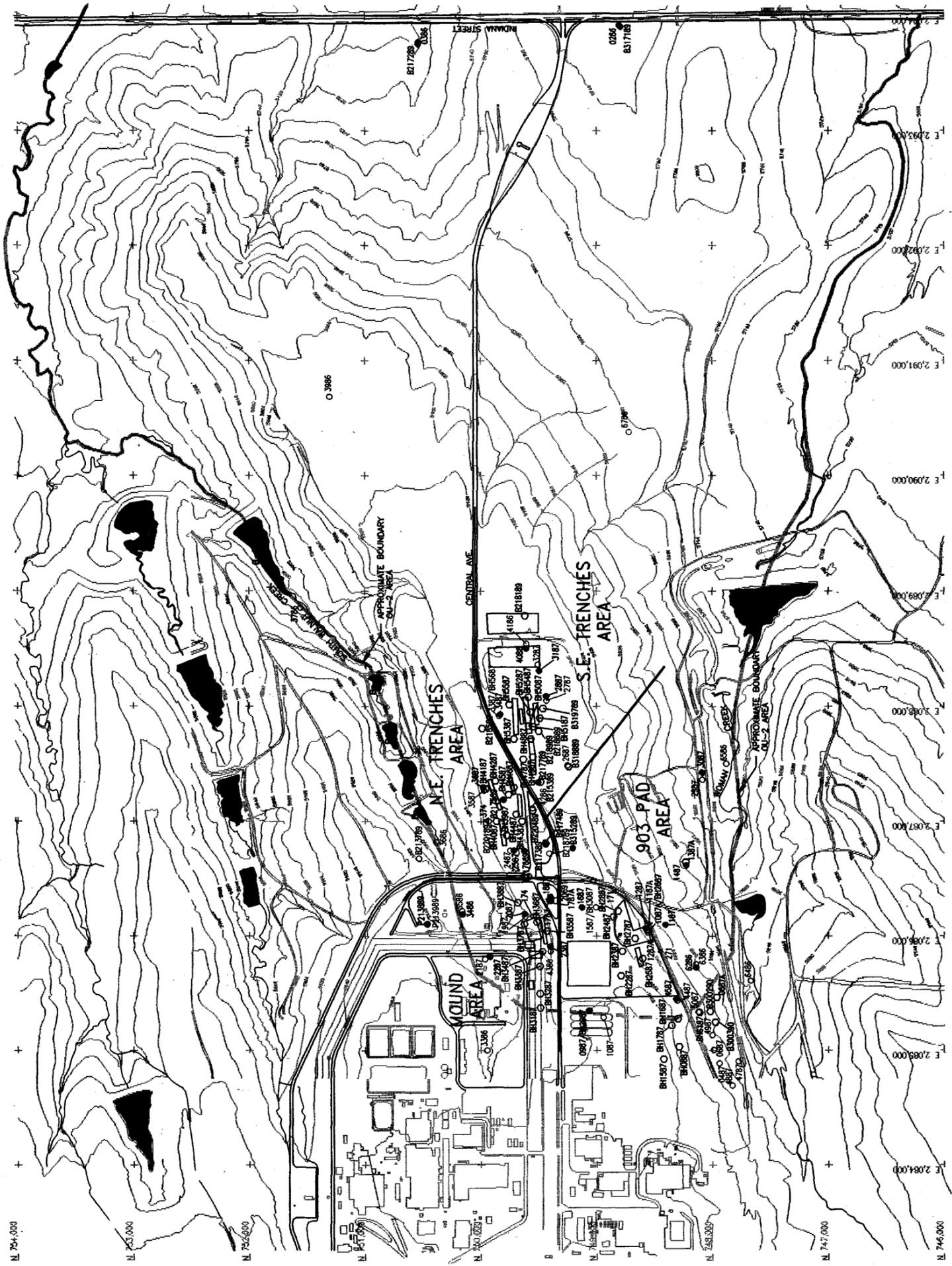
SCALE : 1 INCH = 1000 FEET  
 1000' 0 1000'  
 CONTOUR INTERVAL = 20'

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 TECHNICAL MEMORANDUM NO.8

**PRE-1990 MONITORING WELL AND BOREHOLE LOCATIONS**

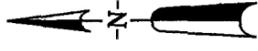
FIGURE 1-5 MARCH 1993

REF0051

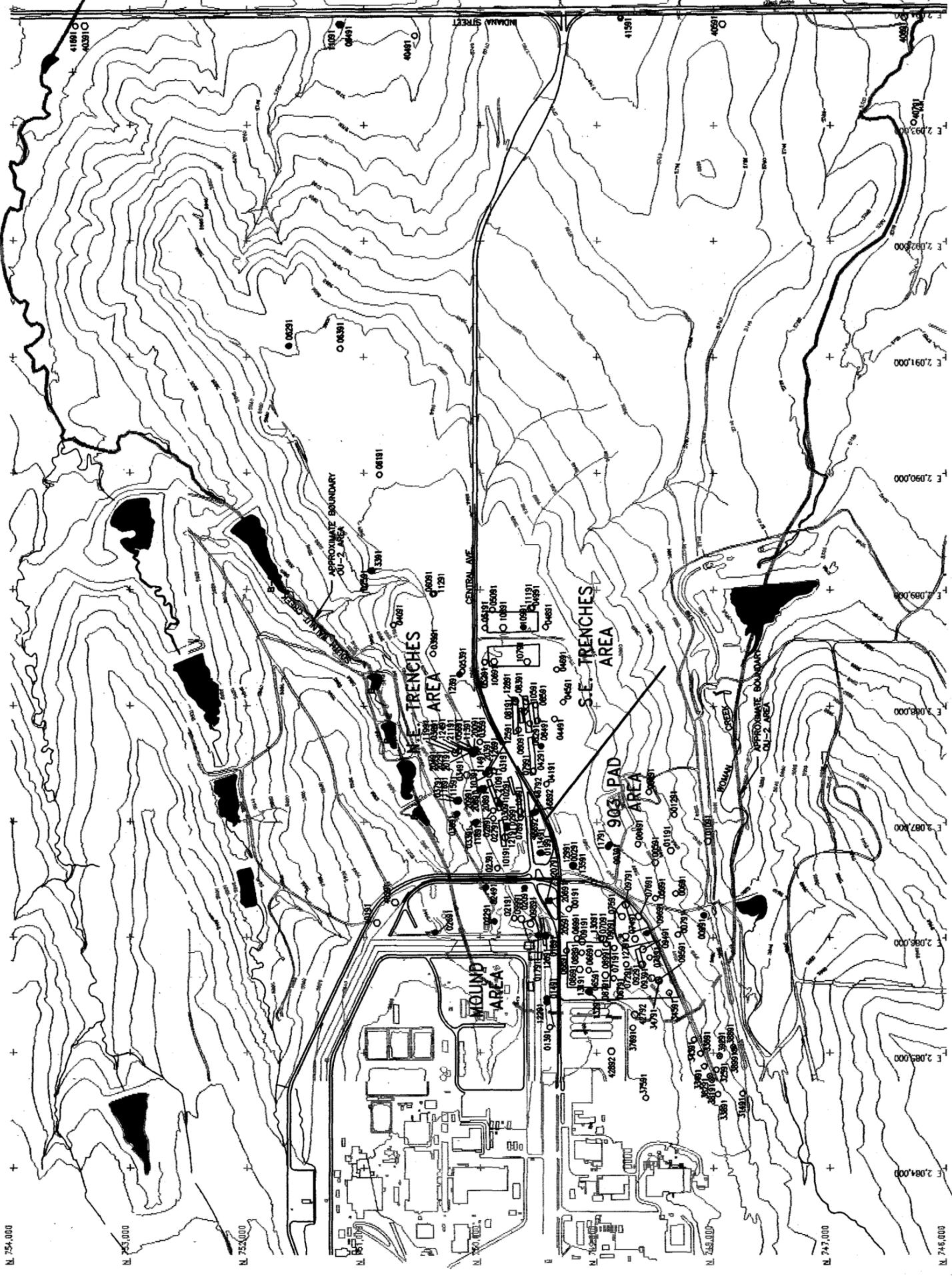


EXPLANATION

- 1991-1992 BEDROCK MONITORING WELL
- 1991 ALLUVIAL MONITORING WELL
- 1991 AND 1992 BOREHOLE
- ⊕ PIEZOMETER
- ALLUVIAL OBSERVATION WELL
- ▲ BEDROCK PUMPING WELL
- BEDROCK OBSERVATION WELL
- ▭ INDIVIDUAL HAZARDOUS SUBSTANCE SITE LOCATION
- APPROXIMATE BOUNDARY OF OU-2 AREA



SCALE : 1 INCH = 1000 FEET  
 1000' 0 1000'  
 CONTOUR INTERVAL = 20'



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1991 AND 1992 MONITORING WELL AND BOREHOLE LOCATIONS

NORTH

SOUTH WALNUT CREEK

SOUTH

WOMAN CREEK

MOUND & TRENCHES AREA

903 PAD AREA

CLAYSTONE

UHSU  
LHSU

UHSU  
LHSU

No. 1 SANDSTONE  
(ARAPAHOE FM.)

SUBCROPPING SANDSTONES

LARAMIE FM SANDSTONE

LARAMIE FM SANDSTONE

LARAMIE FM SANDSTONE

LARAMIE FM SANDSTONE

Qrf

Qc

Qc

Qdl

NOTE: NOT TO SCALE

**EXPLANATION**

- Qdl STREAM ALLUVIUM
- Qc COLLUVIUM
- Qrf ROCKY FLATS ALLUVIUM
- No. 1 ARAPAHOE FORMATION SANDSTONE
- LARAMIE FM SANDSTONE
- UHSU
- LHSU
- BOUNDARY BETWEEN UHSU AND LHSU
- SCHEMATIC WATER LEVEL

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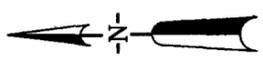
SCHEMATIC DIAGRAM OF THE  
CONCEPTUAL UHSU AND LHSU  
BOUNDARY

FIGURE 1-8

MARCH 1993

# EXPLANATION

- 5940 BEDROCK MONITOR WELL LOCATION SHOWING ELEVATION (in Feet) OF TOP OF BEDROCK
- 5887 ALLUVIAL/COLLUVIAL MONITOR WELL LOCATION SHOWING ELEVATION (in Feet) OF TOP OF BEDROCK
- 5883 BOREHOLE LOCATION SHOWING ELEVATION (in Feet) OF TOP OF BEDROCK
- 2700 TOP OF BEDROCK (Arapahoe and Laramie Formations) ELEVATION CONTOUR (Dashed Where Approximately Located or Inferred)
- APPROXIMATE BOUNDARY OF OU-2 AREA



SCALE : 1 INCH = 500 FEET

CONTOUR INTERVAL = 20'

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TOP OF BEDROCK  
(Arapahoe and Laramie Formations)  
BENEATH ALLUVIAL/COLLUVIAL COVER

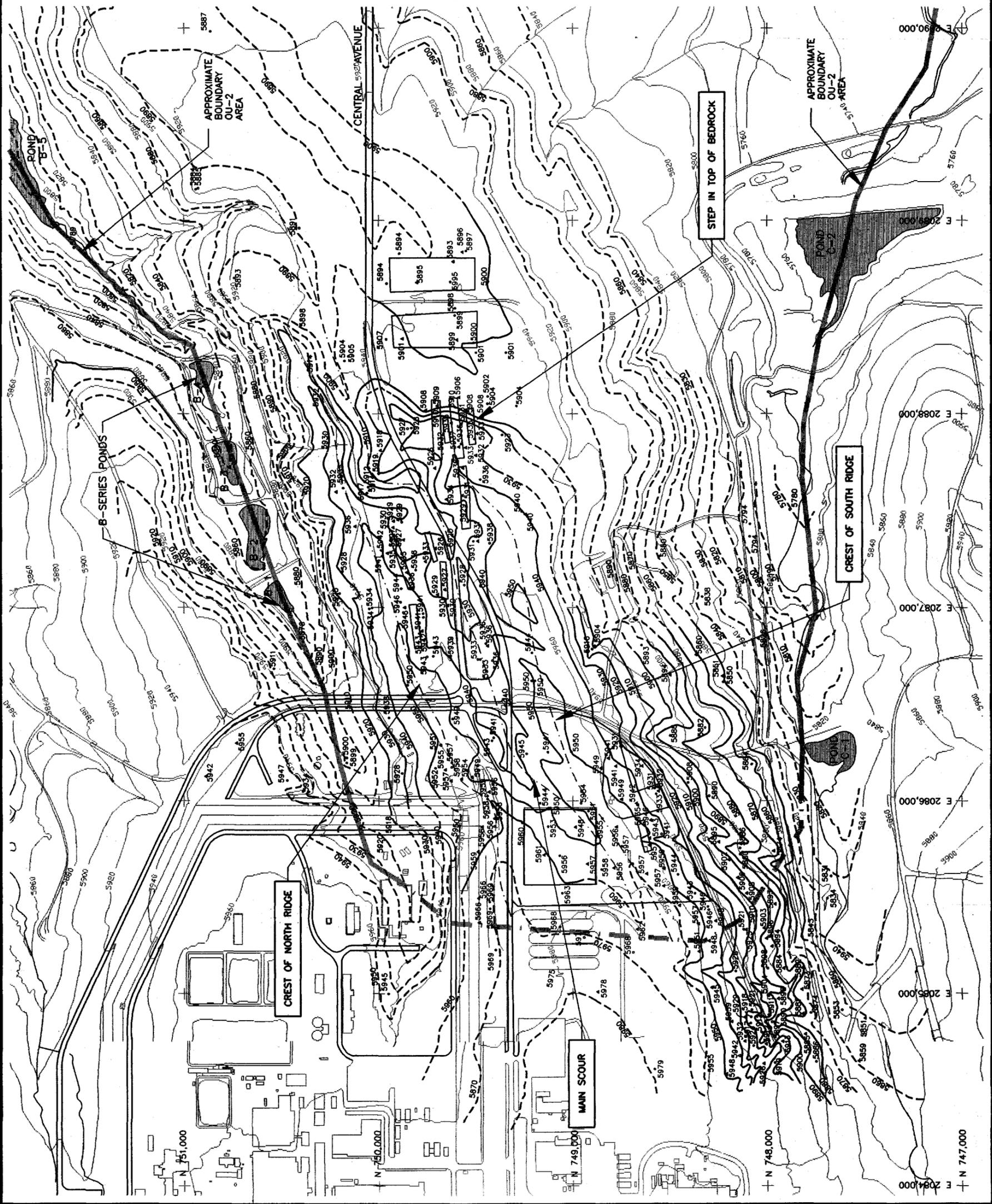
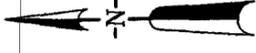


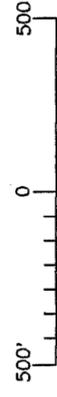
FIGURE 1-9 MARCH 1993  
REL0056 1-500

# EXPLANATION

- CONTROL POINT SHOWING THICKNESS (in Feet) OF CLAYSTONE/SILTSTONE LAYER BETWEEN BASE OF ALLUVIUM/COLLUVIUM AND TOP OF NO.1 SANDSTONE
- THICKNESS CONTOUR (in Feet) OF CLAYSTONE/SILTSTONE LAYER BETWEEN BASE OF ALLUVIUM/COLLUVIUM AND TOP OF NO.1 SANDSTONE (5 Ft. Contour Interval; Dashed Where Approximate or Inferred Thickness)
- BOUNDARY OF NO.1 SANDSTONE CHANNEL
  - (---) Approximate Location
  - (- - -) Inferred Location
- EROSIONAL LIMIT OF SANDSTONE (i.e., Intersection of Sandstone Bottom and Topography of Hillside)
- AREA OF DIRECT CONTACT BETWEEN NO.1 SANDSTONE AND OVERLYING ALLUVIUM/COLLUVIUM
- VEGETATED AREAS ASSOCIATED WITH NO.1 SANDSTONE GROUNDWATER SEEPS
- APPROXIMATE BOUNDARY OF OU-2 AREA



