

GLO21A

HUNT ENERGY CORPORATION
2500 FIRST NATIONAL BANK BUILDING
DALLAS, TEXAS 75202

A Ross ✓
RECEIVED
JUN 22 1979
AREA GEOTHERMAL SUPERVISOR'S OFFICE
CONSERVATION DIVISION
U.S. GEOLOGICAL SURVEY
MENLO PARK, CALIFORNIA

June 19, 1979

U. S. Geological Survey
Conservation Division
Area Geothermal Supervisor's Office
2465 E. Bayshore Road
Suite 400, Room 401
Palo Alto, CA 94303

**UNIVERSITY OF UTAH
RESEARCH INSTITUTE
EARTH SCIENCE LAB.**

Gentlemen:

Hunt Energy Corporation, Geothermal Department, as designated operator for certain Federal geothermal leases in Steptoe Valley of White Pine Co., Nevada herein submits a Plan of Exploration Operation for Deep Drilling.

Hunt has been and is continuing to execute certain programs toward the discovery of an economic geothermal resource in the area. Because several geological and geophysical studies are still providing data leading to the deep drilling phase, certain sections of the Plan will be completed at a later date by addenda to the Plan. A multi-well program is proposed with the expectation that any one or more of the sites could be drilled.

For ease of reference, the Plan follows the format outlined in the proposed GRO Order No. 5.

Yours truly,
Robert M. Sanford
Robert M. Sanford
Geothermal Manager

RLB/pss

enclosures

PLAN OF EXPLORATION OPERATION
FOR
DEEP DRILLING

SCHELLBOURNE AREA, STEPTOE VALLEY
WHITE PINE CO., NEVADA

Hunt Energy Corporation
Geothermal Department
2500 1st National Bank Bldg.
Dallas, Texas

May 1979

PLAN OF OPERATION-DRILLING

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I. GENERAL INFORMATION

PLAN OF EXPLORATION OPERATION
FOR
DEEP DRILLING

SHELLBOURNE AREA, STEPTOE VALLEY
WHITE PINE CO., NEVADA

Lessee:	Federal Lease Number:
W. H. Hunt	N-12114 N-12120 N-12123 N-12115 N-12121 N-12124 N-12116 N-12122
Nelson B. Hunt	N-12119
Norma Knobel Hunt	N-14981 N-14983 N-14985 N-14982 N-14984
Caroline Hunt Schoellkopf	N-14986

The above leases are located approximately 56 km (35 mi.) north of the town of Ely, Nevada and cover an area of almost 143 sq km (56 sq. mi.) on the west side of Steptoe Valley in White Pine County.

Specifically:

T. 21 N., R. 63 E. Mount Diablo Meridian
Secs: 1-4, 9-12.

T. 21 N., R. 64 E.
Secs: 4-9.

T. 22 N., R. 63 E.
Secs: 1-4, 9-15, 21-28, 33-36.

T. 22 N., R. 64 E.
Secs: 4-9, 16-21, 28-33.

R. 63 E.

R. 64 E.

T. 23

T. 23

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T. 22

T. 22

N.

N.

