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OU 7 Landfill Closure IM/IRA
Technical Working Group Meeting
February 1, 1995

AGENDA

Introductions

Landfill Closure IM/IRA

- Review of Alternatives Development
- Four Preferred Alternatives
- Additional Modeling Results
- Additional Research on Slurry Wall Effectiveness
- Status of Lab Testing

Agency Meeting

- Status of DOE Management Strategy Letters
- Presentation of Alternatives (preferred alternative or all)
- Format for Presentation
  ↳ Fault -

Action Items

1) Risk Assessment }

1/17

established 1959

February 6, 1995
2510-95/18

Ms. Laurie Peterson-Wright
EG&G Rocky Flats, Inc.
P.O. Box 464, Bldg. 080
Golden, Colorado 80402-0464

Subject: Submittal of February 1, 1995 Meeting Minutes
Technical Working Group Meeting for Operable Unit No. 7
(MTS Contract 353017TB3)

Dear Ms. Peterson-Wright:

Enclosed are meeting minutes to document the February 1, 1995, technical working group meeting for the OU 7 landfill closure interim measure/interim remedial action and environmental assessment.

If you have any questions, please contact me at your convenience.

Sincerely,

Myra K. Vaag
Project Manager

Enclosure

cc:	W. Bartholomew w/o	EG&G	B. Caruso	Stoller
	L. Brooks	EG&G	A. Crockett	Stoller
	R. Cygnarowicz	EG&G	M. Eisenbeis	Stoller
	T. Lindsay	EG&G	D. Garcia	Stoller
	P. Martin	EG&G	C. Gee	Stoller
	P. Corser	TerraMatrix	J. Jankousky	Stoller
	J. Kendall	TerraMatrix	D. Palmer	Stoller
			L. Ross w/o	Stoller
			B. Stephanus w/o	Stoller
			MKV Chron w/o	Stoller
			OU7 Project File	

Minutes for the OU 7 Seep Collection/Landfill Closure IM/IRA
Technical Working Group Meeting
February 1, 1995

Technical working group members were introduced to Peg Witherill, who is the new DOE project manager. The following topics were discussed:

Landfill Closure IM/IRA

Review of Alternatives Development - Stoller reviewed the presumptive remedy approach, preliminary assumptions, groundwater modeling, alternatives development, conceptual cost estimates, initial screening, and the preferred alternatives development.

Four Preferred Alternatives - Stoller reviewed the decision matrix, which compares the effectiveness, implementability, environmental impacts, and conceptual costs of the four preferred alternatives (1a, 2a, 2d, and 5a). Alternative 2a is the best from a total score and cost standpoint. Alternatives 1a, 2a, and 2d are essentially the same for effectiveness, implementability, and environmental impacts.

Additional Modeling Results - Modeling runs were performed to measure the effectiveness of the different components of the landfill closure remedy. Both a cap and a slurry wall (1E-7 cm/sec) are needed to reduce flows from the landfill and water levels within the landfill. Although there will be differential heads inside and outside of the slurry wall, Stoller and TerraMatrix believe that the slurry wall is shallow enough that the head buildup will not cause failure. Several modeling scenarios were performed to examine head buildup west of the landfill. Groundwater will surface during periods of high flow (typically April). Some method must be devised to manage this water.

Downgradient Groundwater Quality - Analytical results have been received from the first month of sampling for downgradient wells 53094 (bedrock or LHSU) and 53194 (alluvium or UHSU). Concentrations of lithium, sodium, lead, and fluoride in the UHSU are above the upper tolerance limit for 99 percent of the population with a 99 percent level of confidence ($UTL_{99/99}$). Concentrations of nickel, chloride, and total dissolved solids (TDS) in the LHSU are above the $UTL_{99/99}$. Additional comparisons will be performed between upgradient wells and downgradient wells and between landfill wells and downgradient wells.