SCALE : 1 INCH = 500 FEET



CONTOUR INTERVAL = 20'

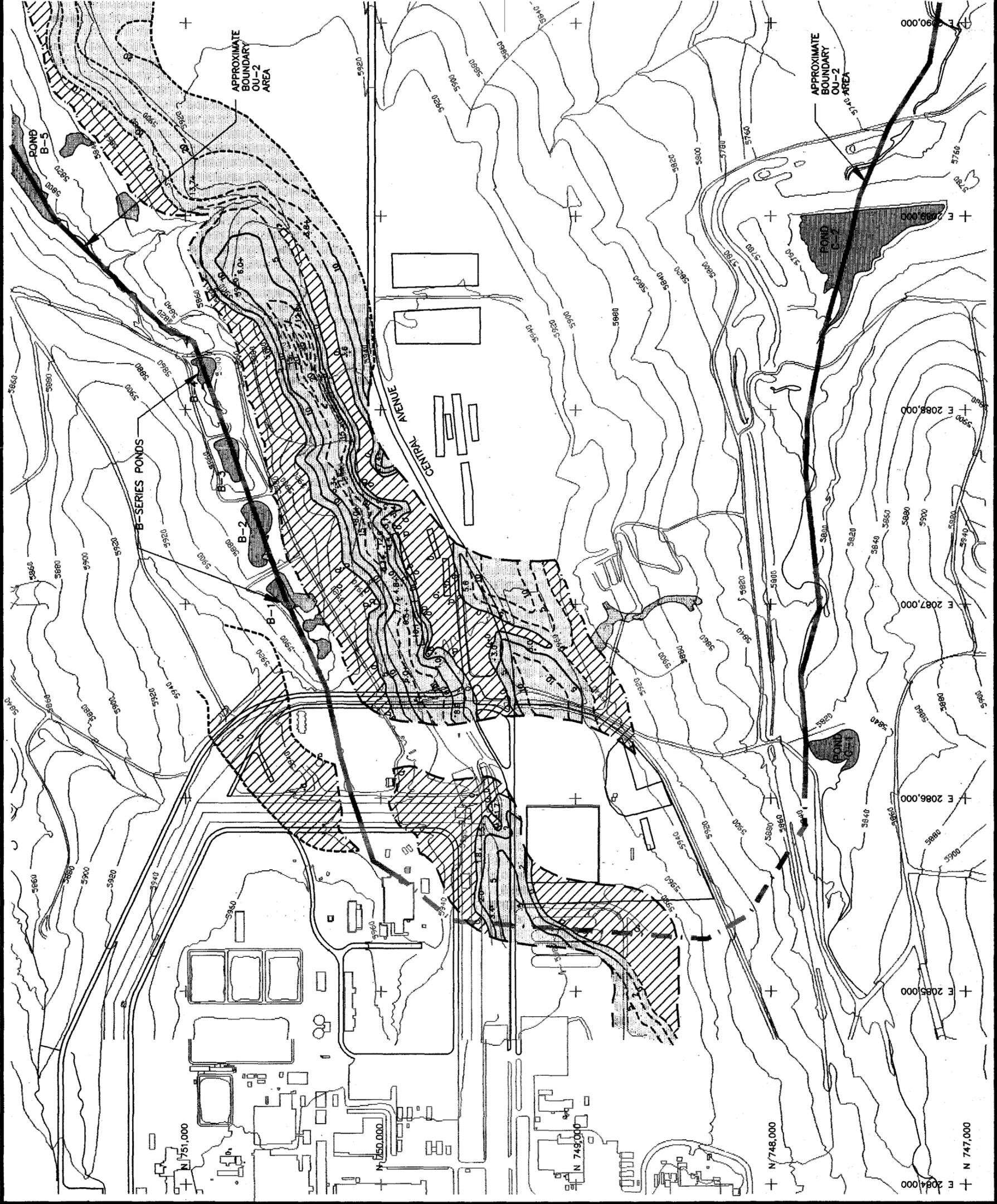
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LATERAL EXTENT OF NO.1 SANDSTONE AND CONTACT ZONES WITH OVERLYING ALLUVIUM/COLLUVIUM

FIGURE 1-10

MARCH 1993



# EXPLANATION

- 5940
- 5900
- 5900
- 5900
- 5900
- 5900

ELEVATION (IN FEET) OF POTENTIOMETRIC SURFACE IN ALLUVIAL/COLLUVIAL MONITOR WELL (March, 1991 Measurements)

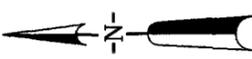
POTENTIOMETRIC SURFACE ELEVATION CONTOUR (Dashed Where Approximately Located)

EXTENT OF SATURATION IN ALLUVIUM/COLLUVIUM

AREAL EXTENT OF ROCKY FLATS ALLUVIUM (Dashed Where Approximately Located)

VEGETATED AREAS ASSOCIATED WITH ALLUVIAL GROUNDWATER SEEPS

APPROXIMATE BOUNDARY OF OU-2 AREA



SCALE : 1 INCH = 500 FEET

500' 0 500'

CONTOUR INTERVAL = 20'

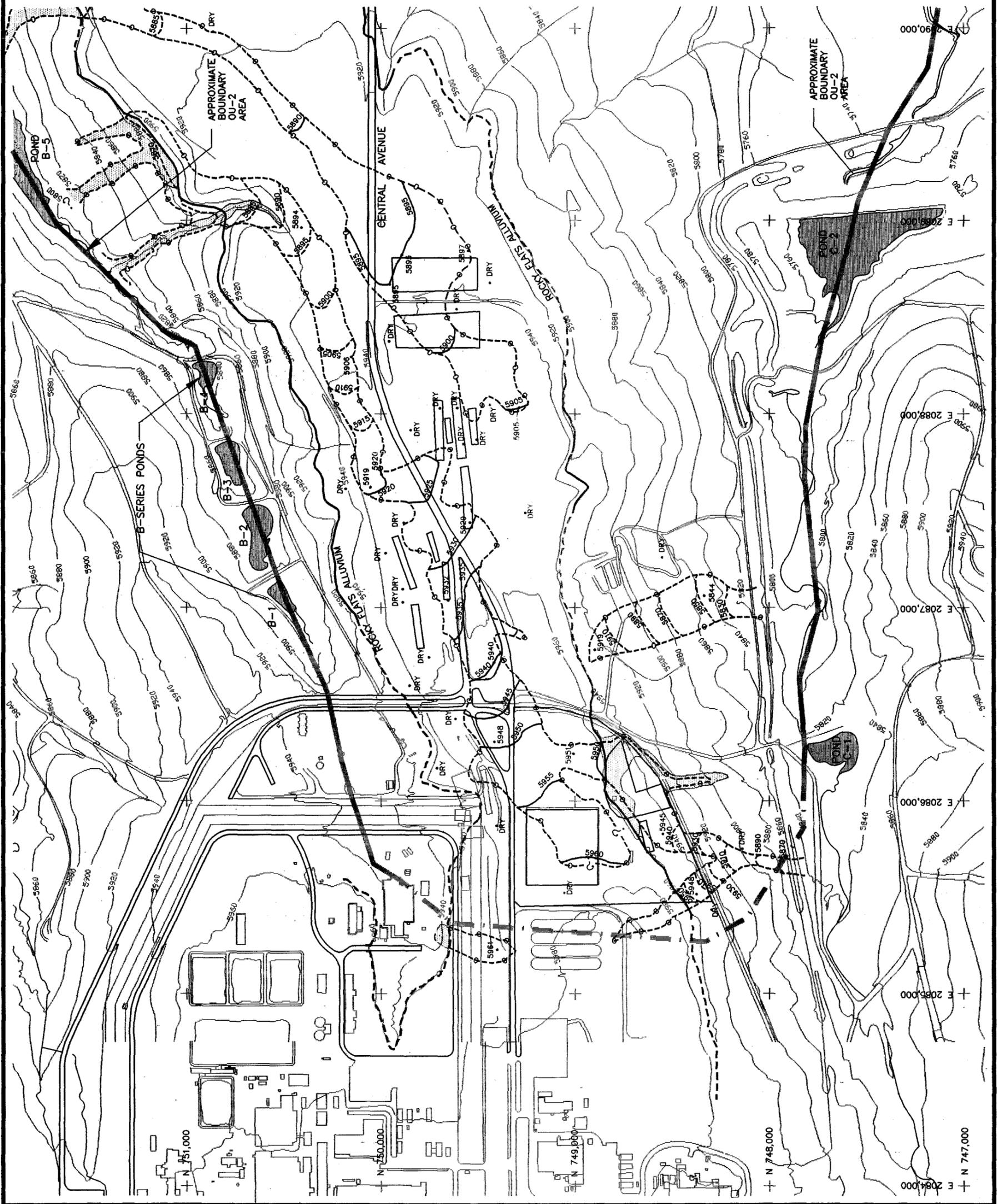
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POTENTIOMETRIC SURFACE WITHIN THE  
ROCKY FLATS ALLUVIUM AND COLLUVIUM  
UHSU GROUNDWATER FLOW SYSTEM  
FIRST QUARTER 1992

FIGURE 1-11 MARCH 1993

RF10058 1-500



# EXPLANATION

- 5833
- 5800
- 5800
- 5800
- 5800
- 5800

ELEVATION (In Feet) OF POTENTIOMETRIC SURFACE WITHIN NO.1 SANDSTONE MONITOR WELL (January, 1992 Measurements)

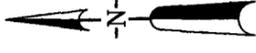
POTENTIOMETRIC SURFACE ELEVATION CONTOUR (Dashed Where Approximately Located or Inferred)

BOUNDARY OF NO.1 SANDSTONE CHANNEL (--- Approximate Location) (--- Inferred Location)

EROSIONAL LIMIT OF SANDSTONE (i.e., intersection of Ss. Bottom and topography of Hillsides)

VEGETATED AREAS ASSOCIATED WITH NO.1 SANDSTONE GROUNDWATER SEEPS

APPROXIMATE BOUNDARY OF OU-2 AREA



SCALE : 1 INCH = 500 FEET

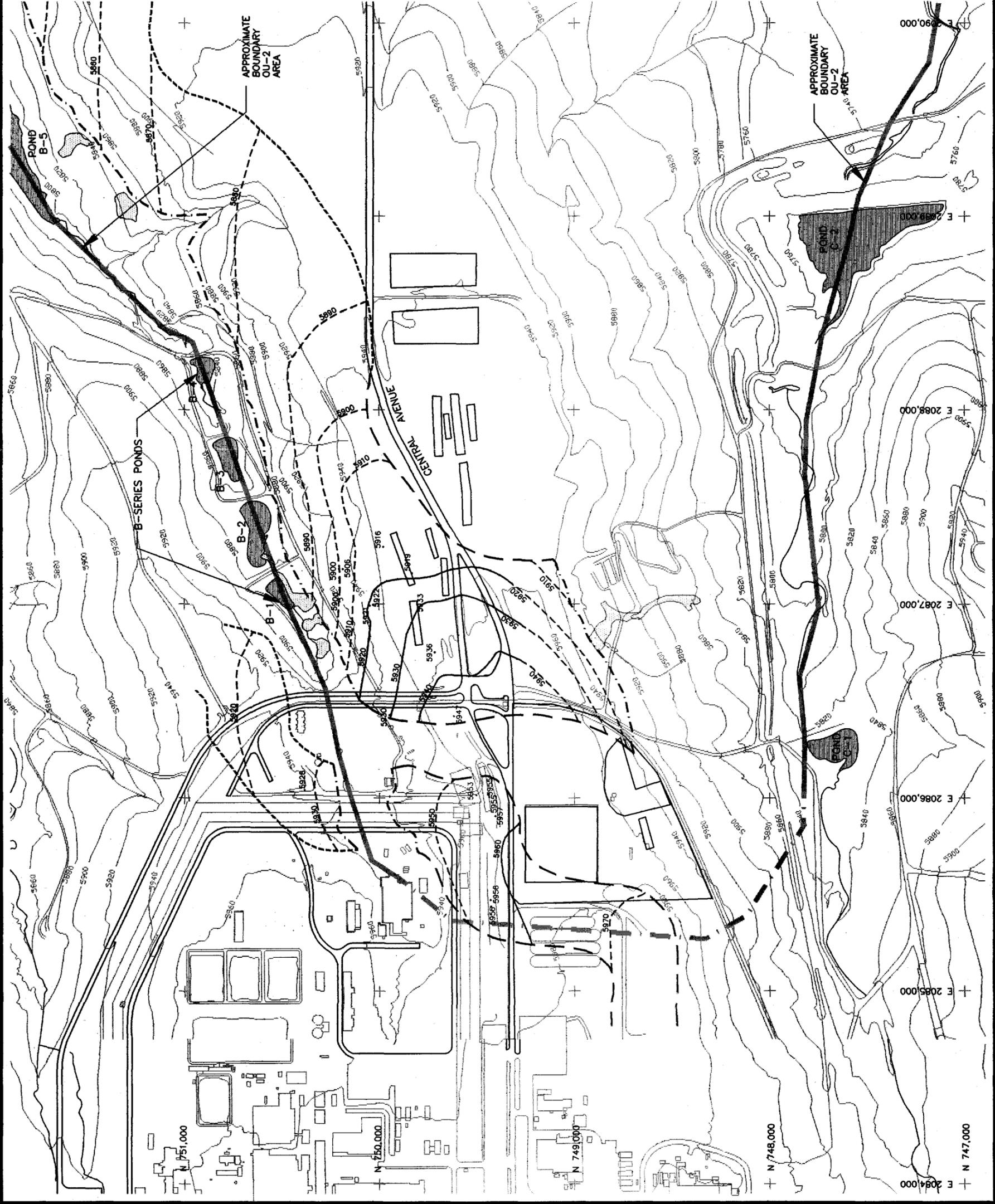
500' 0 500'

CONTOUR INTERVAL = 20'

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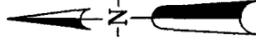
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POTENTIOMETRIC SURFACE  
WITHIN THE NO.1 SANDSTONE  
UHSU GROUNDWATER FLOW SYSTEM  
FIRST QUARTER 1992



**EXPLANATION**

- ALLUVIAL MONITORING WELL
- BEDROCK MONITORING WELL
- BEDROCK OBSERVATION WELL
- BOREHOLE
- GEOLOGIC CROSS-SECTION LINES
- INDIVIDUAL HAZARDOUS SUBSTANCE SITE LOCATION
- APPROXIMATE BOUNDARY OF OU-2 AREA



SCALE : 1 INCH = 500 FEET

CONTOUR INTERVAL = 20'

