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DOTY & ASSOCIATES
ENVIRONMENTAL, GROUND-WATER AND WASTE MANAGEMENT ENGINEERS

20011 GOLDEN GATE CANYON ROAD
SUITE 100
GOLDEN, COLORADO 80403-8125

TELEPHONE: (303) 279-9181
FAX: (303) 279-9186

February 20, 1992
505-04

Mr. Scott R. Grace
U.S. Department of Energy
Environmental Restoration Division
P.O. Box 928
Golden, Colorado 80402-9028

Subject: West End of French Drain
881 Hillside
Operable Unit 1

Dear Mr. Grace:

This letter has been prepared to address the questions posed in your discussions with Mr. Mark Burmeister of February 18, 1992, regarding continued french drain construction.

As you know, we have encountered ground water at relatively shallow depth between stations 0+00 and about 6+75 that will require changes in construction techniques or possibly in the basic design of the french drain. Several possibilities have been discussed for completion of the drain, as follows:

1. install dewatering wells and a construction dewatering trench in order to reduce pore pressures and allow construction to continue using the current techniques,

2. re-align the french drain to coincide with the alignment drilled in DOE (1990b) in order to avoid the very wet conditions from about 0+00 to 5+00, and

3. continue construction on the current alignment but truncate the drain at a point such that all alluvial ground water flowing through Operable Unit 1 is collected.

Each of these options is discussed below.

CONSTRUCTION DEWATERING

The shallow ground water between stations 0+00 and about 6+75 will require changes in construction techniques in order to have stable slopes. Our approach has been to remove the ground water using dewatering wells and a temporary dewatering trench. You

posed several questions to Mr. Burmeister regarding the dewatering, as follows.

Source of Ground Water

The ground water encountered between stations 0+00 and about 5+00 is believed to originate from beneath the Rocky Flats surface in the general area of Building 850. This is based on the following.

1. Potentiometric surface maps presented in DOE (1990b), one of which is reproduced here as Figure 1, indicate that the ground water present in the area results from flow from the northwest (from areas outside of Operable Unit 1).

2. Drilling data collected along the original french drain alignment indicate that unsaturated conditions exist on the slope above stations 2+50 to 3+50, i.e., saturation is discontinuous between the Building 881 area and the drain alignment.

Therefore, the ground water is believed to come from the general area of Building 850.

Based on one recent ground water sample collected from an exploratory pit at station 1+00, the ground water appears to be free from organic contamination. Additional samples have been collected and are being analyzed.

Ground-Water Recharge and Production

Only limited data are available to evaluate the rate of ground-water recharge and expected dewatering volumes. In general, the soils have a hydraulic conductivity of about 4×10^{-5} centimeters per second (cm/s) based on a drawdown recovery test of well 2-87 located just south of the skimming pond (Rockwell, 1988). The conductivity probably varies somewhat depending on the grain sizes and could be as high as 1×10^{-3} cm/s in sandy zones.

Assuming that 4×10^{-5} cm/s is an appropriate bulk hydraulic conductivity and that the saturated thickness is ten feet, a steady flow to a dewatering well of approximately 0.06 gallons per minute (gpm) can be anticipated. This is consistent with recovery rates measured on February 18, 1992, in a 16-inch diameter dewatering well south of the discharge point of the Building 881 footing drain (0.01 feet per minute).

Based on the lithologies exposed in the exploratory test pits and visual estimates of inflows to them, we expect slightly higher recharge rates along the western end of the drain.

Immediately after excavation, it was estimated that the inflows were about 1 gpm. We anticipate a steady production of approximately 0.2 gpm from dewatering wells in this area.

During construction, assuming that there are three dewatering wells near the skimming pond producing about 0.1 gpm each, and a 500 foot long temporary dewatering trench, we estimate that the total flow from the construction dewatering system will be approximately 1.3 gpm. The inflow to the drain is based on a double sided, steady drawdown of 10 feet in a material of $4x10^{-5}$ cm/s hydraulic conductivity and saturated thickness of 10 feet. Such a drain will produce approximately 1.5 gpm after one day and 0.5 gpm after seven days of drainage.

Based on a confined, steady discharge analysis (0.1 gpm per well), the saturated thickness will be reduced by about 35 percent at a distance of 24 feet from the dewatering well after about 60 days of pumping. This distance is equivalent to the point at which a drain excavation of twenty feet would daylight (side slopes of 40 degrees). Approximately 86,000 gallons of water will be produced by the entire dewatering system (1 gpm for 60 days) to achieve the 35 percent head reduction.