Additional Research on Slurry Wall Effectiveness - TerraMatrix reviewed slurry-wall defects cited in the literature, determined which ones are applicable to OU 7, proposed preventive measures, and estimated cost impacts to the project. Improperly mixed backfill, slurry entrapment during backfill placement, trench sediments covered by backfill, slurry trench excavation not keyed into the impermeable layer, cycles of freezing and thawing, cycles of wetting and drying, and chemical incompatibility may be potential problems at OU 7. Proper design, controlled mixing conditions, material testing, and a CQA program could prevent these slurry wall defects. There would be minimal increases in material, material testing, and construction quality assurance (CQA) costs.

TerraMatrix also researched long-term failure rates for slurry walls. Approximately 10 percent of slurry walls installed have had one or more of the problems noted above. Confirmed quality control (QC) and quality assurance (QA) procedures will reduce the risk of failure.

Status of Lab Testing - Soil index tests have been completed for samples collected along the slurry wall alignment. Materials have been classified as silty, clayey sand with some gravel (SM to CL) and silty clay with a trace sand (CH). Mixing tests will be performed on samples of the sandier material. Testing will consist of fabricating samples at various bentonite mixtures ratios and testing for permeability and compatibility. TerraMatrix is overseeing the lab testing program.

Seep Collection PAM/ Title II Design

Preferred Treatment Alternative - DOE/ER reviewed the existing data for the seep water to determine the best method for treatment. DOE/ER review of the data indicated that treatment for organics is not needed. DOE/ER suggested that the preferred option for handling seep water is to propose to CDPHE and EPA to delist the water. A risk assessment can be performed to strengthen the position.

Agency Meeting

Status of DOE Management Strategy Letters - DOE is waiting for a response on the letter regarding the wells proposed for abandonment. The letters regarding consolidation of soils and sediments under RCRA corrective action and the disposition of investigation-derived material are being written or reviewed at EG&G and have not been sent to DOE.

Presentation of Alternatives - Two agency meetings will be scheduled for successive weeks at the end of February or the beginning of March. The purpose of the meetings is to present the conceptual model for the landfill closure IM/IRA under the presumptive remedy and RCRA corrective action; discuss the options analysis; present four alternatives; discuss their effectiveness, implementability, and cost; and select the preferred alternative.

Format for Presentation - Overhead transparencies and handouts will be used to present material. The inferred fault will be discussed, and design recommendations will be made where the slurry wall could be affected.

Action Items

The formal meeting minutes are the forum for tracking action items. A list of the action item, the person responsible for the action, and the status of the action item is included below. The list will be updated weekly. When an action has been completed, it will be stated as such, and the item will be removed from the action item list the following week.

01-121 Completed.

122 Determine possible trucking route from Western Aggregates to the present landfill east of Colorado Highway 93 (T. Lindsay, EG&G). EG&G is investigating options for a trucking route in the buffer zone between Western Aggregates and OU 5 and OU 7 and plans to propose constructing two new roads. NEPA approval will be required. In progress.

123-149 Completed.

150 Obtain information regarding cover designs for Lowry Landfill, Marshall Landfill, and RMA (T. Lindsay, EG&G). EG&G provided Stoller with information on cover designs from Hanford, Los Alamos, and Marshall. Completed.

151-157 Completed.

158 Determine allowable activities for radiological contaminants in soils/sediments (L. Peterson-Wright, EG&G). The no-rad-added policy is being reconsidered based on the reorganization of the cognizant professionals. In progress.

159-166 Completed.

167 Follow up on the sample of seep water collected for TOC analysis (P. Pigeon, DOE/PME).

168-172 Completed.

173 Investigate the nature of contamination, if any, in the LHSU downgradient of the landfill using analytical results from well 53094 (J. Jankousky, Stoller). Stoller received analytical results from the first round of monthly sampling. Chloride, TDS, and nickel concentrations are above their respective $UTL_{99/99}$ values. Downgradient concentrations will be compared to upgradient and landfill concentrations under a new action item. Completed.

174 Provide Stoller with O&M costs for groundwater treatment at the existing OU 1 facility (P. Martin, EG&G). EG&G provided O&M costs. Completed.

175-182 Completed.