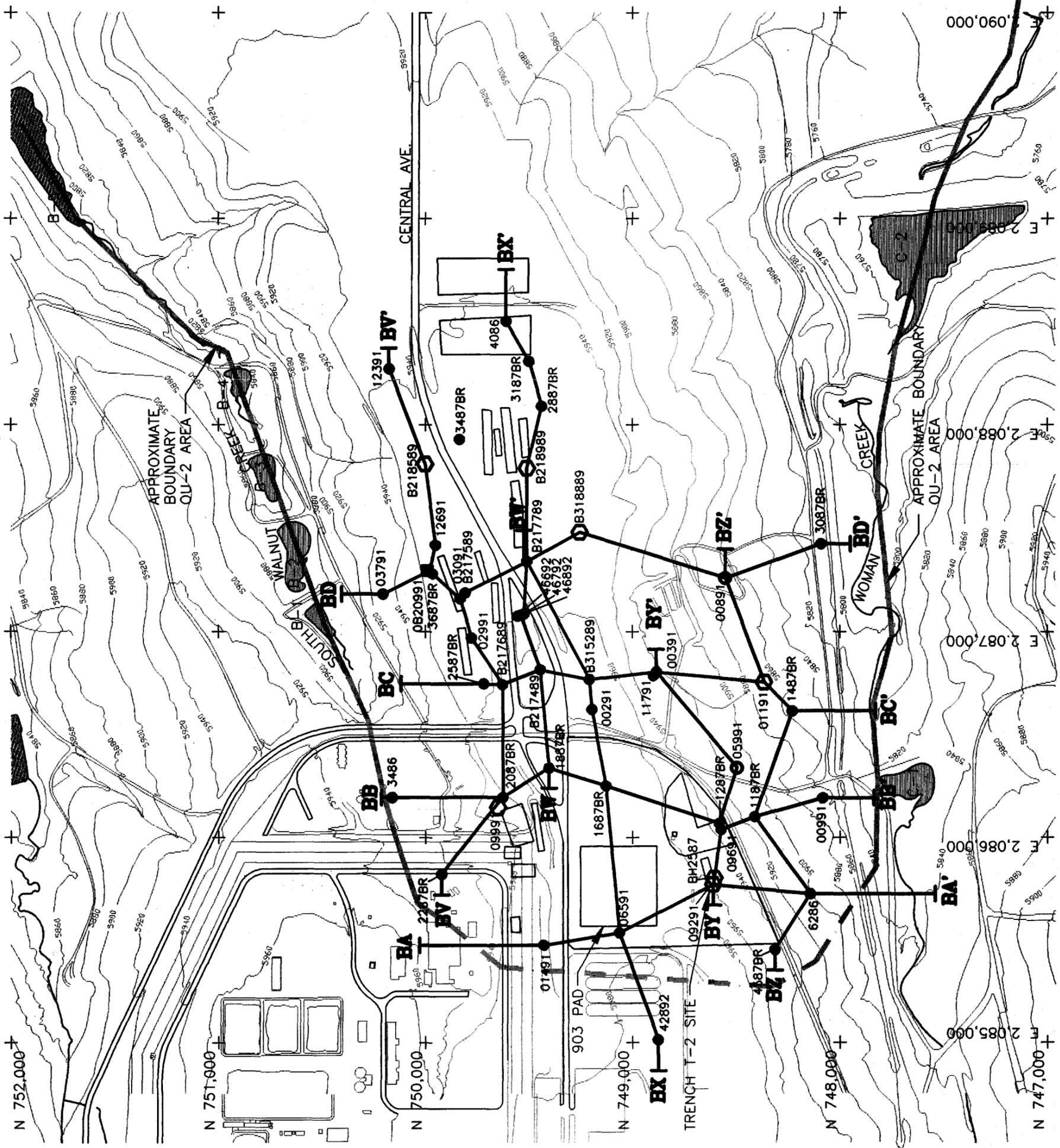
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LOCATION MAP  
GEOLOGIC CROSS-SECTIONS

FIGURE 1-13 MARCH 1993

RF00071



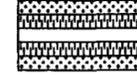
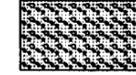
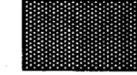
SOIL SYMBOLS

|   |    |  |
|---|----|--|
|    | GW | WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES  |
|    | GP | POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES  |
|    | GM | SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES   |
|    | GC | CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES  |
|    | SW | WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES  |
|    | SP | POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES  |
|   | SM | SILTY SANDS, SAND-SILT MIXTURES  |
|  | SC | CLAYEY SANDS, SAND-CLAY MIXTURES   |
|  | ML | INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY |
|  | CL | INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS                  |
|  | CH | INORGANIC CLAYS OR HIGH PLASTICITY, FAT CLAYS  |

BEDROCK SYMBOLS

|   |  |
|---|--|
|    | SANDSTONE                                  |
|    | SILTY SANDSTONE                            |
|    | CLAYEY SANDSTONE                           |
|    | SILTSTONE                                  |
|    | SANDY SILTSTONE                            |
|    | CLAYEY SILTSTONE                           |
|   | CLAYSTONE                                  |
|  | SANDY CLAYSTONE                            |
|  | SILTY CLAYSTONE                            |
|  | CALICHE                                    |
|  | NO RECOVERY OR SAMPLED INTERVAL NOT LOGGED |

WELL CONSTRUCTION SYMBOLS

|   |   |
|---|---|
|    | CONCRETE SURROUNDING SOLID WELL PIPE                |
|    | BENTONITE SEAL SURROUNDING SOLID WELL PIPE          |
|    | SAND FILTER PACK SURROUNDING SOLID WELL PIPE        |
|    | GROUT SURROUNDING SOLID WELL PIPE                   |
|   | SAND FILTER PACK SURROUNDING WELL SCREENED INTERVAL |
|  | CONCRETE FILL                                       |
|  | BENTONITE FILL                                      |

WATER LEVEL AND LOCATION SYMBOLS

|   |      |  |
|---|------|--|
|  | 4/92 | STATIC WATER LEVEL AND MEASUREMENT DATE                              |
|  |      | ALLUVIAL MONITORING WELL   |
|  |      | BEDROCK MONITORING WELL  |
|  |      | BEDROCK OBSERVATION WELL   |
|  |      | BOREHOLE   |
| 01491   |      | WELL NUMBER. LAST 2 DIGITS INDICATE YEAR IN WHICH WELL WAS INSTALLED |

GROUNDWATER ANALYTE DATA

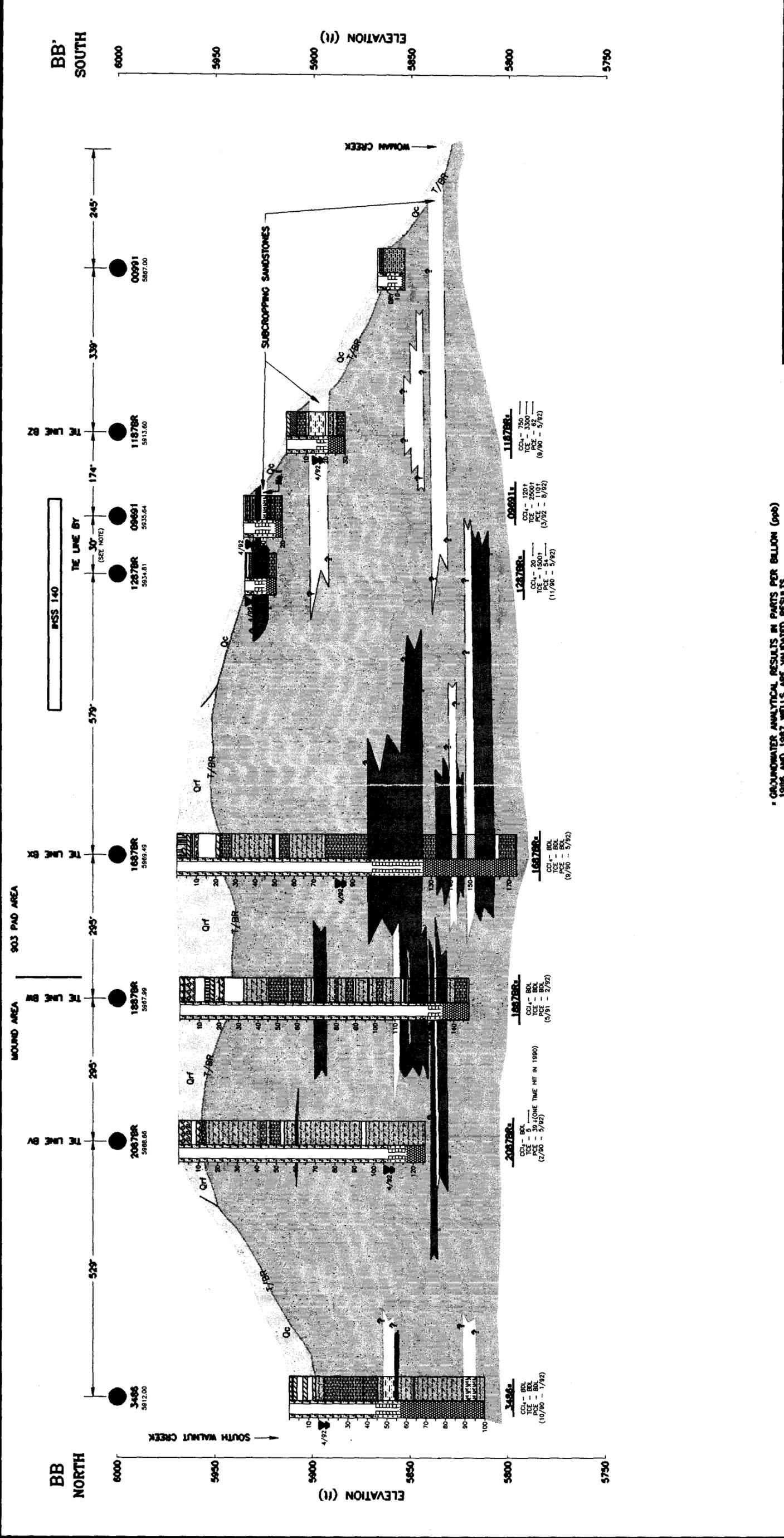
|                  |   |
|------------------|---|
| CCl <sub>4</sub> | CARBON TETRACHLORIDE                                    |
| TCE              | TRICHLOROETHENE   |
| PCE              | TETRACHLOROETHENE                                       |
| 280              | CONCENTRATION (ppb)                                     |
| BDL              | BELOW DETECTION LEVEL                                   |
| —                | RESULTS CONSTANT OVER TIME                              |
| ↑ ↓              | RESULTS INCREASED OR DECREASED OVER TIME TO LEVEL SHOWN |
| (3/92-5/92)      | SAMPLING PERIOD   |

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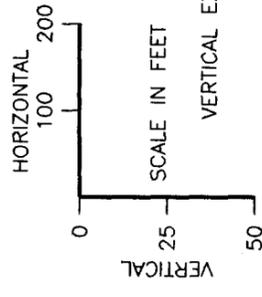
**GEOLOGIC CROSS-SECTIONS LEGEND**

FIGURE 1-14 MARCH 1993

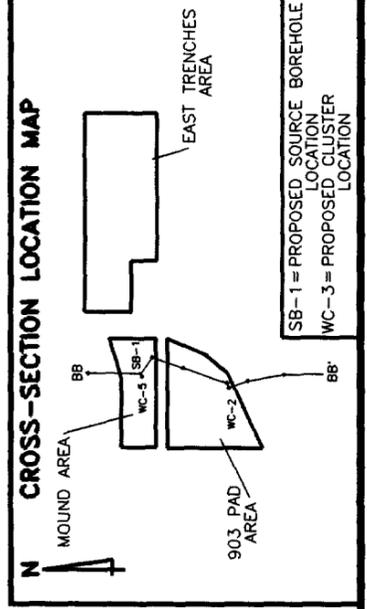
RFL0070



\* GROUNDWATER ANALYTICAL RESULTS IN PARTS PER BILLION (ppb) 1986 AND 1987 WELLS ARE VALIDATED RESULTS 1989, 1991 AND 1992 WELLS ARE NON-VALIDATED RESULTS



NOTE: DISTANCE SHOWN BETWEEN WELLS 1287BR, 09691 IS NOT TO HORIZONTAL SCALE.



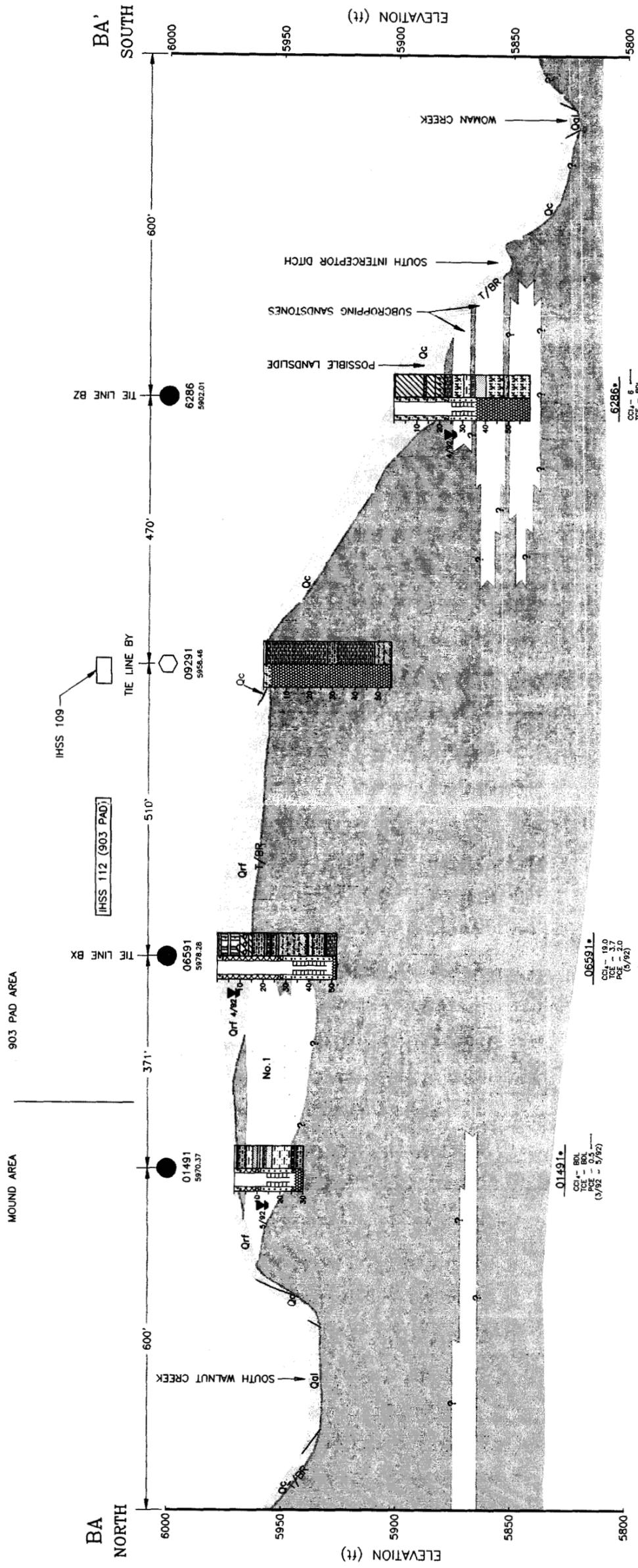
- EXPLANATION**
- Qd1 = STREAM ALLUVIUM
  - Qc = COLLUVIUM
  - Qr1 = ROCKY FLATS ALLUVIUM
  - No. 1 = ARAPAHOE FORMATION (FM) SANDSTONE
  - ALL SANDSTONES BELOW THE BASE OF THE NO. 1 SANDSTONE (ARAPAHOE FM) ARE LARAMIE FM SANDSTONES
  - T/BR = TOP OF BEDROCK
  - = LOCATION SYMBOL
  - 3486 = LOCATION NAME
  - 5912.00 = GROUND SURFACE ELEVATION (ft)
- (SEE LEGEND PAGE FOR MORE ON SYMBOLS AND ANALYTE DATA)

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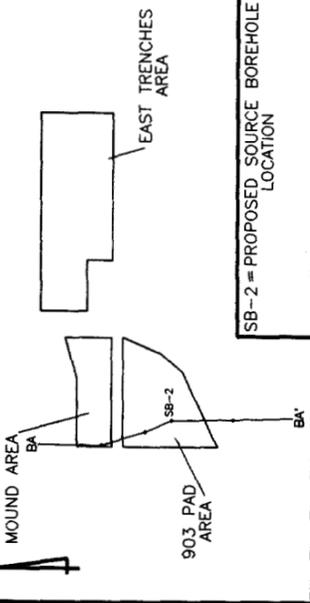
**GEOLOGIC CROSS-SECTION BB-BB'**