T. 21

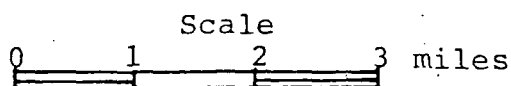
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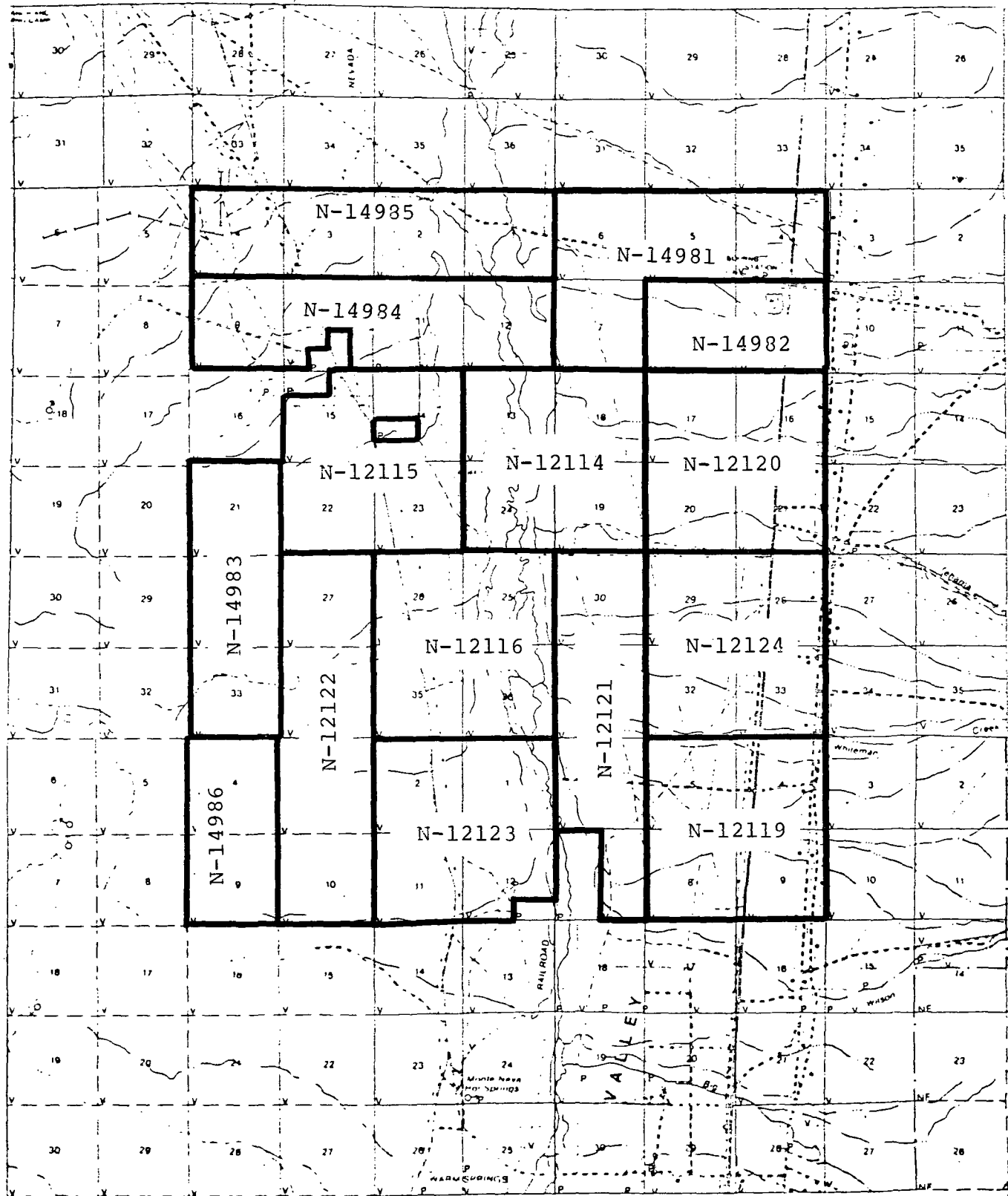
R. 63 E.

R. 64 E.



LEASE MAP

SHELLBOURNE AREA
 Steptoe Valley
 White Pine Co., Nevada



Designated Operator for all leases:

Hunt Energy Corporation
Geothermal Department
2500 1st National Bank Building
Dallas, Texas 75202
Phone: (214) 748-1300

Supervisors:

Robert M. Sanford, Manager

Roger L. Bowers, Operations
Home phone: (817) 461-1038

Contractor: to be selected.

Field Supervisors: to be selected.

Names, addresses, and phone numbers for all contractors and supervisors will be provided before operations begin.

Objectives: to drill one or more deep (max. 3,000 m) wells within the lease area to test for a commercial geothermal resource. If a resource is found, development and production will follow. A full description of the proposed operation is detailed in the following sections.

Dates: The first wildcat is scheduled to start in August 1979.