183 Use groundwater flow model to determine how much head buildup will occur upgradient of the slurry wall. Add a drain to the flow model to decrease heads, if necessary (J. Jankousky, Stoller). Head buildup will occur and groundwater will surface during high flow conditions in April, which is historically a wetter month. Some method must be devised to manage this water. Completed.

184 Research long-term failures of slurry walls (J. Kendall, TerraMatrix). Long-term failure rate is approximately 10 percent. Completed.

185 Determine which slurry-wall defects cited in the literature are applicable to OU 7 and what preventive measures will be taken (J. Kendall, TerraMatrix). Improperly mixed backfill, slurry entrapment during backfill placement, trench sediments covered by backfill, slurry trench excavation not keyed into the impermeable layer, cycles of freezing and thawing, cycles of wetting and drying, and chemical incompatibility may be potential problems at OU 7. Proper design, controlled mixing conditions, material testing, and a CQA program could prevent these slurry wall defects. Completed.

185 Provide Stoller with a copy of the OU 4 IM/IRA-EA Decision Document (L. Peterson-Wright, EG&G).

186 Completed.

187 Determine if a small French drain would decrease head buildup in groundwater west of the landfill using the existing groundwater model (J. Jankousky, Stoller).

188 Compare groundwater quality upgradient of and within the landfill to groundwater quality downgradient of the landfill. Estimate the dispersion and retardation that might occur (J. Jankousky, Stoller).

189 Check the data constraining the location of the fault that cuts across OU 7 (M. Vaag, Stoller).

190 Check the progress on the management strategy letter regarding consolidation of sediments and soils under RCRA corrective action (L. Peterson-Wright, EG&G).

191 Schedule two meetings with CDPHE and EPA to discuss the conceptual model for the landfill closure IM/IRA and specific alternatives (L. Peterson-Wright, EG&G).

192 Solicit a response from CDPHE and EPA on the wells proposed for abandonment (P. Witherill, DOE).

193 Investigate conducting a risk analysis of the seep water (L. Peterson-Wright, EG&G, and M. Vaag, Stoller).

194 Find out what the acceptance criteria are for the Rocky Flats sewage treatment plant (L. Peterson-Wright, EG&G).

Next Meeting

The next meeting will be at 10:00 a.m. on February 8, 1995, in the EG&G small west conference room.

6

List of Attendees

Name	Organization	Phone
Pat Corser	TerraMatrix	(303) 879-6260
Mary Eisenbeis	Stoller	546-4474
John Jankousky	Stoller	546-4412
Tom Lindsay	EG&G	966-6985
Peter Martin	EG&G	966-8695
Laurie Peterson-Wright	EG&G Project Manager	966-8553
Paul Pigeon	RTG/DOE/PME	966-5611
Myra Vaag	Stoller Project Manager	546-4417
Peg Witherill	DOE Project Manager	966-6585

Summary of Recent Modeling Efforts

Effectiveness of Landfill Closure Remedy Components

Last week a series of modeling runs were conducted in an attempt to measure the effectiveness of the different components of the landfill closure remedy. Capture of groundwater approximately 500 feet below the current dam area was assumed for all scenarios. The scenarios and flow results include the following:

1. Dam is removed, collection below dam area, no cap, no slurry wall. Average 30-year flow is 2.03 gpm.

2. Dam is removed, collection below dam area, impermeable cap, no slurry wall. Average 30-year flow is 1.73 gpm.

3. Dam is removed, collection below dam area, impermeable cap, 1E-7 cm/sec slurry wall. Average 30-year flow is 1.04 gpm.

4. Dam is removed, collection below dam area, impermeable cap, 1E-12 cm/sec slurry wall. Average 30-year flow is 0.94 gpm.

These scenarios indicate that both the cap and a 1E-7 slurry wall are needed to effectively reduce flows from the landfill and water levels in the landfill.

Differential Heads Between Inside and Outside of Slurry Wall

The model simulates differential heads between inside and outside of the slurry wall at approximately 15-20 feet. EPA has raised concerns about slurry wall failure due in part to high differential heads. Stoller's conversations with vendors indicate that the OU 7 slurry wall is considered shallow to moderate, and that this level of differential head should not be a concern.