RETURN TO ORIGINAL ALIGNMENT

In order to avoid the saturated conditions between 0+00 and 5+00, it has been suggested that the drain could be re-aligned to coincide with the alignment drilled in DOE (1990b). Both Alignments are shown on Figure 2. The alignment was changed to the current alignment in order to minimize excavation depths through an area of fill that was placed on the hillside during the original construction of Building 881. However, we are currently in the process of moving the old fill in order to unload the uphill side of the drain excavation. Therefore, the original objection to this alignment has been in part removed.

A return to the original alignment has several advantages, as follows.

1. The original alignment was intended to limit the possibility for flow around the west end of the drain. As stated in DOE (1990a), the drain

> ... extends uphill on the west side to an elevation equal to that of SWMU 107 and is keyed into a dry ridge on the east end. This should preclude flow around the drain.

When the drain was re-aligned to avoid the deep cuts on the west end, the drain was lengthened in order to achieve the same goal. If we return to the original alignment, we can meet the goal directly and reduce the length of the drain by approximately 100 feet.

2. The original alignment angles to the north across the existing slump feature which we have already reactivated. The original alignment is marginally more stable than the current alignment because the current alignment is nearly perpendicular to the direction of movement, while the original alignment is at about 45 degrees to the direction of movement.

3. The drilling reported in DOE (1990b) indicates significantly less ground water along the original alignment. Therefore, construction should be easier.

SHORTEN THE DRAIN

The final option that has been discussed involves continuing to construct on the current alignment but truncating the drain at a point such that all alluvial ground water flowing through Operable Unit 1 is collected. In our opinion, this approach meets the goals of the interim remedial action. As stated in DOE (1990a), the goal of the interim action is as follows.

> ... the drain will intercept and contain all alluvial ground water flowing from the area (page 4-46).

The "area" in the above sentence is the 881 Hillside (Operable Unit 1).

Based on a flownet analysis, the ground-water flow from the Operable Unit 1 area will be collected between stations 5+00 and 19+50 (the eastern end of the drain). As shown on Figure 3, a hypothetical particle of water leaving the western edge of OU-1 moves downhill following the potentiometric surface and crosses the drain location at station 5+00. Thus, the first 500 feet of the current alignment will collect water from other areas of the plant.

Because the goal of the interim action is to collect ground water from the Operable Unit, it is recommended that serious consideration be given to truncating the drain at station 5+00. There is some risk that the flow directions from the west end of the Operable Unit may be more directly downhill (to the south) than is implied by the potentiometric surface mapping. This further implies that a particle of ground water from the extreme

western end of the unit might not be captured by drain. However, this risk is probably appropriate given that:

1. there is no evidence available to date of contamination in the extreme western end of the Operable Unit nor between stations 0+00 and 5+00 on the current alignment, and

2. the french drain is intended to be an interim measure, not the final solution for environmental control. Should the recently completed Phase III drilling indicate any problems in the western portions of the unit or along the drain alignment from 0+00 to 5+00, they can be addressed as part of the feasibility study/final remediation process.

The advantages to truncating the drain are that construction of the last 500 feet of the drain through very difficult ground conditions will be avoided. In addition, the project will be completed in a reasonable amount of time while still achieving the original intent of the interim action. Truncating the drain will also help to minimize continued slippage of the hillside.

Even if the drain is truncated at station 5+00, the alignment between 5+00 and about 6+60 will still require construction dewatering in order to improve slope stability. Three wells have been proposed for this area, each of which is expected to produce approximately 0.1 gpm on average. This water will be pumped into the french drain for storage until such time as the permanent storage is available at the treatment plant. Truncating the drain will also mean that clean dewatering waters will not be introduced into the treatment system.

* * *

I trust that you find the above useful. Please call if you have questions or need additional information.

Sincerely,
DOTY & ASSOCIATES

Benjamin P. Doty, P.E.

REFERENCES

DOE, 1990a, Final, Interim Measures/Interim Remedial Action Plan and Decision Document, 881 Hillside Area, Operable Unit 1, U.S. Department of Energy, Rocky Flats Plant, Golden, Colorado, January.