FIGURE 1-16 MARCH 1993



\* GROUNDWATER ANALYTICAL RESULTS IN PARTS PER BILLION (ppb)  
 1986 AND 1987 WELLS ARE VALIDATED RESULTS  
 1989, 1991 AND 1992 WELLS ARE NON-VALIDATED RESULTS

**CROSS-SECTION LOCATION MAP**

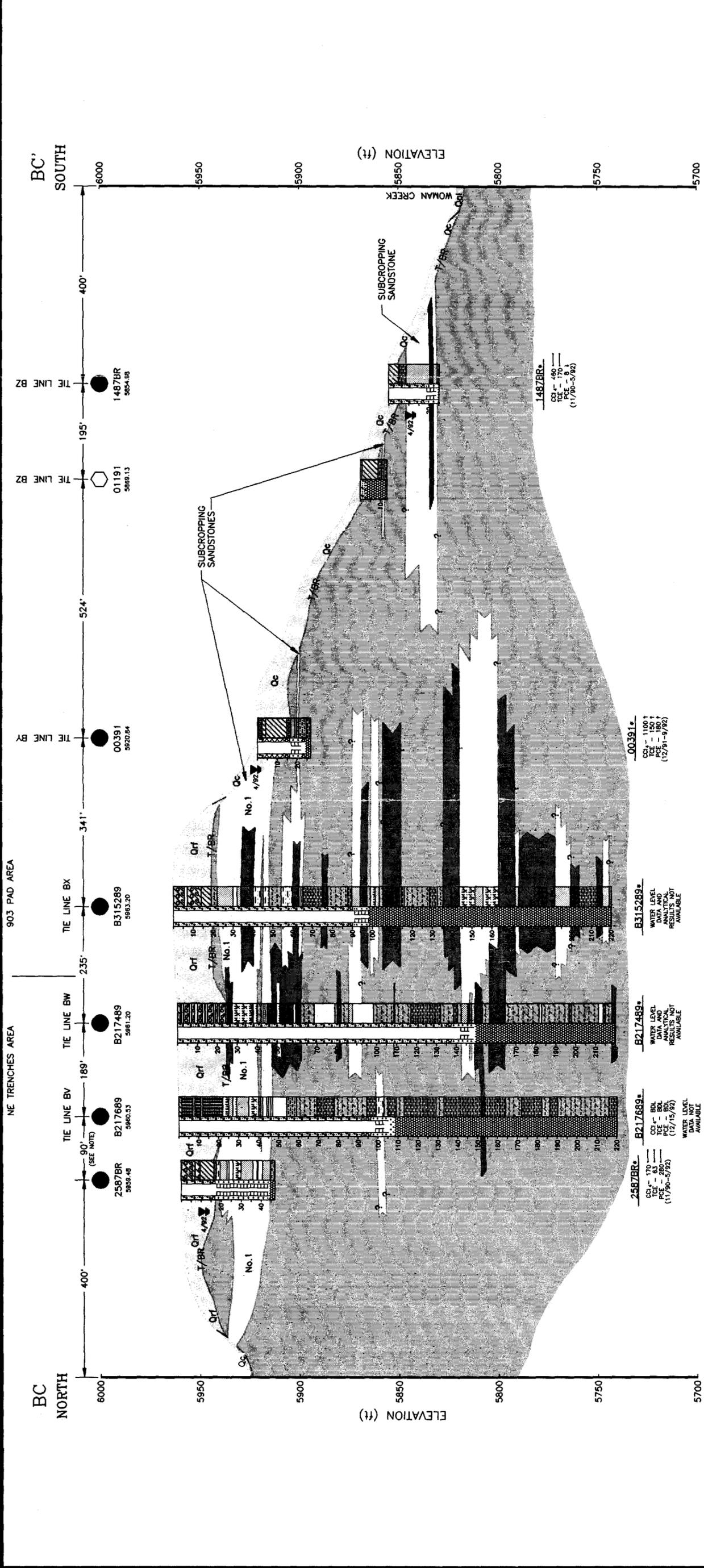


**EXPLANATION**

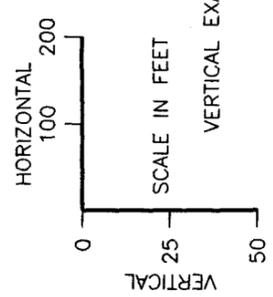
- Qd1 = STREAM ALLUVIUM
  - Qc = COLLUVIUM
  - Qrf = ROCKY FLATS ALLUVIUM
  - No. 1 = ARAPAHOE FORMATION (FM) SANDSTONE
  - ALL SANDSTONES BELOW THE BASE OF THE No. 1 SANDSTONE (ARAPAHOE FM) ARE LARAMIE FM SANDSTONES
  - T/BR = TOP OF BEDROCK
  - = LOCATION SYMBOL
  - 3486 = LOCATION NAME
  - 5912.00 = GROUND SURFACE ELEVATION (ft)
- (SEE LEGEND PAGE FOR MORE ON SYMBOLS AND ANALYTE DATA)

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**GEOLOGIC CROSS-SECTION BA-BA'**

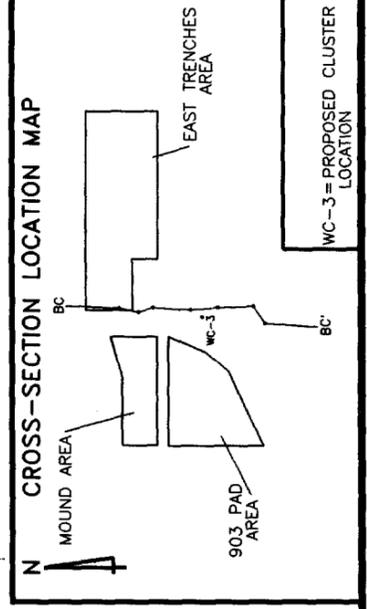
FIGURE 1-15 MARCH 1993



\* GROUNDWATER ANALYTICAL RESULTS IN PARTS PER BILLION (ppb) 1986 AND 1987 WELLS ARE VALIDATED RESULTS 1989, 1991 AND 1992 WELLS ARE NON-VALIDATED RESULTS



NOTE: DISTANCE SHOWN BETWEEN WELLS 2587BR, B217689 IS NOT TO HORIZONTAL SCALE.



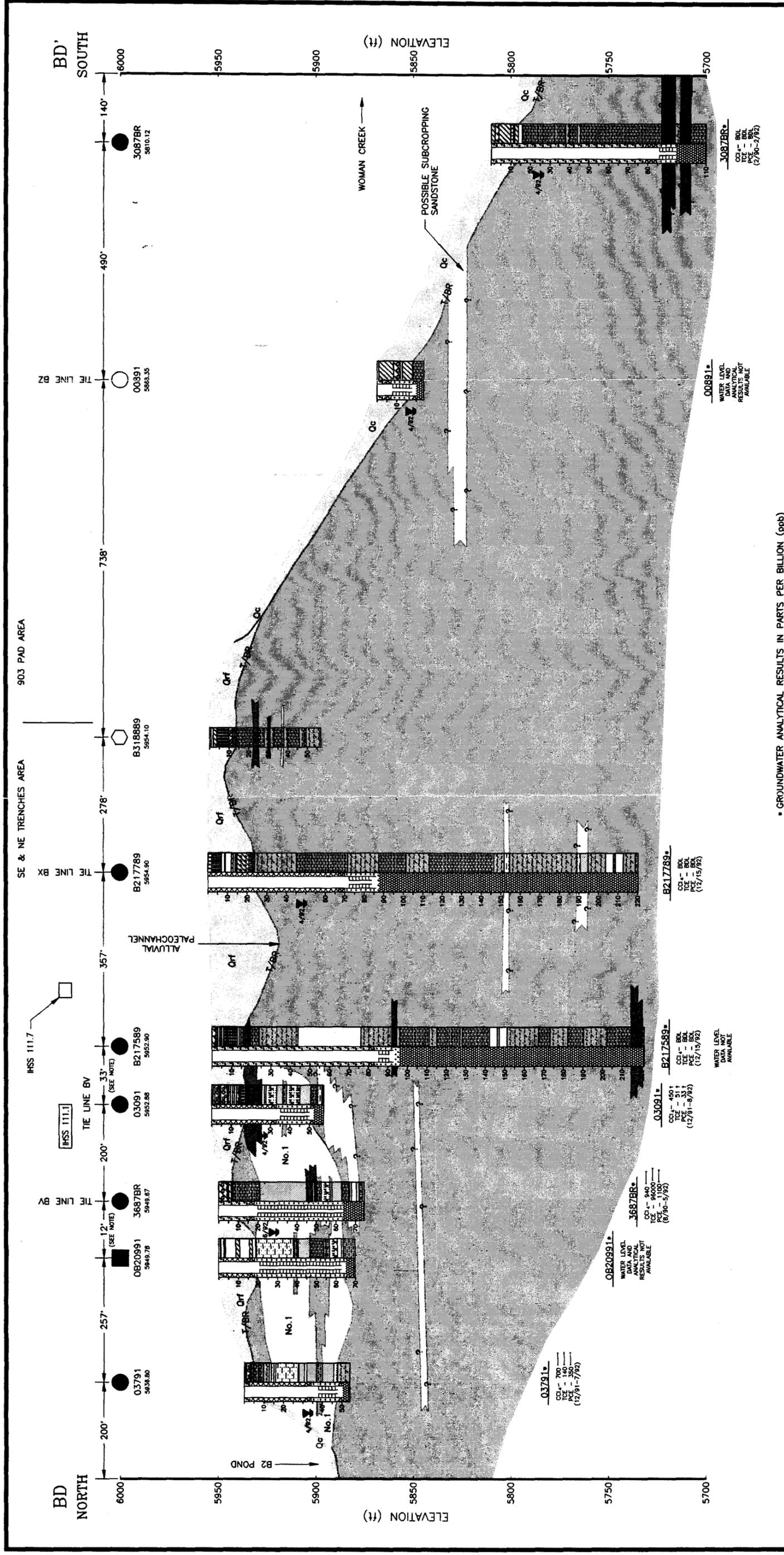
**EXPLANATION**

|   |   |                                   |
|---|---|-----------------------------------|
| Qal   | = | STREAM ALLUVIUM                   |
| Qc  | = | COLLUVIUM                         |
| Qrf   | = | ROCKY FLATS ALLUVIUM              |
| No.1  | = | ARAPAHOE FORMATION (FM) SANDSTONE |
| ALL SANDSTONES BELOW THE BASE OF THE No.1 SANDSTONE (ARAPAHOE FM) ARE LARAMIE FM SANDSTONES |   |                                   |
| T/BR  | = | TOP OF BEDROCK                    |
| ●   | = | LOCATION SYMBOL                   |
| 3486  | = | LOCATION NAME                     |
| 5912.00   | = | GROUND SURFACE ELEVATION (ft)     |
| (SEE LEGEND PAGE FOR MORE ON SYMBOLS AND ANALYTE DATA)                                      |   |                                   |

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 REVISED BEDROCK WORK PLAN  
 TECHNICAL MEMORANDUM NO.8  
 GEOLOGIC CROSS-SECTION BC-BC'

FIGURE 1-17 MARCH 1993

RFL0062



U.S. DEPARTMENT OF ENERGY  
 Rocky Flats Plant, Golden, Colorado

OPERABLE UNIT 2  
 REVISED BEDROCK WORK PLAN  
 TECHNICAL MEMORANDUM NO.8

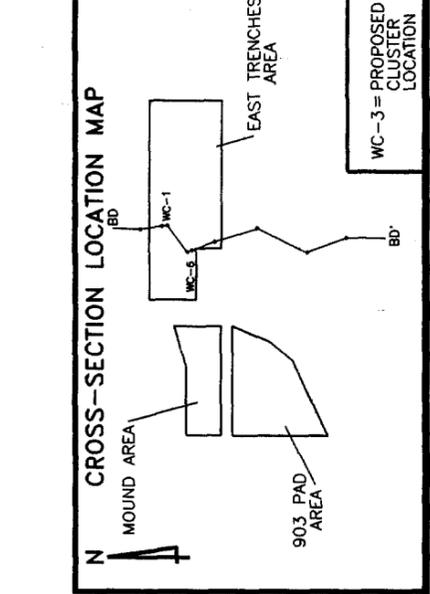
GEOLOGIC CROSS-SECTION BD-BD'

• GROUNDWATER ANALYTICAL RESULTS IN PARTS PER BILLION (ppb)  
 1986 AND 1987 WELLS ARE VALIDATED RESULTS  
 1989, 1991 AND 1992 WELLS ARE NON-VALIDATED RESULTS

**EXPLANATION**

Qd1 = STREAM ALLUVIUM  
 Qc = COLLUVIUM  
 Qrf = ROCKY FLATS ALLUVIUM  
 No.1 = ARAPAHOE FORMATION (FM) SANDSTONE  
 ALL SANDSTONES BELOW THE BASE OF THE No.1 SANDSTONE (ARAPAHOE FM) ARE LARAMIE FM SANDSTONES  
 T/BR = TOP OF BEDROCK

● = LOCATION SYMBOL  
 3486 = LOCATION NAME  
 9912.00 = GROUND SURFACE ELEVATION (ft)  
 (SEE LEGEND PAGE FOR MORE ON SYMBOLS AND ANALYTE DATA)