Buildup of Heads West of the Landfill

EPA has also raised concerns about the surfacing of ground water west of the landfill due to the buildup of heads west of the slurry wall. A series of modeling scenarios were conducted examining the buildup of heads just west of the landfill. Heads referenced below are at the approximate location of alluvial well 1086.

Ground Surface Elevation: 5996.6 feet

Standard Flow Water Table Elevation (before slurry wall): 5983.50 feet

Water Table Elevation with 1E-7 cm/sec Slurry Wall: 5988.98 feet

Water Table Elevation with 1E-12 cm/sec Slurry Wall: 5989.96 feet

9

Historic High Flows (usually in April), 1987 through 1993: for three of seven years the high flow water table elevation exceeds 5995.0 feet.

This combination of increased water table due to either slurry wall and potential seasonal high flows indicates that water should not surface under normal conditions but will most likely surface under high flow conditions. Some method of managing this water must be devised.

A series of modeling runs were conducted under standard flow conditions and with three drain cells located at the west end of the landfill to simulate pumping wells. One drain cell was located at the approximate location of well 1086, one located 100 feet to the north, and one located 100 feet to the south. Required flows to lower the water table under different scenarios were recorded. These results include the following:

1. 1E-7 cm/sec Slurry Wall. With no drain cells, the head at well 1086 is 5988.98 feet. To lower the heads at this well and at the two nearby wells approximately **two feet**, the required pumping rate is 25 ft^3/day, or approximately 0.13 gpm.

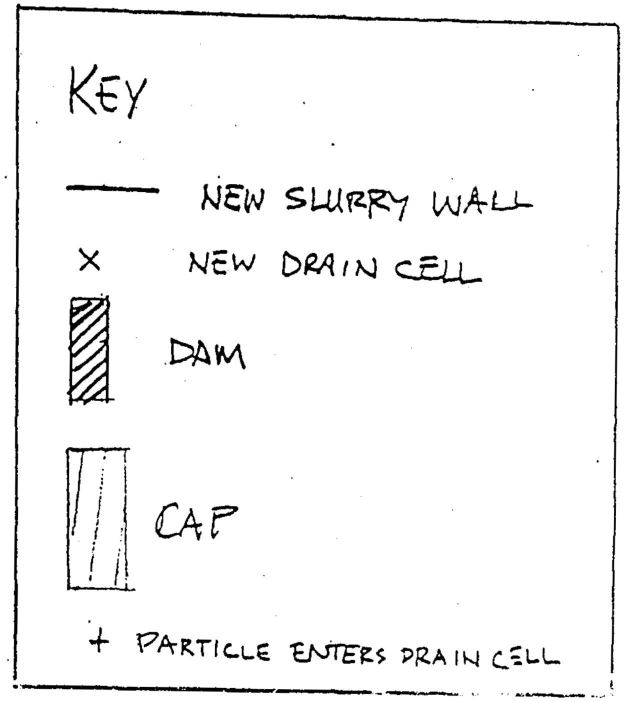
2. 1E-7 cm/sec Slurry Wall. With no drain cells, the head at well 1086 is 5988.98 feet. To lower the heads at this well and at the two nearby wells approximately **four feet**, the required pumping rate is 50 ft^3/day, or approximately 0.26 gpm.

3. 1E-12 cm/sec Slurry Wall. With no drain cells, the head at well 1086 is 5989.96 feet. To lower the heads at this well and at the two nearby wells approximately **one** foot to the level expected with the 1E-7 slurry wall, the required pumping rate is 5 ft^3/day, or approximately 0.026 gpm.