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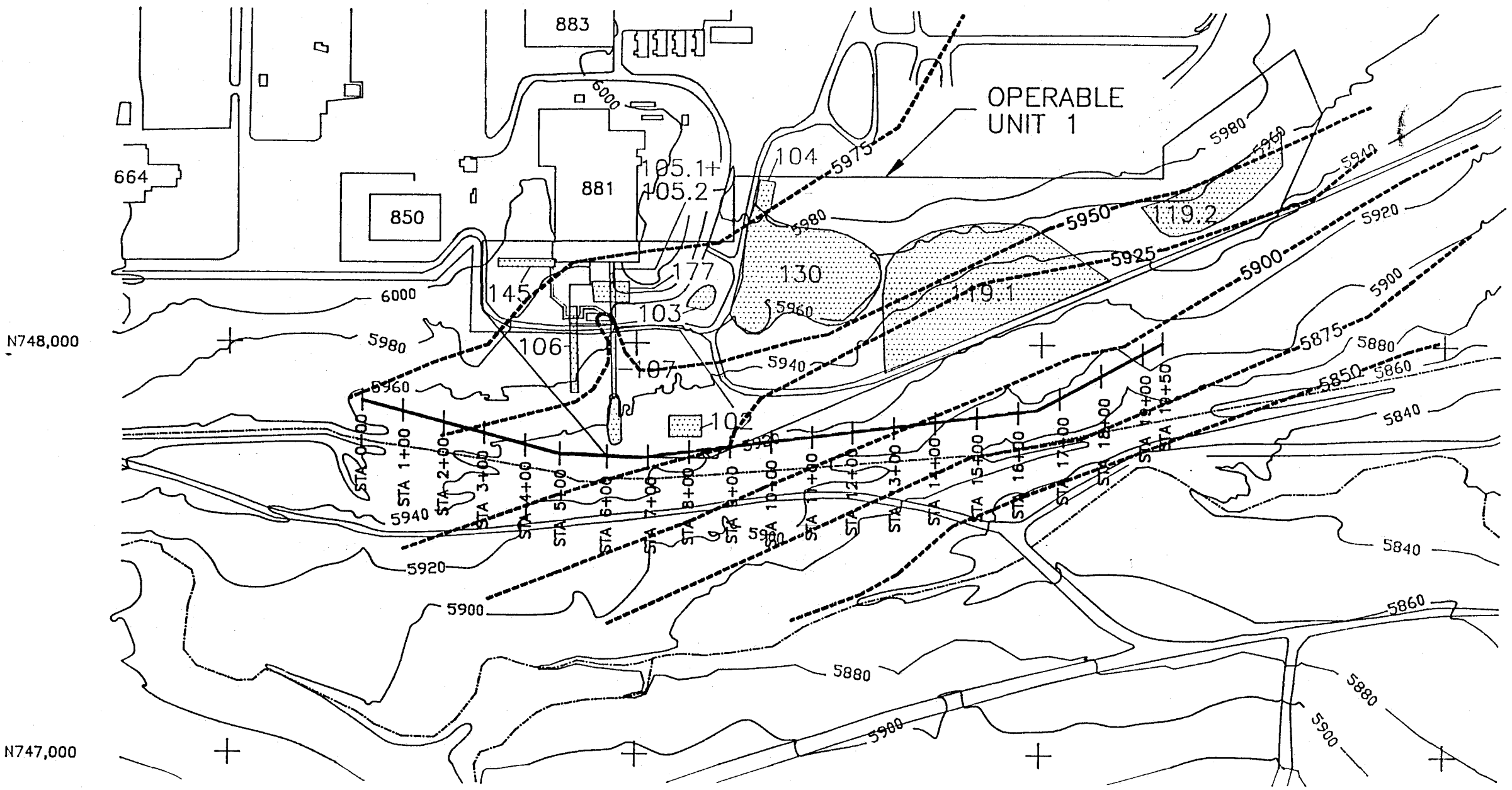
Rockwell, 1988, Draft Final Remedial Investigation Report for High Priority Sites (881 Hillside Area), U.S. Department of Energy, Rockwell International, Rocky Flats Plant, Golden, Colorado, 1 March.