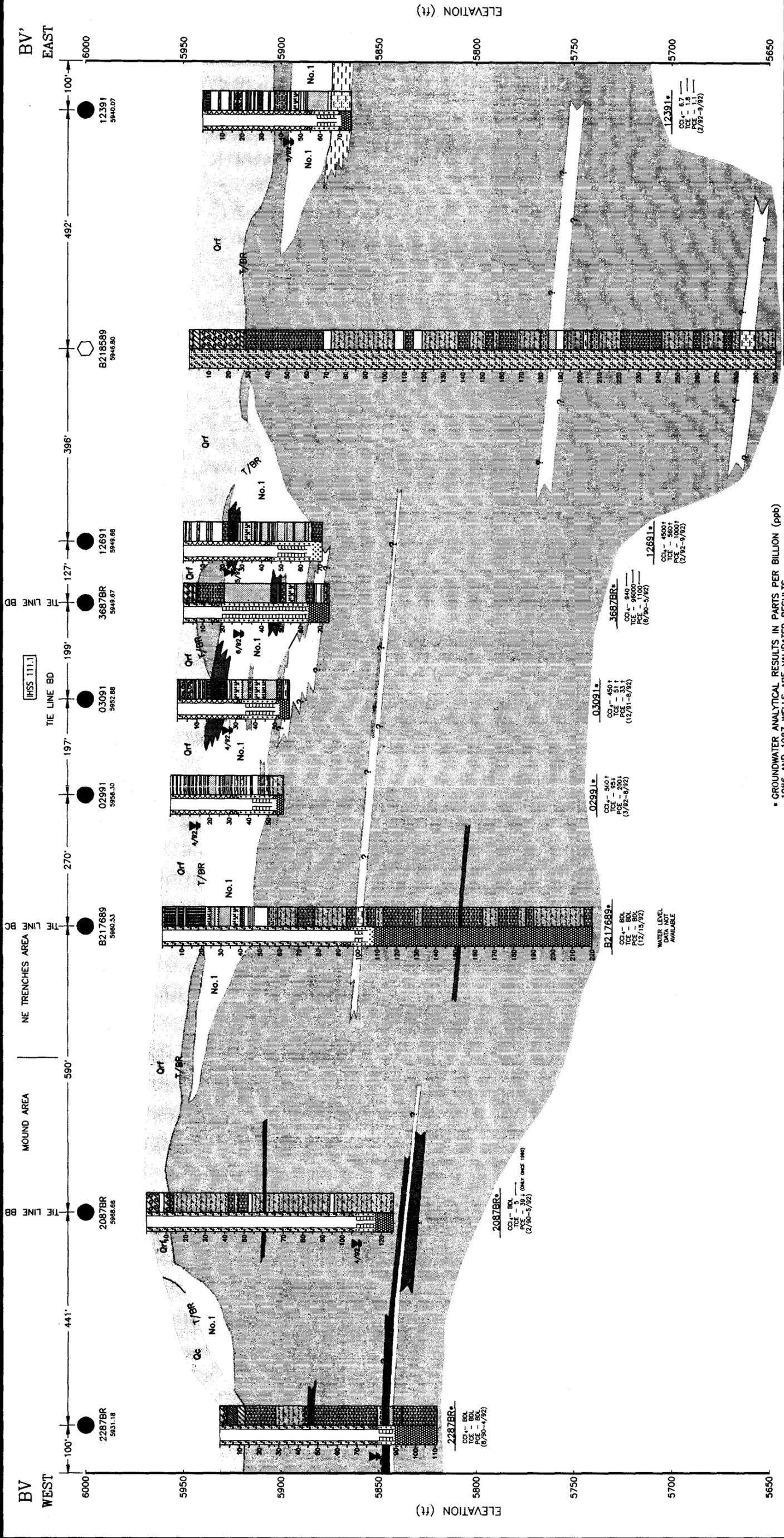


HORIZONTAL SCALE IN FEET: 0, 100, 200

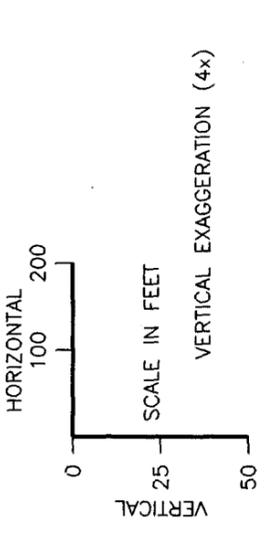
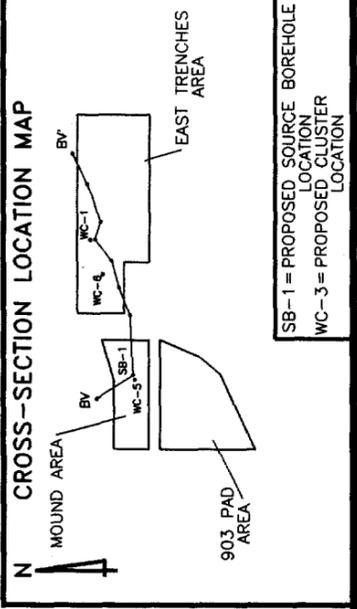
VERTICAL SCALE IN FEET: 0, 25, 50

VERTICAL EXAGGERATION (4x)

NOTE: DISTANCE SHOWN BETWEEN WELLS 0820991, 3687BR AND 03091, B217589 ARE NOT TO HORIZONTAL SCALE.



\* GROUNDWATER ANALYTICAL RESULTS IN PARTS PER BILLION (ppb)  
 1986 AND 1987 WELLS ARE VALIDATED RESULTS  
 1989, 1991 AND 1992 WELLS ARE NON-VALIDATED RESULTS



**EXPLANATION**

- Qd1 = STREAM ALLUVIUM
- Qc = COLLUVIUM
- Qrf = ROCKY FLATS ALLUVIUM
- No. 1 = ARAPAHOE FORMATION (FM) SANDSTONE
- ALL SANDSTONES BELOW THE BASE OF THE No. 1 SANDSTONE (ARAPAHOE FM) ARE LARAMIE FM SANDSTONES
- T/BR = TOP OF BEDROCK
- = LOCATION SYMBOL
- 3486 = LOCATION NAME
- 5912.00 = GROUND SURFACE ELEVATION (ft)

(SEE LEGEND PAGE FOR MORE ON SYMBOLS AND ANALYTE DATA)

U.S. DEPARTMENT OF ENERGY  
 Rocky Flats Plant, Golden, Colorado

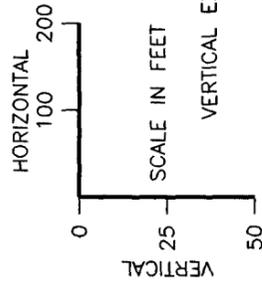
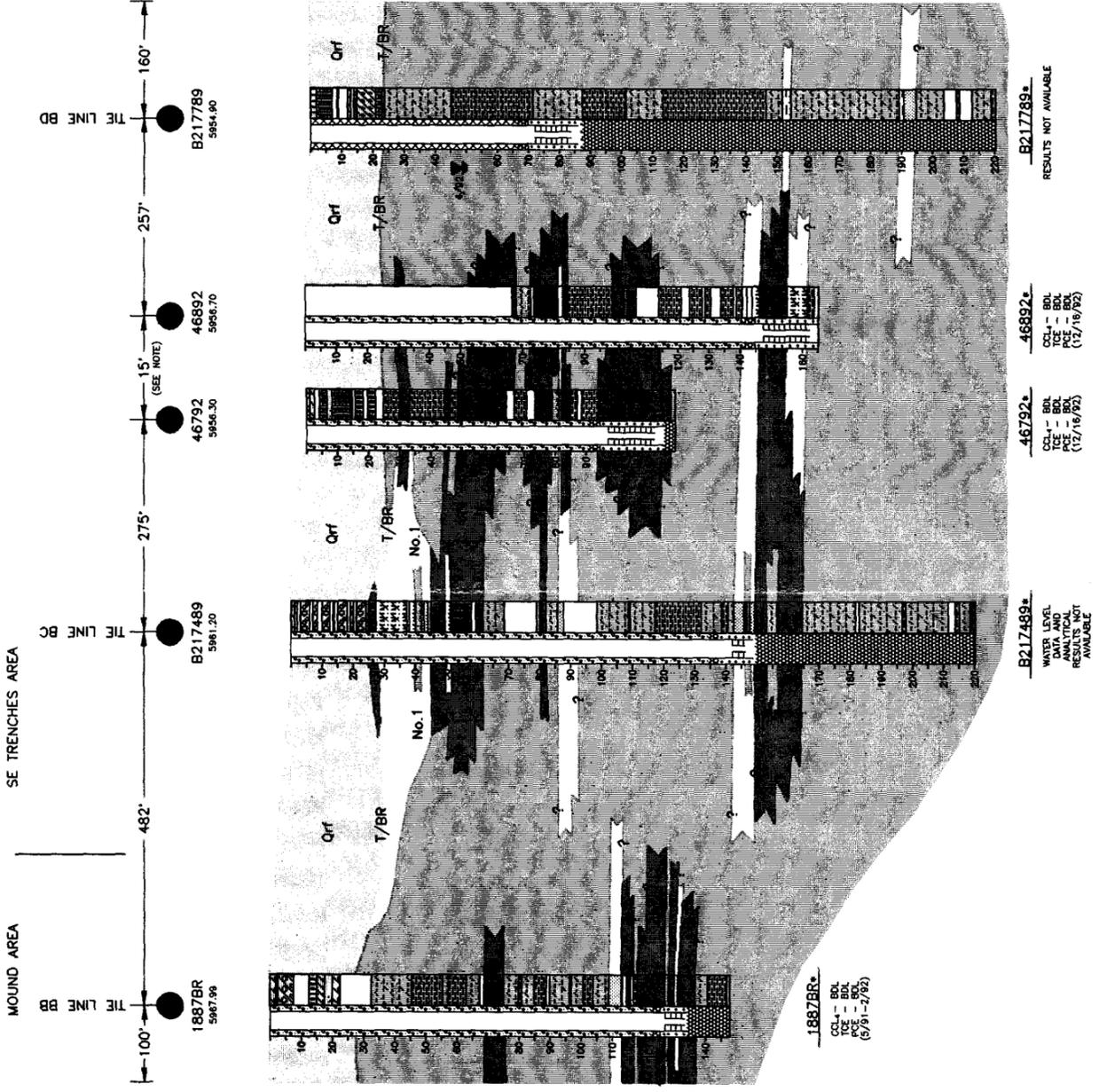
OPERABLE UNIT 2  
 REVISED BEDROCK WORK PLAN  
 TECHNICAL MEMORANDUM NO. 8

**GEOLOGIC CROSS-SECTION BV-BV'**

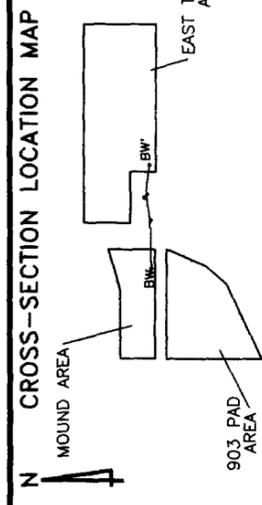
FIGURE 1-19 MARCH 1993

BW WEST  
ELEVATION (ft)  
6000  
5950  
5900  
5850  
5800  
5750  
5700

BW EAST  
ELEVATION (ft)  
6000  
5950  
5900  
5850  
5800  
5750  
5700



NOTE: DISTANCE SHOWN BETWEEN WELLS 46792, 46892 IS NOT TO HORIZONTAL SCALE.



**CROSS-SECTION LOCATION MAP**

**EXPLANATION**

Qol = STREAM ALLUVIUM  
 Qc = COLLUVIUM  
 Qrl = ROCKY FLATS ALLUVIUM  
 No.1 = ARAPAHOE FORMATION (FM) SANDSTONE  
 ALL SANDSTONES BELOW THE BASE OF THE NO.1 SANDSTONE (ARAPAHOE FM) ARE LARAMIE FM SANDSTONES  
 T/BR = TOP OF BEDROCK  
 ● = LOCATION SYMBOL  
 3486 = LOCATION NAME  
 5912.00 = GROUND SURFACE ELEVATION (ft)  
 (SEE LEGEND PAGE FOR MORE ON SYMBOLS AND ANALYTE DATA)

\* GROUNDWATER ANALYTICAL RESULTS IN PARTS PER BILLION (ppb) 1986 AND 1987 WELLS ARE VALIDATED RESULTS 1989, 1991 AND 1992 WELLS ARE NON-VALIDATED RESULTS

1887BR\*  
 QCL - BDL  
 QCE - BDL  
 PCE - BDL  
 (5/91-2/92)

B217489\*  
 WATER LEVEL  
 DATA AND  
 ANALYTICAL  
 RESULTS NOT  
 AVAILABLE

46792\*  
 QCL - BDL  
 QCE - BDL  
 PCE - BDL  
 (12/18/92)  
 WATER LEVEL  
 DATA AND  
 ANALYTICAL  
 RESULTS NOT  
 AVAILABLE

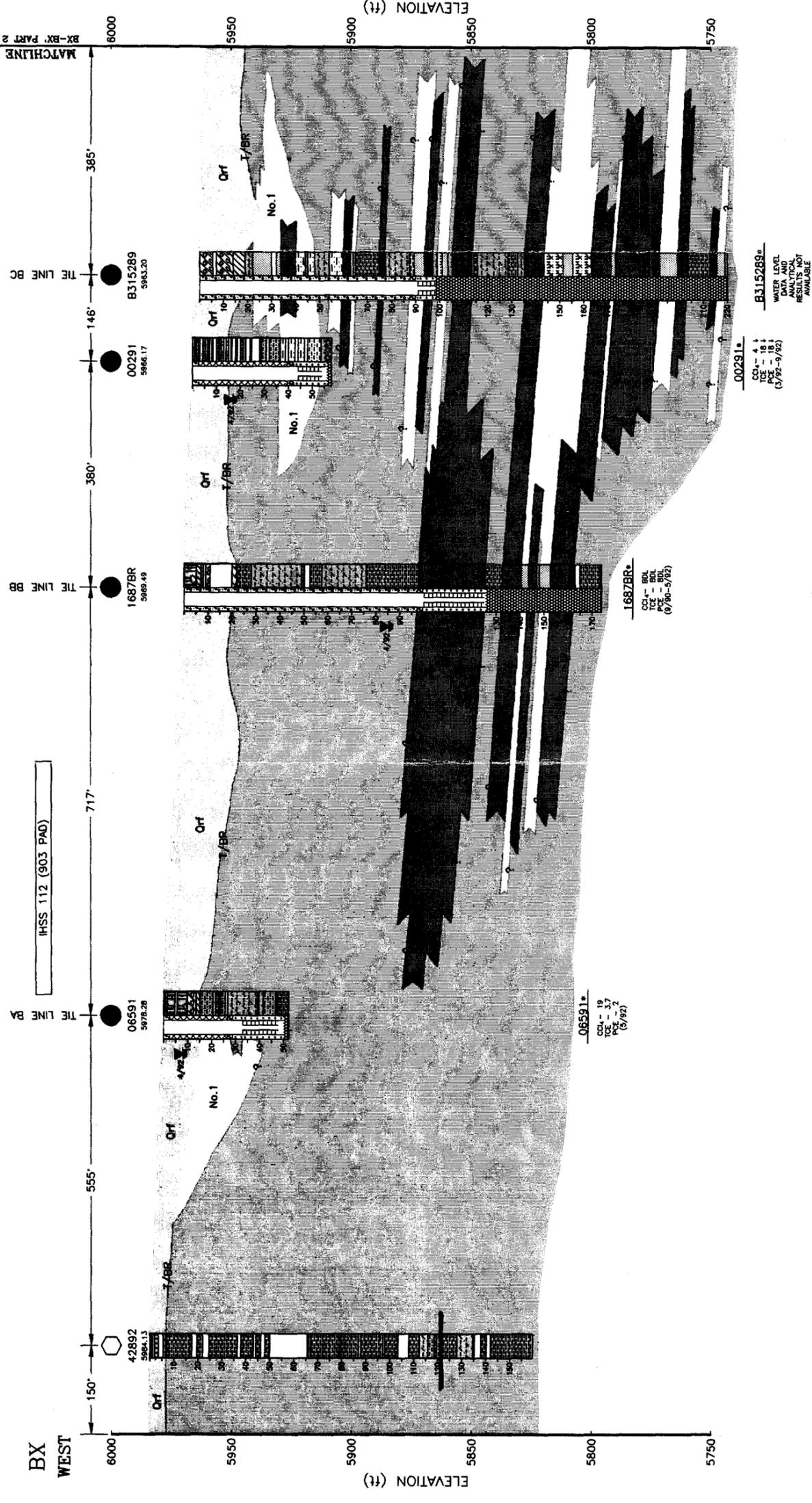
46892\*  
 QCL - BDL  
 QCE - BDL  
 PCE - BDL  
 (12/18/92)  
 WATER LEVEL  
 DATA AND  
 ANALYTICAL  
 RESULTS NOT  
 AVAILABLE

B217789\*  
 RESULTS NOT AVAILABLE

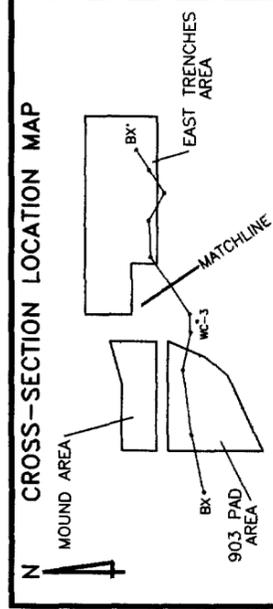
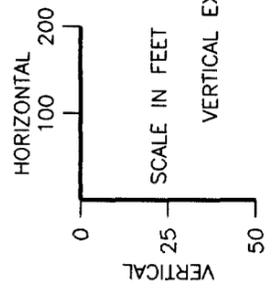
U.S. DEPARTMENT OF ENERGY  
 Rocky Flats Plant, Golden, Colorado  
 OPERABLE UNIT 2  
 REVISED BEDROCK WORK PLAN  
 TECHNICAL MEMORANDUM NO.8