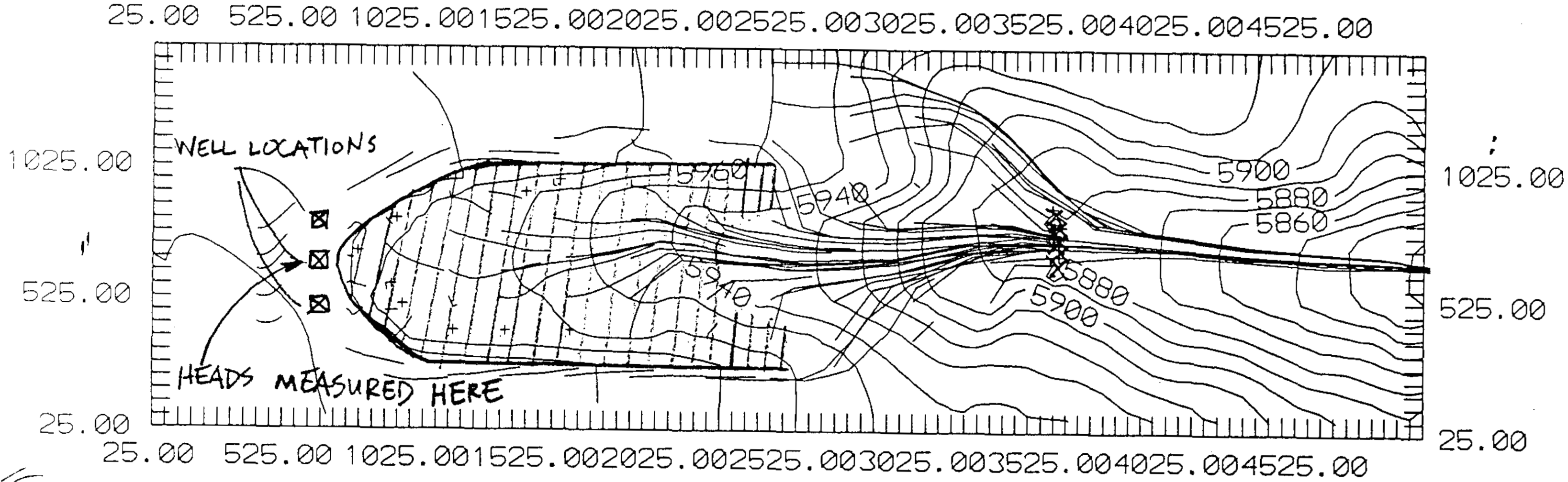
As stated above, the surfacing of ground water is expected only under high flow conditions. Two of the available options for the management of this water are:

1. Collect the water in the surface water diversion ditch and route it around the landfill for release. This option may be a problem because some contamination has been observed at wells west of the landfill (possible source is the PU&D yard).

2. Collect this water using three to five pumping wells. Treat the collected water in the same system that treats downgradient water. The three modeling scenarios above indicate that the required flow rates should be less than 0.5 gpm.



ALT2A3.GRD; 1E-7 Slurry Wall; 1/23/95 #2



Status Meeting
Rocky Flats OU-7 Closure Plan

February 1, 1995

1. **Slurry Wall Defects and Preventative Measures**
   - Attached table lists potential construction defects and potential changes in backfill properties that could effects performance of a slurry wall.
   - The table also lists preventative measures and applicability to OU-7

2. **Typical Quality Control and Quality Assurance Program for Slurry Wall**
   - Contractor - Quality Control Program Components
     - Viscosity of slurry
     - Density of slurry
     - Slump of backfill
     - Location and verticality of trench
     - Depth of trench
     - Tracking of material balance

   - Engineer - Quality Assurance Program
     - Confirmation tests on the following
       - Viscosity of slurry
       - Density of slurry
       - Slump of backfill
       - Location and verticality of trench
       - Depth of trench
       - Tracking of material balance
       - Cleaning of trench bottom
       - Tie-in to aquiclude
       - Bentonite mixtures
       - Permeability of backfill

3. **Review of Past Performance of Slurry Walls**
   - Review of 12 case histories reported in the literature
     - Confirmed potential failure modes listed above
     - Confirmed QC and QA procedures to reduce risks of failure
     - No indications of failure rates
   - Contacted Installation Contractors Regarding Their Experience
     - Experience on over 400 slurry walls
     - Confirmed potential failure modes listed above
     - Confirmed QC and QA procedures to reduce risks of failure
     - General comment: maybe 10 percent of slurry walls installed have had one or more of the problems noted on the attached table.