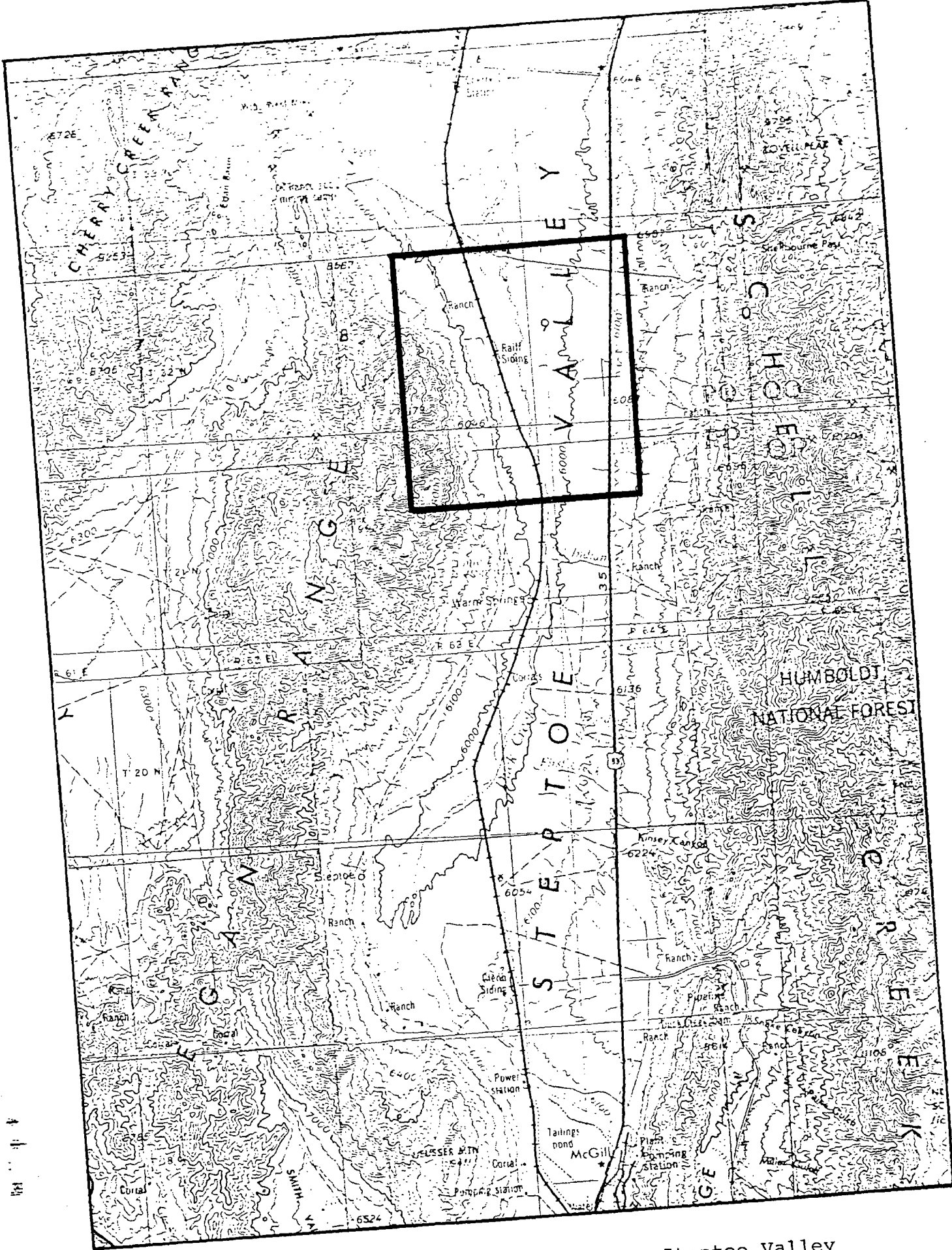
It should be completed in about 90 days from the spud date unless testing procedures are lengthy. If a resource is found, confirmation wells would be drilled over a period of about two years. If no resource is found, operations would cease as soon as practical.