**GEOLOGIC CROSS-SECTION BW-BW'**

FIGURE 1-20 MARCH 1993



\* GROUNDWATER ANALYTICAL RESULTS IN PARTS PER BILLION (ppb)  
 1986 AND 1987 WELLS ARE VALIDATED RESULTS  
 1989, 1991 AND 1992 WELLS ARE NON-VALIDATED RESULTS



**EXPLANATION**

|   |   |                                   |
|---|---|-----------------------------------|
| Qd1   | = | STREAM ALLUVIUM                   |
| Qc  | = | COLLUVIUM                         |
| Qrf   | = | ROCKY FLATS ALLUVIUM              |
| No.1  | = | ARAPAHOE FORMATION (FM) SANDSTONE |
| ALL SANDSTONES BELOW THE BASE OF THE No.1 SANDSTONE (ARAPAHOE FM) ARE LARAMIE FM SANDSTONES |   |                                   |
| T/BR  | = | TOP OF BEDROCK                    |
| ●   | = | LOCATION SYMBOL                   |
| 3486  | = | LOCATION NAME                     |
| 9912.00   | = | GROUND SURFACE ELEVATION (ft)     |
| (SEE LEGEND PAGE FOR MORE ON SYMBOLS AND ANALYTE DATA)                                      |   |                                   |

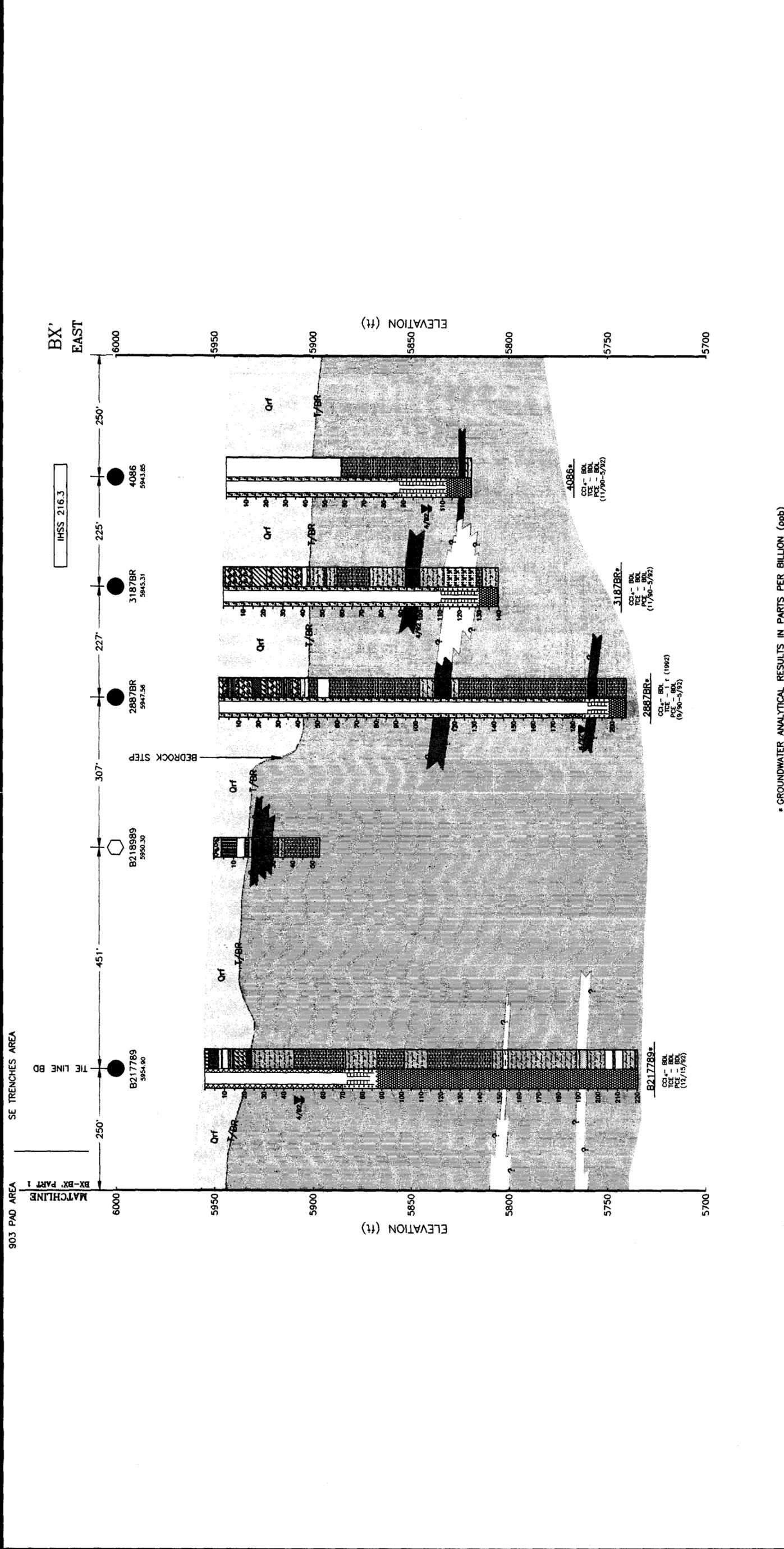
WC-3 = PROPOSED CLUSTER LOCATION

U.S. DEPARTMENT OF ENERGY  
 Rocky Flats Plant, Golden, Colorado

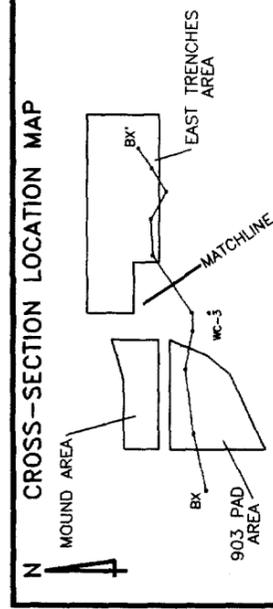
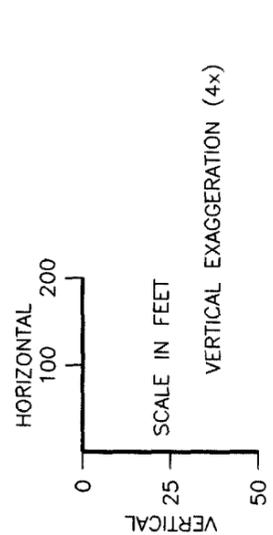
OPERABLE UNIT 2  
 REVISED BEDROCK WORK PLAN  
 TECHNICAL MEMORANDUM NO.8

GEOLOGIC CROSS-SECTION BX-BX'  
 PART 1 OF 2

FIGURE 1-21(e) MARCH 1993



\* GROUNDWATER ANALYTICAL RESULTS IN PARTS PER BILLION (ppb)  
 1986 AND 1987 WELLS ARE VALIDATED RESULTS  
 1989, 1991 AND 1992 WELLS ARE NON-VALIDATED RESULTS



**EXPLANATION**

- Qol = STREAM ALLUVIUM
- Qc = COLLUVIUM
- Qrf = ROCKY FLATS ALLUVIUM
- No. 1 = APAPAHOE FORMATION (FM) SANDSTONE
- ALL SANDSTONES BELOW THE BASE OF THE NO. 1 SANDSTONE (APAPAHOE FM) ARE LARAMIE FM SANDSTONES
- T/BR = TOP OF BEDROCK
- = LOCATION SYMBOL
- 3486 = LOCATION NAME
- 5912.00 = GROUND SURFACE ELEVATION (ft)

(SEE LEGEND PAGE FOR MORE ON SYMBOLS AND ANALYTE DATA)

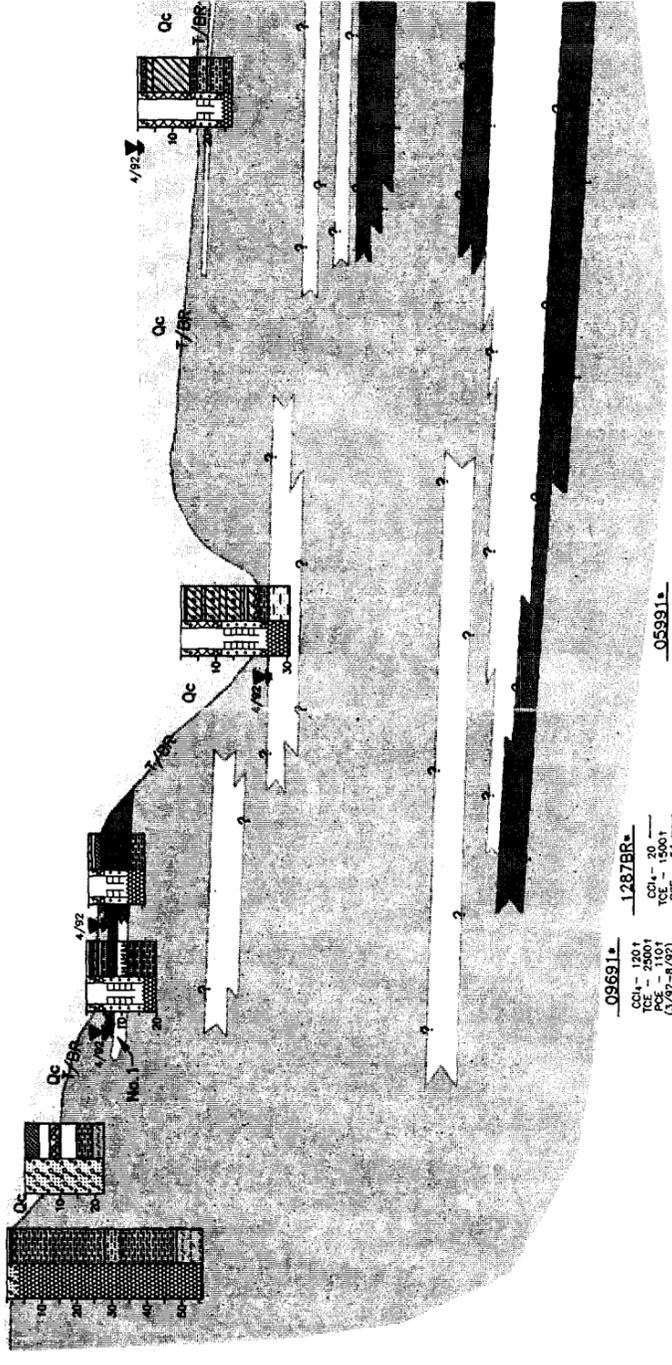
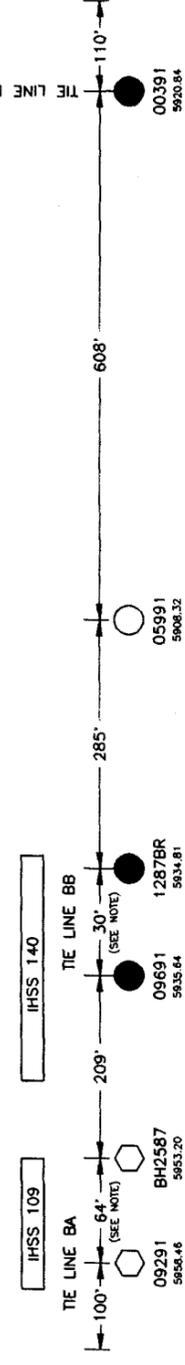
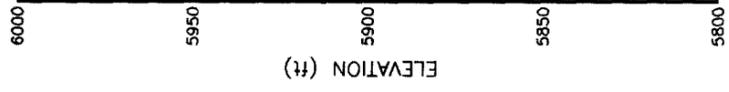
U.S. DEPARTMENT OF ENERGY  
 Rocky Flats Plant, Golden, Colorado

OPERABLE UNIT 2  
 REVISED BEDROCK WORK PLAN  
 TECHNICAL MEMORANDUM NO. 8

GEOLOGIC CROSS-SECTION BX-BX'  
 PART 2 OF 2

FIGURE 1-21(b) MARCH 1993

BY WEST



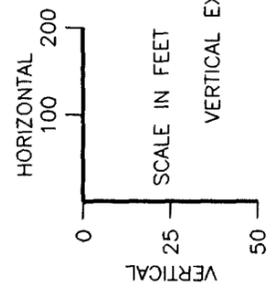
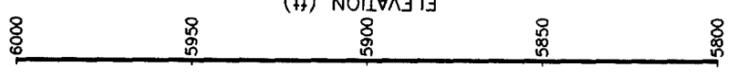
09691  
CCL - 190.1  
TCE - 25001  
PCE - 1101  
(3/92-8/92)

1287BR  
CCL - 30  
TCE - 15001  
PCE - 54  
(11/90-5/92)

00391  
CCL - 1100P  
TCE - 1501  
PCE - 100  
(12/91-9/92)

05991  
ANALYTICAL RESULTS  
NOT AVAILABLE

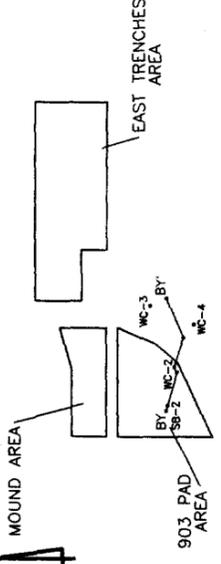
BY EAST



NOTE: DISTANCE SHOWN BETWEEN WELLS 09291, BH2587 AND 09691, 1287BR ARE NOT TO HORIZONTAL SCALE.