4. **Status of Soil Testing for Slurry Wall Mix Design**
    - Soil index tests completed for samples obtained from slurry wall alignment
    - Materials classified as:
        - Silty, clayey, SAND, some gravel (SM to CL)
        - Silty, CLAY, trace sand (CH)
    - Testing of clay bentonite mixtures will be based on composite samples of sandier materials (considered to be conservative)
    - Testing will consist of fabricating samples at various bentonite mixtures ratios and testing for permeability and compatibility.

SLURRY WALL DEFECTS AND PREVENTATIVE MEASURES

Defects	Contributing Factors	Preventative Measure	Potential Cause of Existing OU7 Slurry Wall Failure	Relative Applicability to OU7	Relative Impacts to OU7 Slurry Wall Costs
Construction Defects: Improperly Mixed Backfill - lumps of unmixed backfill material or foreign material introduced during backfill placement	Non-uniform or uncontrolled backfill mixing practices Mixing next to trench resulting in inclusion of foreign material No post placement material verification	QC & QA testing Mechanical mixers Controlled mixing conditions Material sampling and testing Observation during placement operations and verification testing	Yes	Yes (applies to any slurry wall)	Increased mixing costs Increased transportation costs Increased material and CQA costs
Slurry Entrapment During Backfill Placement - backfill overrides slurry along backfill slope entrapping slurry and creating slurry pockets in backfill material	Backfill material too stiff resulting in steep placement slope and cascading of backfill material Backfill material dropped in trench instead of sliding down slope	QC & QA testing Material sampling and testing Placement operations observation and verification	Yes	Yes (applies to any slurry wall)	Minimal increase in material testing and CQA costs
Trench Sediments Covered by Backfill - granular fraction of slurry settles to bottom of trench	Extended periods of inactivity Slurry design with high coarse material content Non-uniform or uncontrolled mixing practices	QC & QA testing Daily sounding and sampling of trench bottom material	Yes	Yes (applies to any slurry wall)	Minimal increase in material testing and CQA costs
Trench Wall Instability: Surface and at Depth - caving of trench wall material at crest and at depth	Change in trench wall soil type or structure	QC & QA testing Sounding immediately prior to backfill placement Clean out trench Modify slurry properties to suit trench wall	No	No Subsurface geology and structure is well defined	None
Slurry trench excavation not keyed into impermeable layer	Poor definition of impermeable layer elevation	QC & QA testing Sounding immediately prior to backfill placement	Yes	Yes (Applies to any slurry wall)	Minimal increase in CQA costs

SLURRY WALL DEFECTS AND PREVENTATIVE MEASURES

Defects	Contributing Factors	Preventative Measure	Potential Cause of Existing OU7 Slurry Wall Failure	Relative Applicability to OU7	Relative Impacts to OU7 Slurry Wall Costs
<u>Changes in Backfill Properties</u>: Cycles of Freezing and Thawing - ice lens formation	Backfill material exposed to frost	Prevented with proper design	No	Yes	None
Cycles of Wetting and Drying - desiccation	Fluctuating water level may result in zone of backfill material being exposed to repeated wetting and drying Backfill material with very high moisture content that dries over time	Prevent with proper design	No	Yes	Drying could occur in unsaturated zone - but will not impact performance of slurry wall
Settlement Fracturing	Deep, wide slurry walls settle under their own weight due to pore water dissipation and particle reorientation High drag filter cake	Reduce settlement with proper backfill mix design Vary slurry design to create low drag filter cake Reduce trench width to reduce settlement potential	No	No Shallow depths and limited settlement	None
Hydraulic Fracturing - High hydrostatic stress allows fluid to penetrate slurry wall	Deep, wide slurry walls subjected to high hydrostatic pressures	Grouting of trench wall zone to reduce hydrostatic stress on slurry wall Inclusion of drains on upgradient side of slurry wall to reduce hydrostatic stress	No	No Shallow depths and limited hydrostatic head	None
Chemical Incompatibility - contaminant increase hydraulic conductivity backfill material	High/Low pH groundwater incompatible with clay type resulting in particle swelling or shrinkage	Use of well graded backfill soil base with high fine content to minimize effects of bentonite shrinkage Conduct compatibility tests with clay and groundwater	Yes	Yes	Testing being conducted for OU7 and site leachate

ref. Evans, J.E., "Vertical Cutoff Walls", <u>Geotechnical Practice for Waste Disposal,</u> D. Daniels, ed., Chapman & Hall, 1993. ISBN 0 412 35270 6.