II. MAPS

A. Topographic maps

A problem exists in that the only published topographic map of the area is at the scale of 1:250,000 (Ely, Nevada sheet). Larger scale mapping has been in progress the past few years, but preliminary prints are not yet available. The only other usable maps are BLM 30-minute quadrangles at scale 1:63,360 (1'=1 mi.).

A section grid at scale 1:24,000 is used to show well locations.



Topographic Map

Steptoe Valley
White Pine Co., Nevada

Scale: 1:250,000

R. 63 E.

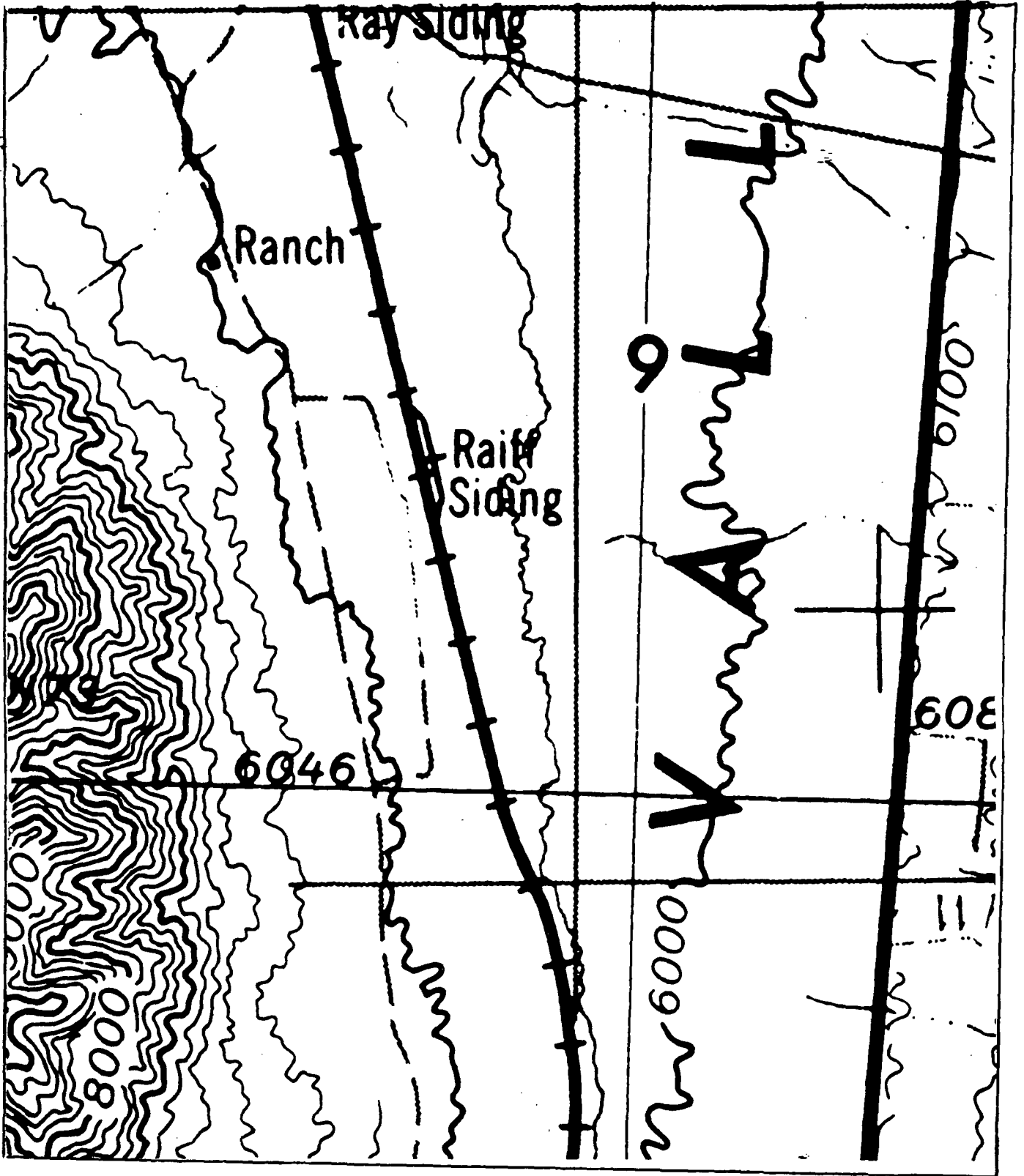
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R. 63 E.