\* GROUNDWATER ANALYTICAL RESULTS IN PARTS PER BILLION (ppb)  
1986 AND 1987 WELLS ARE VALIDATED RESULTS  
1989, 1991 AND 1992 WELLS ARE NON-VALIDATED RESULTS

CROSS-SECTION LOCATION MAP



SB-2 = PROPOSED SOURCE BOREHOLE LOCATION  
WC-3 = PROPOSED CLUSTER LOCATION

EXPLANATION

- Qd1 = STREAM ALLUVIUM
- Qc = COLLUVIUM
- Qrf = ROCKY FLATS ALLUVIUM
- No. 1 = ARAPAHOE FORMATION (FM) SANDSTONE
- ALL SANDSTONES BELOW THE BASE OF THE No. 1 SANDSTONE (ARAPAHOE FM) ARE LARAMIE FM SANDSTONES
- T/BR = TOP OF BEDROCK
- = LOCATION SYMBOL
- 3486 = LOCATION NAME
- 5912.00 = GROUND SURFACE ELEVATION (ft)
- (SEE LEGEND PAGE FOR MORE ON SYMBOLS AND ANALYTE DATA)

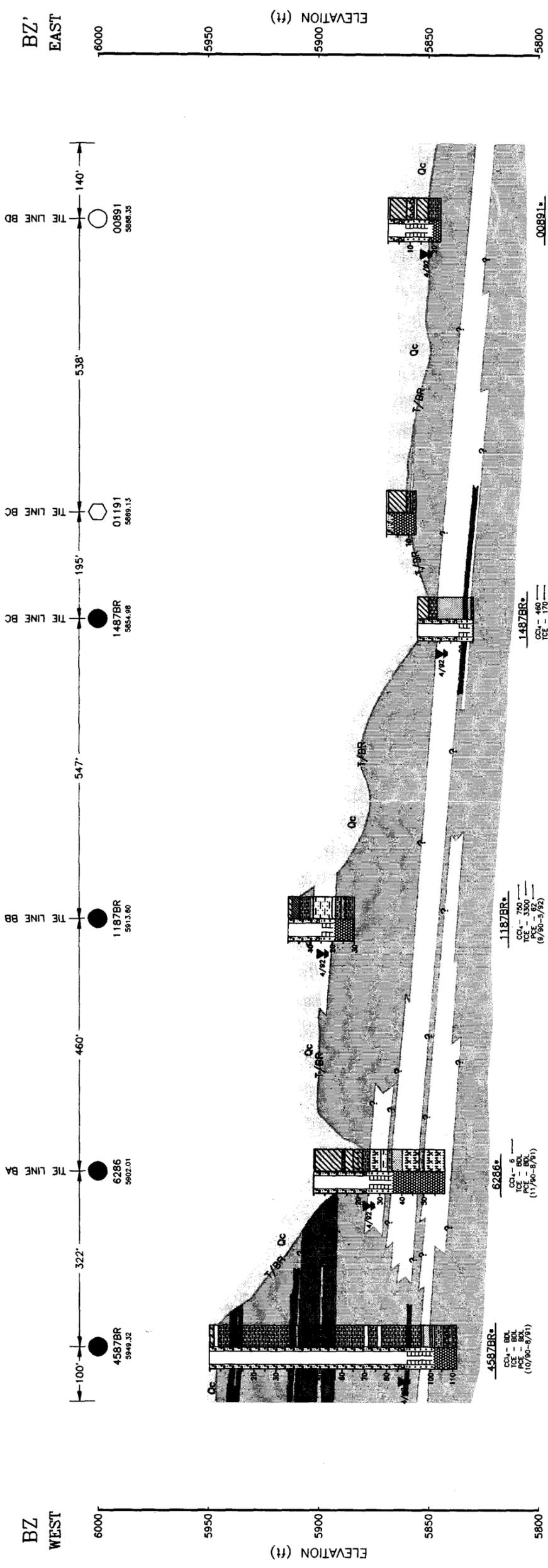
U.S. DEPARTMENT OF ENERGY  
Rocky Flats Plant, Golden, Colorado

OPERABLE UNIT 2  
REVISED BEDROCK WORK PLAN  
TECHNICAL MEMORANDUM NO. 8

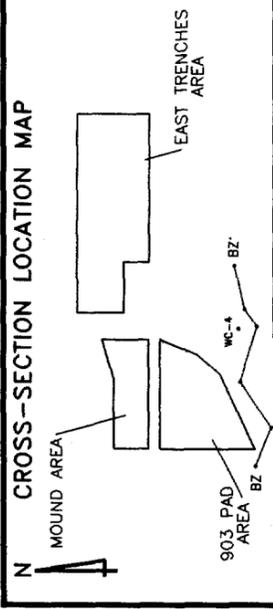
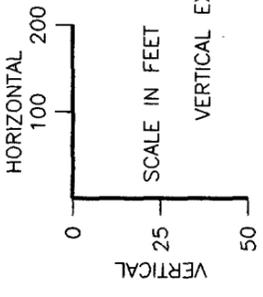
GEOLOGIC CROSS-SECTION BY-BY

FIGURE 1-22 MARCH 1993

RF10068



\* GROUNDWATER ANALYTICAL RESULTS IN PARTS PER BILLION (ppb) 1986 AND 1987 WELLS ARE VALIDATED RESULTS 1989, 1991 AND 1992 WELLS ARE NON-VALIDATED RESULTS



WC-4 = PROPOSED CLUSTER LOCATION

**EXPLANATION**

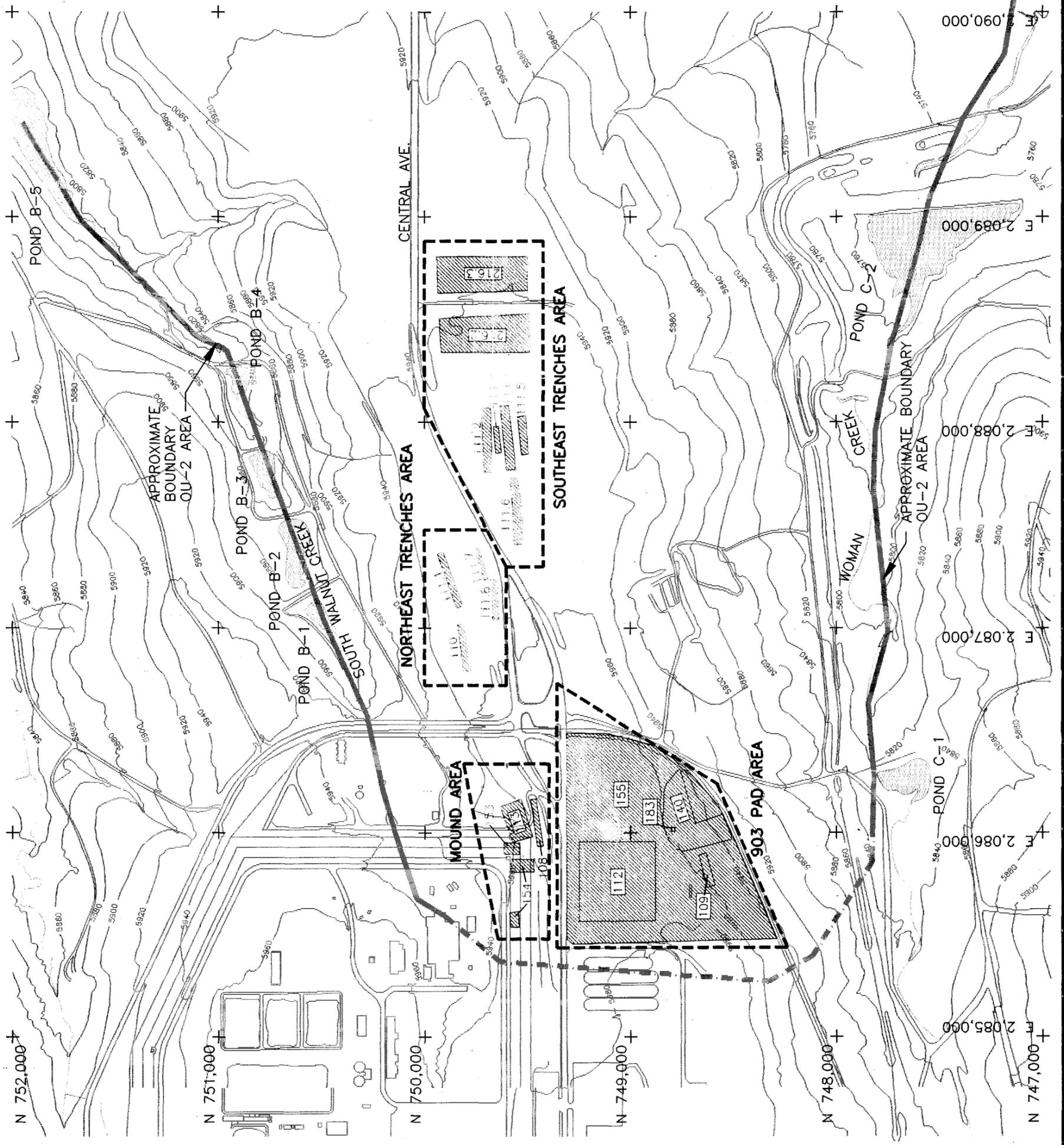
- Qd1 = STREAM ALLUVIUM
  - Qc = COLLUVIUM
  - Qrf = ROCKY FLATS ALLUVIUM
  - No.1 = ARAPAHOE FORMATION (FM) SANDSTONE
  - ALL SANDSTONES BELOW THE BASE OF THE No.1 SANDSTONE (ARAPAHOE FM) ARE LARAMIE FM SANDSTONES
  - T/BR = TOP OF BEDROCK
  - = LOCATION SYMBOL
  - 3486 = LOCATION NAME
  - 5912.00 = GROUND SURFACE ELEVATION (ft)
- (SEE LEGEND PAGE FOR MORE ON SYMBOLS AND ANALYTE DATA)

U.S. DEPARTMENT OF ENERGY  
Rocky Flats Plant, Golden, Colorado

OPERABLE UNIT 2  
REVISED BEDROCK WORK PLAN  
TECHNICAL MEMORANDUM NO.8

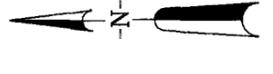
**GEOLOGICAL CROSS-SECTION BZ-BZ'**

FIGURE 1-23 MARCH 1993



**EXPLANATION**

-  INDIVIDUAL HAZARDOUS SUBSTANCE SITE AND IHSS DESIGNATION
-  CONTAMINATION SOURCE AREA
-  APPROXIMATE BOUNDARY OF OU-2 AREA



SCALE : 1 INCH = 500 FEET  
 500' 0 500'  
 CONTOUR INTERVAL = 20'

U.S. DEPARTMENT OF ENERGY  
 Rocky Flats Plant, Golden, Colorado

OPERABLE UNIT 2  
 REVISED BEDROCK WORK PLAN  
 TECHNICAL MEMORANDUM NO.8

INDIVIDUAL HAZARDOUS  
 SUBSTANCE SITES

FIGURE 1-24 MARCH 1993



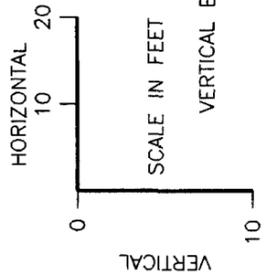
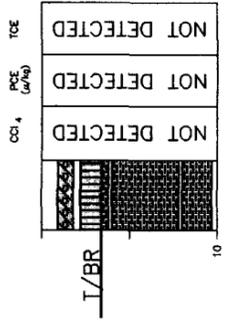
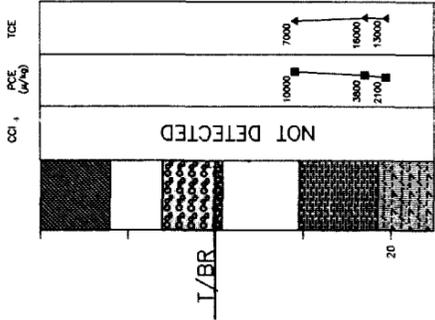
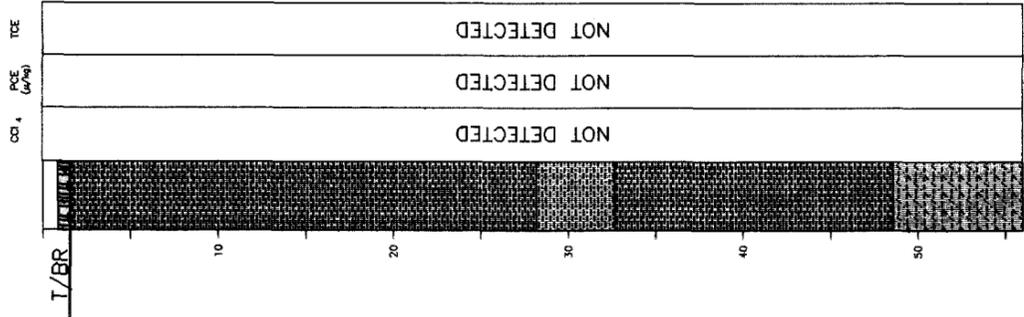




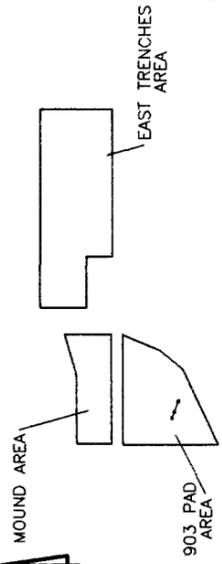
EAST  
5970  
5960  
5950  
5940  
ELEVATION (ft)  
5930  
5920  
5910  
5900

WEST  
5970  
5960  
5950  
5940  
ELEVATION (ft)  
5930  
5920  
5910  
5900

IHSS 109



CROSS-SECTION LOCATION MAP



EXPLANATION

- T/BR = TOP OF BEDROCK
  - = LOCATION SYMBOL
  - 3486 = LOCATION NAME
  - 5912.00 = GROUND SURFACE ELEVATION (ft)
  - = CARBON TETRACHLORIDE (CCl<sub>4</sub>)
  - = TETRACHLOROETHENE (PCE)
  - ▲ = TRICHLOROETHENE (TCE)
- EACH CHEMICAL COLUMN IS A LOGARITHMIC SCALE (INCREASING TO RIGHT) FROM 1 TO 1,000,000 (μg/kg)

(SEE FIGURE 1-14, GEOLOGIC CROSS-SECTION LEGEND, FOR SOIL, BEDROCK AND LOCATION SYMBOLS)

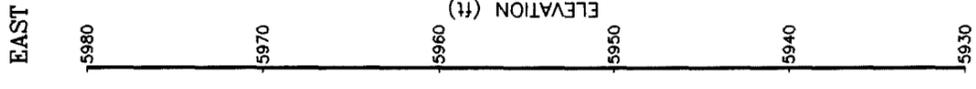
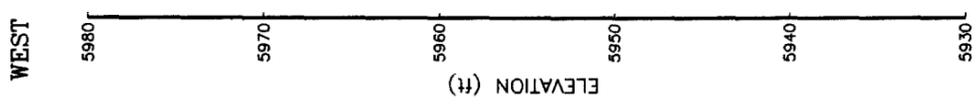
U.S. DEPARTMENT OF ENERGY  
Rocky Flats Plant, Golden, Colorado

OPERABLE UNIT 2  
REVISED BEDROCK WORK PLAN  
TECHNICAL MEMORANDUM NO.8

SOURCE BOREHOLE CHARACTERIZATION  
IHSS 109 (903 PAD AREA)

FIGURE 1-30 MARCH 1993

RFL0072

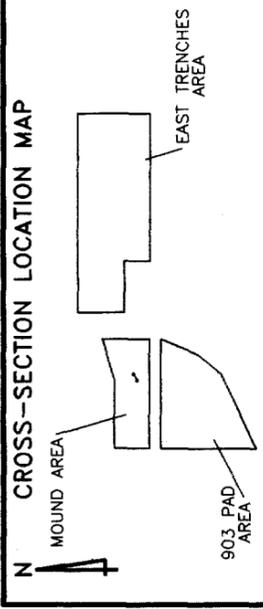
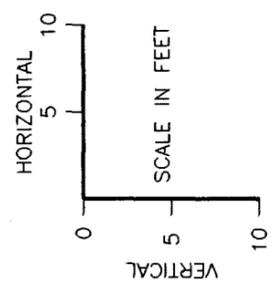
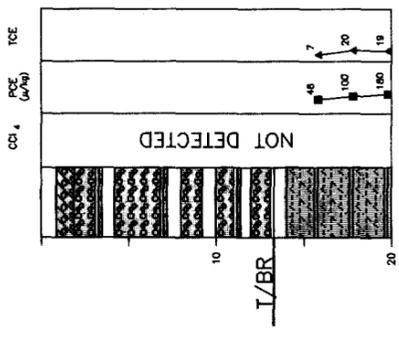
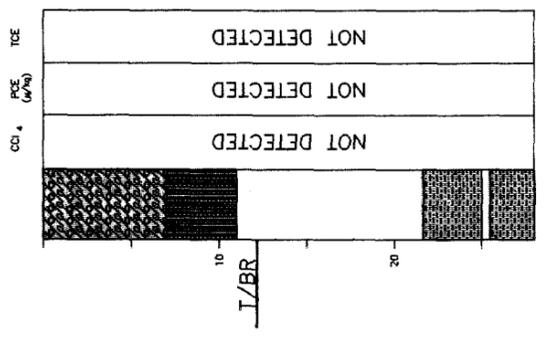


IHSS 113

52'

BH3787  
5986.80

09991  
5987.74



**EXPLANATION**

T/BR = TOP OF BEDROCK

○ = LOCATION SYMBOL

3486 = LOCATION NAME

5972.00 = GROUND SURFACE ELEVATION (ft)