EXPLANATION

- IHSS LOCATION
- OPERABLE UNIT BOUNDARY (DOE, 1990b)
- CURRENT DRAIN ALIGNMENT (ENGINEERING–SCIENCE, 1991)
- POTENTIOMETRIC SURFACE (DOE, 1990b)

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OPERABLE UNIT 1

POTENTIOMETRIC SURFACE MAP

505-04	02/19/92	FIGURE 1

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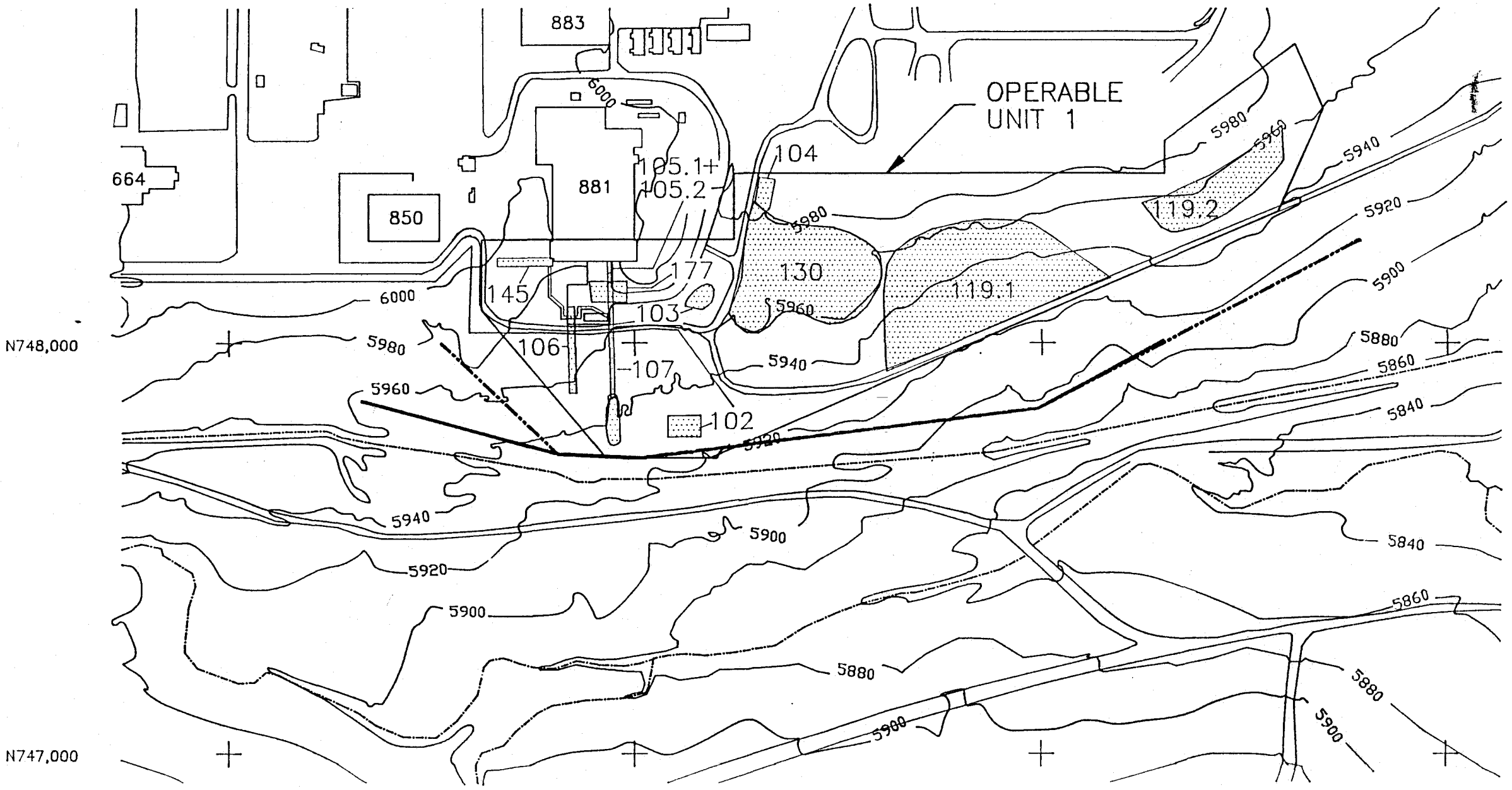

EXPLANATION

- IHSS LOCATION
- OPERABLE UNIT BOUNDARY (DOE, 1990b)
- CURRENT DRAIN ALIGNMENT (ENGINEERING–SCIENCE, 1991)
- ORIGINAL DRAIN ALIGNMENT (DOE,1990b)