R. 64 E.

Scale
1" = 1 mi.

Note: Enlarged from 1:250,000
topo map

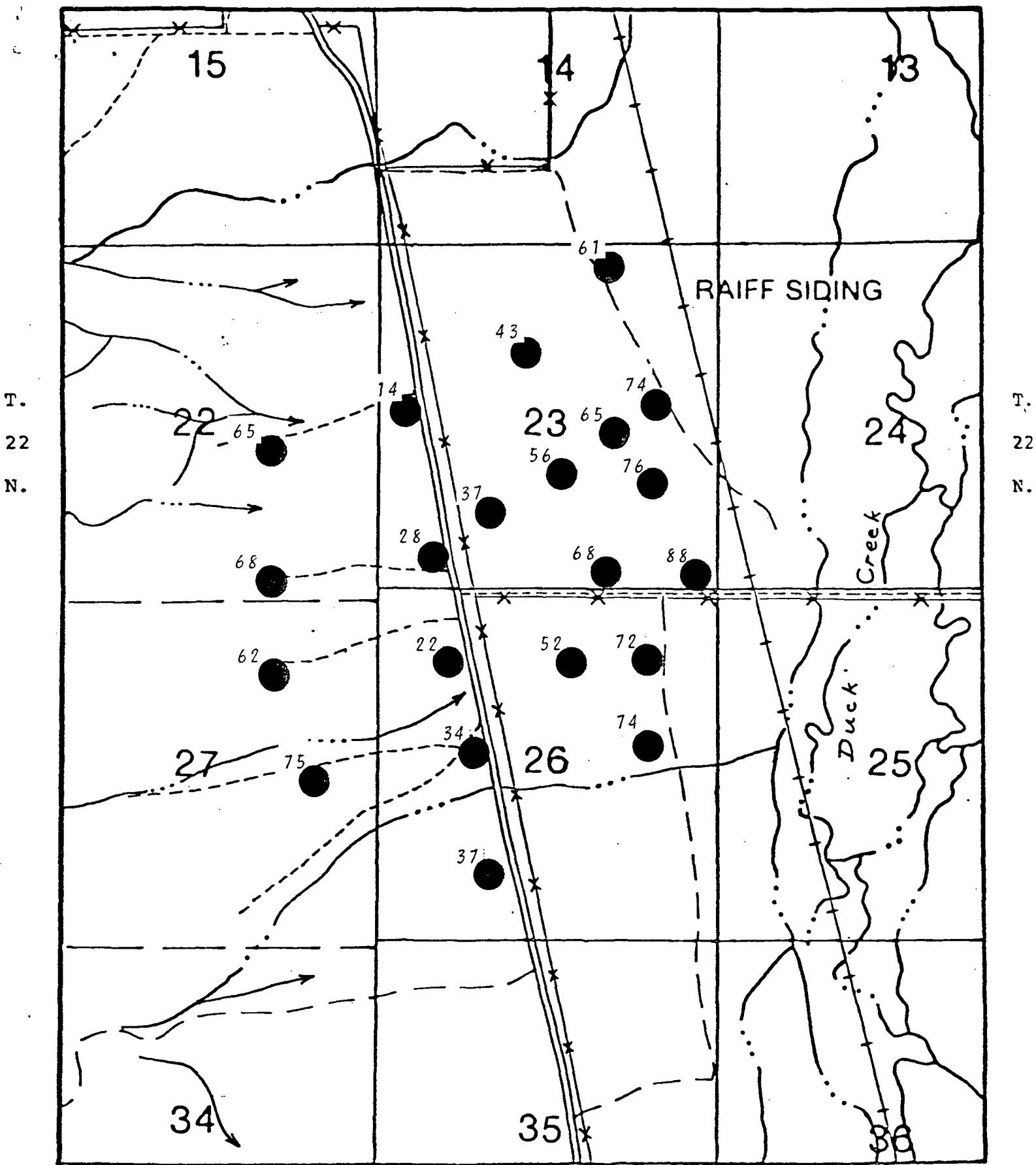
SHELLBOURNE AREA
Steptoe Valley
White Pine Co., Nevada