● = CARBON TETRACHLORIDE (CCl<sub>4</sub>)

■ = TETRACHLOROETHENE (PCE)

▲ = TRICHLOROETHENE (TCE)

EACH CHEMICAL COLUMN IS A LOGARITHMIC SCALE (INCREASING TO RIGHT) FROM 1 TO 1,000,000 (μg/kg)

CCl<sub>4</sub> PCE (μg/kg) TCE

25 200 1000 10000

1000 10000

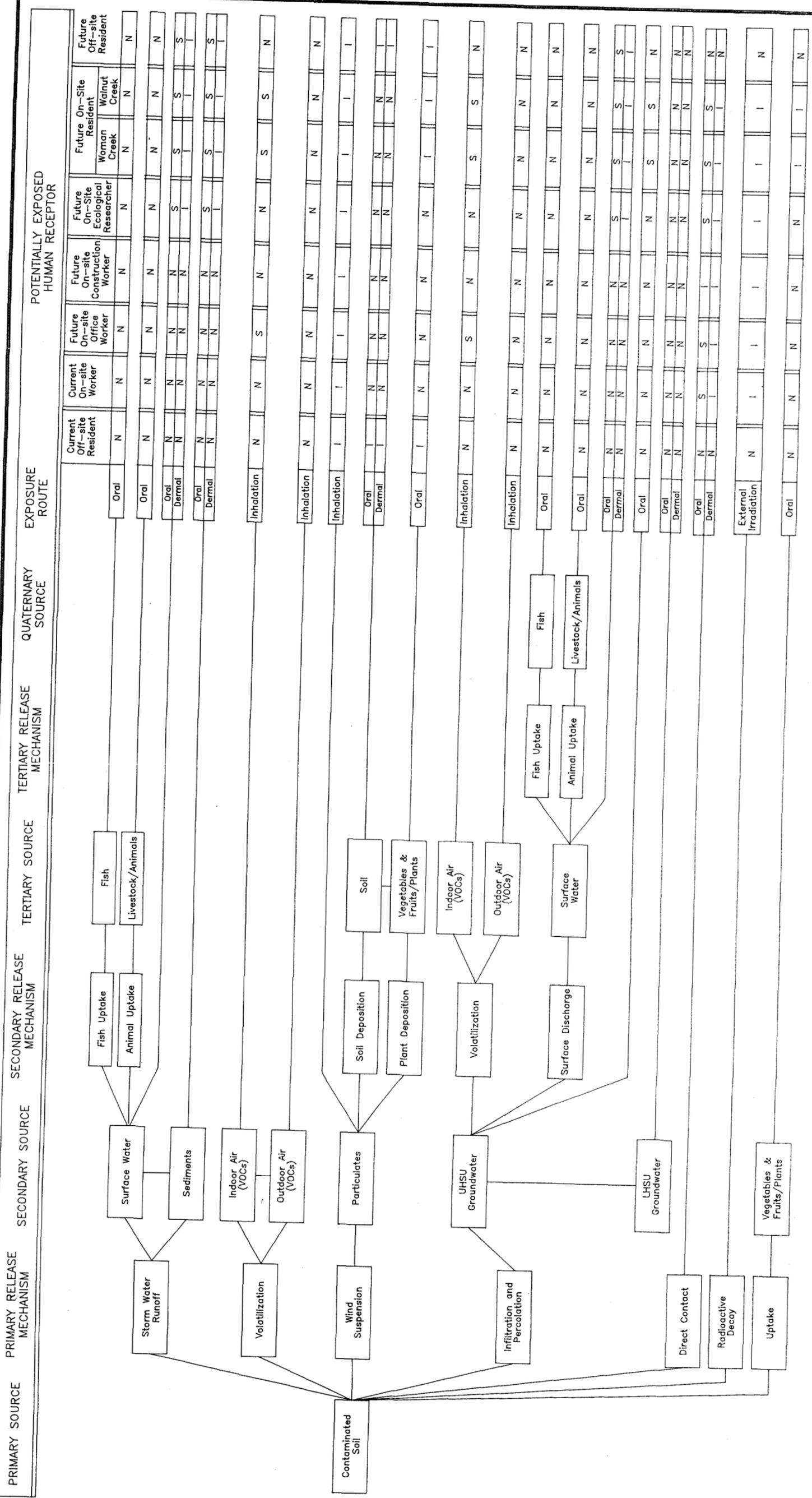
(SEE FIGURE 1-14, GEOLOGIC CROSS-SECTION LEGEND, FOR SOIL, BEDROCK AND LOCATION SYMBOLS)

U.S. DEPARTMENT OF ENERGY  
Rocky Flats Plant, Golden, Colorado

OPERABLE UNIT 2  
REVISED BEDROCK WORK PLAN  
TECHNICAL MEMORANDUM NO.8

SOURCE BOREHOLE CHARACTERIZATION  
IHSS 113 (MOUND AREA)

FIGURE 1-31 MARCH 1993



LEGEND  
 S = Significant Potential Exposure Pathway  
 I = Insignificant Potential Exposure Pathway  
 N = Negligible or Incomplete Exposure Pathway  
 UHSU = Upper Hydrostratigraphic Unit  
 LHSU = Lower Hydrostratigraphic Unit

Note: Significant and insignificant potential exposure pathways will be quantitatively evaluated.

U.S. DEPARTMENT OF ENERGY  
 Rocky Flats Plant, Golden, Colorado  
 OPERABLE UNIT 2  
 REVISED BEDROCK WORK PLAN  
 TECHNICAL MEMORANDUM NO. 8  
 CONCEPTUAL SITE MODEL  
 FOR ROCKY FLATS OU-2

FIGURE 1-32 MARCH, 1993

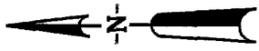
RF CONCI

**EXPLANATION**

- 1991-1992 BEDROCK MONITORING WELL BOREHOLE
- HISTORICAL BEDROCK MONITORING WELL
- INDIVIDUAL HAZARDOUS SUBSTANCE SITE LOCATION
- APPROXIMATE BOUNDARY OF OU-2 AREA

**PROPOSED LOCATIONS**

- WC-1 PROPOSED LHSU BEDROCK WELL CLUSTER
- ⊙ SBI SOURCE BOREHOLE



SCALE : 1 INCH = 600 FEET  
 600' 0 600'  
 CONTOUR INTERVAL = 20'

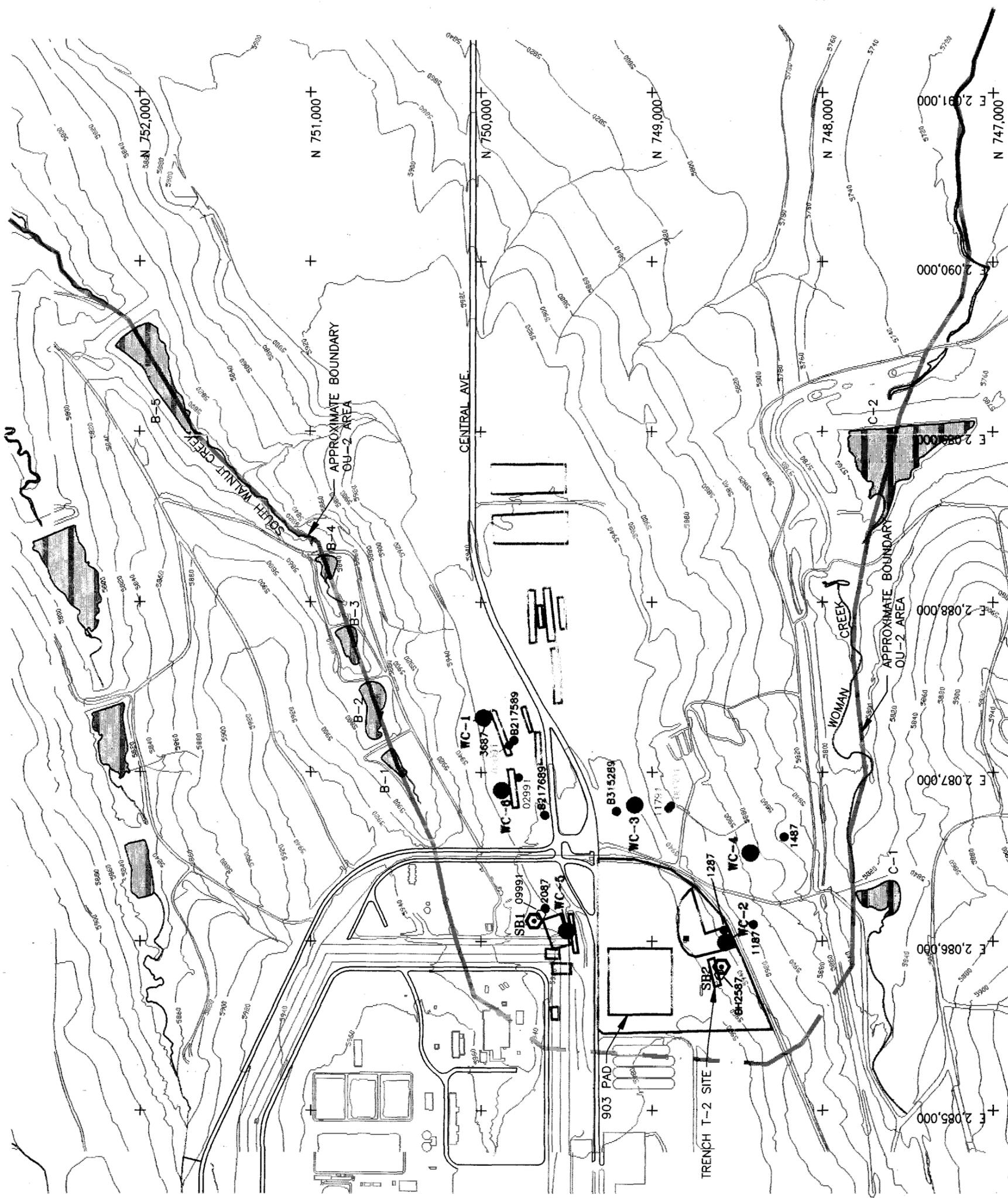
U.S. DEPARTMENT OF ENERGY  
 Rocky Flats Plant, Golden, Colorado

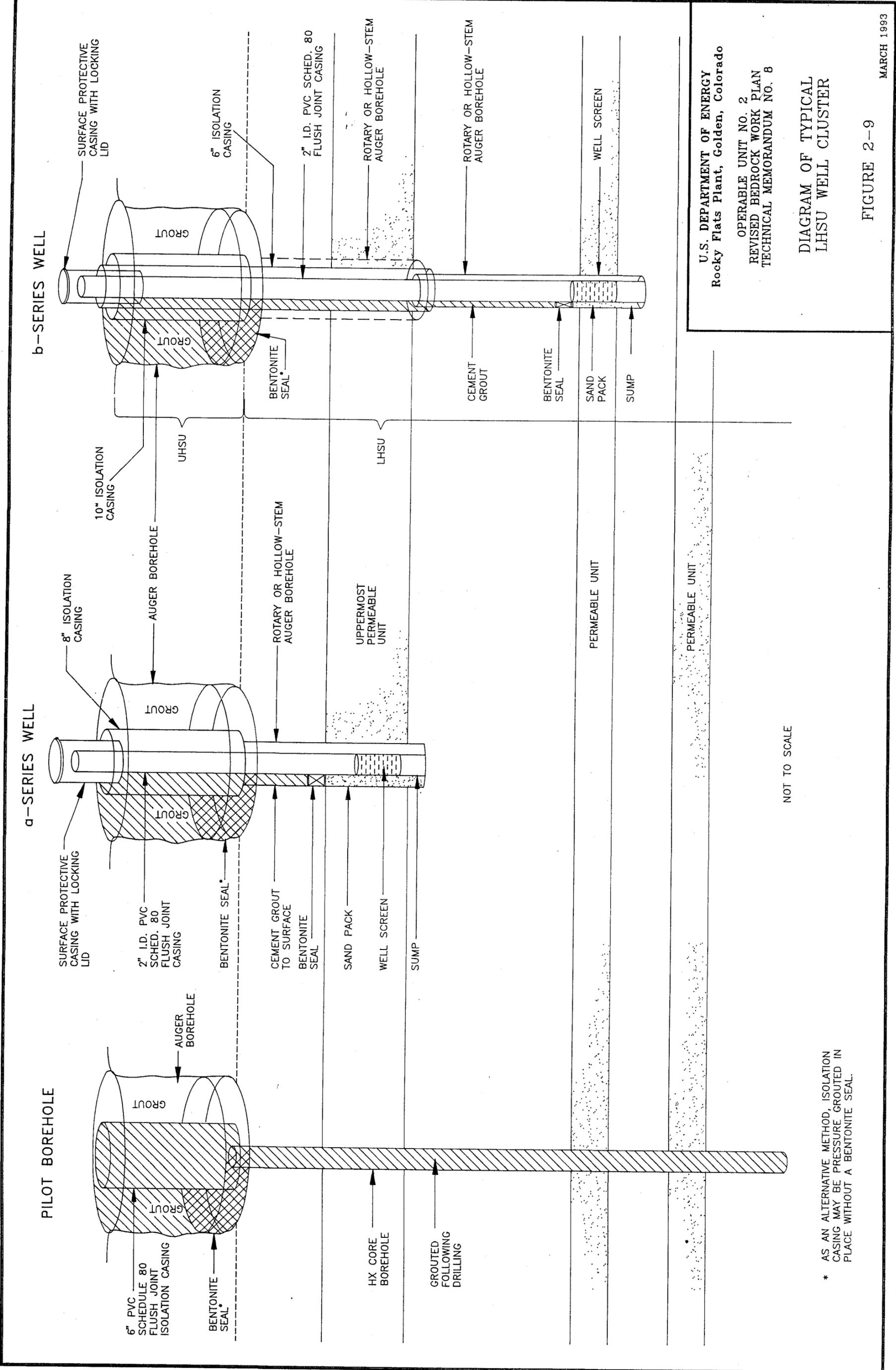
OPERABLE UNIT 2  
 REVISED BEDROCK WORK PLAN  
 TECHNICAL MEMORANDUM NO.8

**PROPOSED INVESTIGATION LOCATIONS**

FIGURE 2-1 MARCH 1993

RF10054





\* AS AN ALTERNATIVE METHOD, ISOLATION CASING MAY BE PRESSURE GROUTED IN PLACE WITHOUT A BENTONITE SEAL.

NOT TO SCALE

U.S. DEPARTMENT OF ENERGY  
 Rocky Flats Plant, Golden, Colorado  
 OPERABLE UNIT NO. 2  
 REVISED BEDROCK WORK PLAN  
 TECHNICAL MEMORANDUM NO. 8

DIAGRAM OF TYPICAL  
 LHSU WELL CLUSTER

FIGURE 2-9

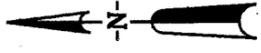
MARCH 1993

**EXPLANATION**

- INDIVIDUAL HAZARDOUS SUBSTANCE SITE LOCATION
- DECONTAMINATION BOUNDARY LINES

**PROPOSED LOCATIONS**

- WC-1 PROPOSED LHSU BEDROCK WELL CLUSTER
- ⊙ SB1 SOURCE BOREHOLE



SCALE : 1 INCH = 600 FEET

CONTOUR INTERVAL = 20'

U.S. DEPARTMENT OF ENERGY  
Rocky Flats Plant, Golden, Colorado

OPERABLE UNIT 2  
REVISED BEDROCK WORK PLAN  
TECHNICAL MEMORANDUM NO.8

**DECONTAMINATION BOUNDARIES**

FIGURE 2-10 MARCH 1983

RF00053