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OPERABLE UNIT 1

DRAIN ALIGNMENTS

505–04	02/19/92	FIGURE 2

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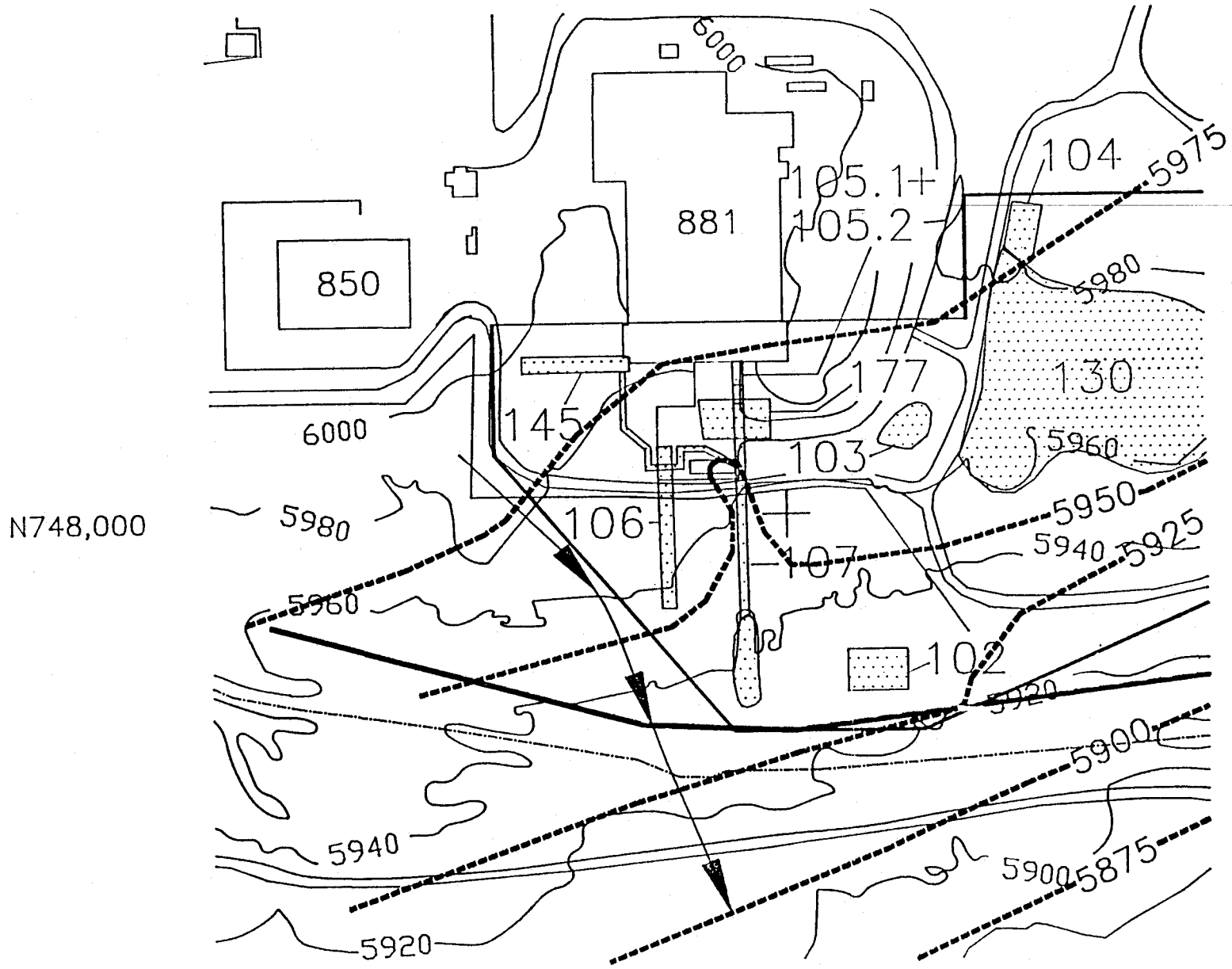

EXPLANATION

IHSS LOCATION

OPERABLE UNIT BOUNDARY (DOE, 1990b)

CURRENT DRAIN ALIGNMENT (ENGINEERING–SCIENCE, 1991)

POTENTIOMETRIC SURFACE (DOE, 1990b)

FLOW PATH

0 100 200
IN FEET

CONTOUR INTERVAL = 20'

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OPERABLE UNIT 1

FLOW PATH ANALYSIS

505–04	02/19/92	FIGURE 3

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