WELL LOCATIONS

PROPOSED WELL LOCATIONS
SCHELLBOURNE ANOMALY
WHITE PINE CO., NEVADA

T. 22 N., R. 63 E. M.D.M.

	<u>Kettleman Number</u>	<u>Land Description</u>
1.	65-22	NE $\frac{1}{4}$ NW $\frac{1}{4}$ SE $\frac{1}{4}$, Sec. 22
2.	68-22	SE $\frac{1}{4}$ SW $\frac{1}{4}$ SE $\frac{1}{4}$, Sec. 22
3.	14-23	SW $\frac{1}{4}$ SW $\frac{1}{4}$ NW $\frac{1}{4}$, Sec. 23
4.	28-23	SE $\frac{1}{4}$ SW $\frac{1}{4}$ SW $\frac{1}{4}$, Sec. 23
5.	37-23	NW $\frac{1}{4}$ SE $\frac{1}{4}$ SW $\frac{1}{4}$, Sec. 23
6.	43-23	NE $\frac{1}{4}$ SE $\frac{1}{4}$ NW $\frac{1}{4}$, Sec. 23
7.	56-23	SW $\frac{1}{4}$ NW $\frac{1}{4}$ SE $\frac{1}{4}$, Sec. 23
8.	61-23	NE $\frac{1}{4}$ NW $\frac{1}{4}$ NE $\frac{1}{4}$, Sec. 23
9.	65-23	NE $\frac{1}{4}$ NW $\frac{1}{4}$ SE $\frac{1}{4}$, Sec. 23
10.	68-23	SE $\frac{1}{4}$ SW $\frac{1}{4}$ SE $\frac{1}{4}$, Sec. 23
11.	74-23	SW $\frac{1}{4}$ SE $\frac{1}{4}$ NE $\frac{1}{4}$, Sec. 23
12.	76-23	SW $\frac{1}{4}$ NE $\frac{1}{4}$ SE $\frac{1}{4}$, Sec. 23
13.	88-23	SE $\frac{1}{4}$ SE $\frac{1}{4}$ SE $\frac{1}{4}$, Sec. 23
14.	22-26	SE $\frac{1}{4}$ NW $\frac{1}{4}$ NW $\frac{1}{4}$, Sec. 26
15.	34-26	SW $\frac{1}{4}$ SE $\frac{1}{4}$ NW $\frac{1}{4}$, Sec. 26
16.	37-26	NW $\frac{1}{4}$ SE $\frac{1}{4}$ SW $\frac{1}{4}$, Sec. 26
17.	52-26	SW $\frac{1}{4}$ NW $\frac{1}{4}$ NE $\frac{1}{4}$, Sec. 26
18.	72-26	SW $\frac{1}{4}$ NE $\frac{1}{4}$ NE $\frac{1}{4}$, Sec. 26
19.	74-26	SW $\frac{1}{4}$ SE $\frac{1}{4}$ NE $\frac{1}{4}$, Sec. 26
20.	62-27	SE $\frac{1}{4}$ NW $\frac{1}{4}$ NE $\frac{1}{4}$, Sec. 27
21.	75-27	NW $\frac{1}{4}$ NE $\frac{1}{4}$ SE $\frac{1}{4}$, Sec. 27