The S.M. Stoller Corporation
Informal Memorandum

To: Brian Caruso, Myra Vaag

From: John Jankousky

Date: 1/27/95

Subject: Analytical Results from New Wells

The analytical results from well 53194 (alluvium) and well 53094 (unweathered bedrock) were compared to the Upper Tolerance Limits, 99% level of confidence, 99% of population ($UTL_{99/99}$) for the upper and lower flow systems, respectively. $UTL_{99/99}$ values were taken from Background Geochemical Characterization Report, EG&G 1993. The results are presented below:

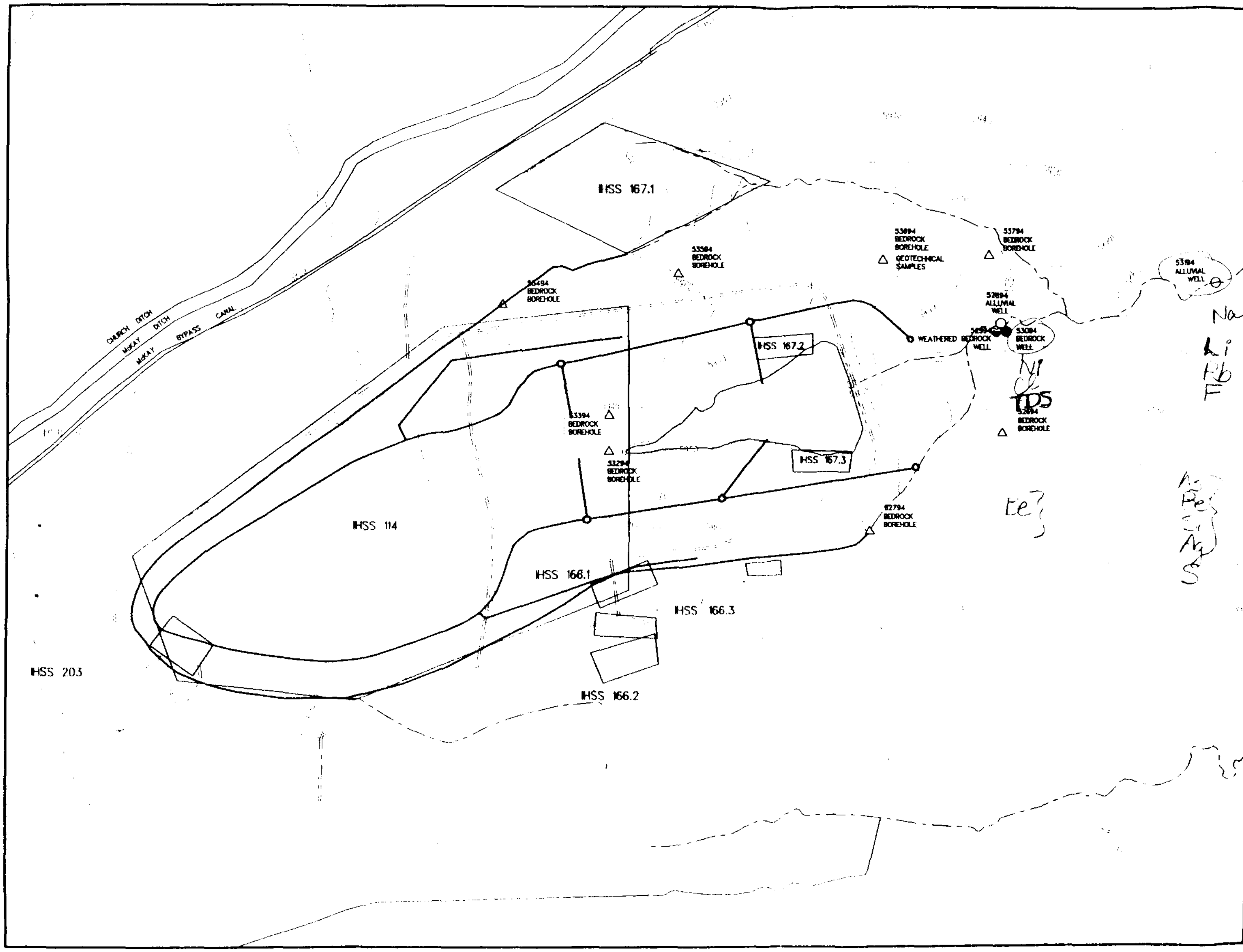
For alluvial well 53194:

- **Volatile organic** concentrations were all nondetects, with the following exceptions:
  - Methylene Chloride, 1 BJ, ug/L
  - Butylbenzylphthalate, 1 BJ, ug/L
- All **dissolved metal** concentrations were below $UTL_{99/99}$ values, with the following exceptions:
  - Sodium (d): result = 184,000 ug/L compared to $UTL_{99/99}$ = 133,758 ug/L.
  - The following metals were above detection limits and $UTL_{99/99}$ values were not available: arsenic (d), beryllium (d), silicon (d).
- All **total metal** concentrations were below $UTL_{99/99}$ values, with the following exceptions:
  - Lithium (t): result = 160 ug/L compared to $UTL_{99/99}$ = 147.37 ug/L.
  - Sodium (t): result = 188,000 ug/L compared to $UTL_{99/99}$ = 123,327 ug/L.
  - Lead (t): result = 50.5 ug/L compared to $UTL_{99/99}$ = 11.75 ug/L.
  - The following metals were above detection limits and $UTL_{99/99}$ values were not available: silver (t) and beryllium (t).

- All **water quality parameter** concentrations were below $UTL_{99/99}$ values, with the following exceptions:
  - Flouride: result =2,090 ug/L compared to $UTL_{99/99}$ = 1,710 ug/L.
  - The following water quality parameter concentration was above detection limits and a $UTL_{99/99}$ values was not available: sulfide.
- All **radionuclide** concentrations were below $UTL_{99/99}$ values where $UTL_{99/99}$ values were available. A $UTL_{99/99}$ value was not available for cesium-134. The result for this analyte was negative.

For unweathered bedrock well 53094:

- **Volatile organic** concentrations were all nondetects.
- **Dissolved metal** concentrations were not reported.
- All **total metal** concentrations were below $UTL_{99/99}$ values, with the following exception:
  - Nickel (t): result = 35.2 ug/L compared to $UTL_{99/99}$ = 32.89 ug/L.
  - The following metal was above detection limits and a $UTL_{99/99}$ values was not available: beryllium (t).
- All **water quality parameter** concentrations were below $UTL_{99/99}$ values, with the following exceptions:
  - Chloride: result = 887,999 ug/L compared to $UTL_{99/99}$ = 489,654 ug/L.
  - Total dissolved solids: result = 1,720,000 ug/L compared to $UTL_{99/99}$ = 1,582,665 ug/L.
- All **radionuclide** concentrations were below $UTL_{99/99}$ values.



EXPLANATION

- ○ Alluvial Well
- ◒ Weathered Bedrock Well
- ● Unweathered Bedrock Well
- △ Borehole

- Ditch
- Intermittent Stream
- Dirt Road
- OU 7 IHSS Boundary
- OU 6 IHSS Boundary
- Landfill Structures

0 Feet 300 600

Topographic Contour Interval = 20 Feet

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

Proposed Phase II Monitoring Well and Borehole Locations

Revised Work Plan | Operable Unit No. 7

Date: August 1994 - Figure 6-3

09/01/94 PROPOSED GW.MAP

17/17