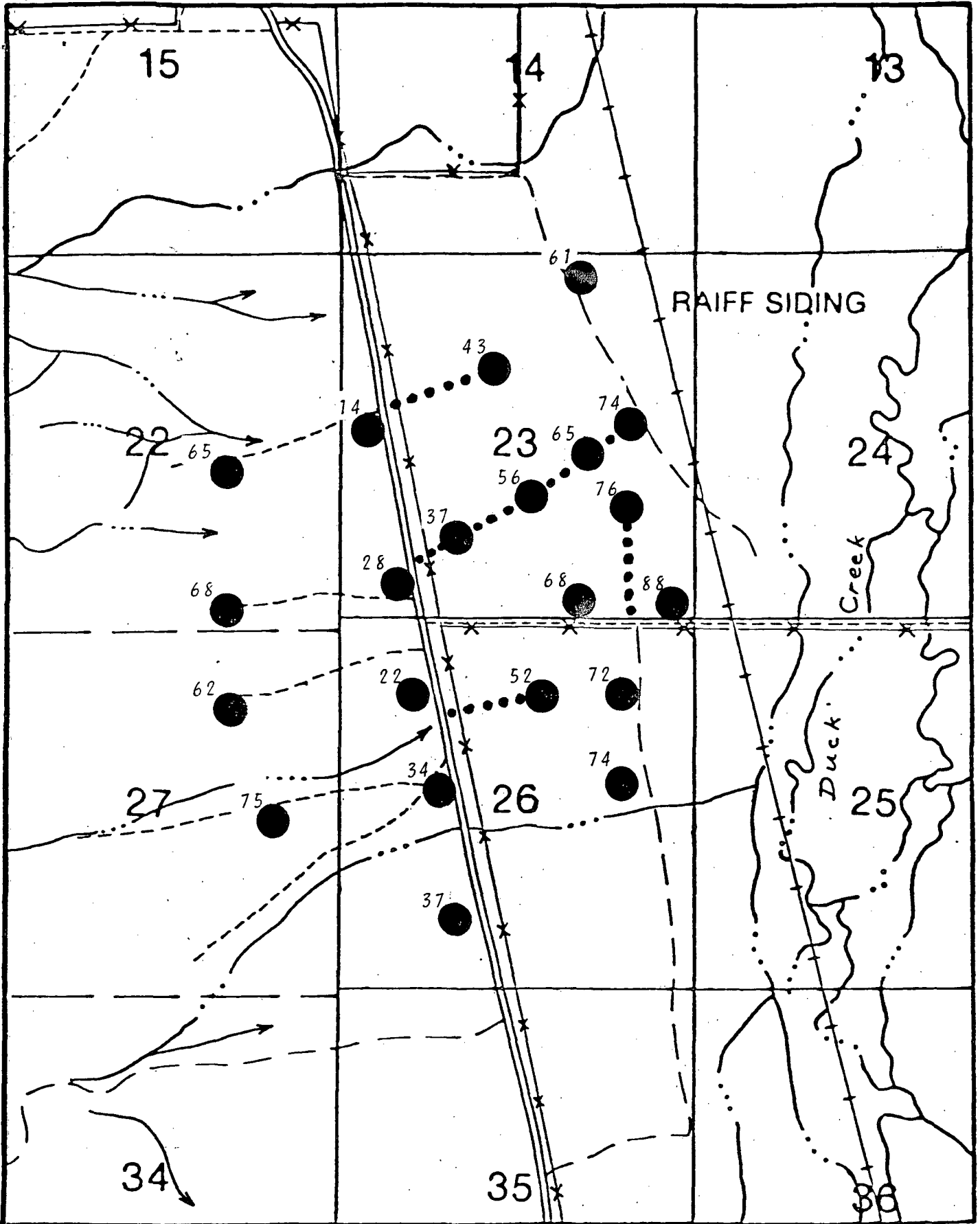
Scale: 1" = 2,000'

Proposed Well Locations

SCHELLBOURNE ANOMALY
Monte Neva Prospect
White Pine Co., Nevada

ACCESS ROADS

Most locations are accessible by existing roads and trails. New roads would be constructed over the shortest practical distance.



Scale: 1" = 2,000'

Access Roads

●●●● suggested new road if necessary

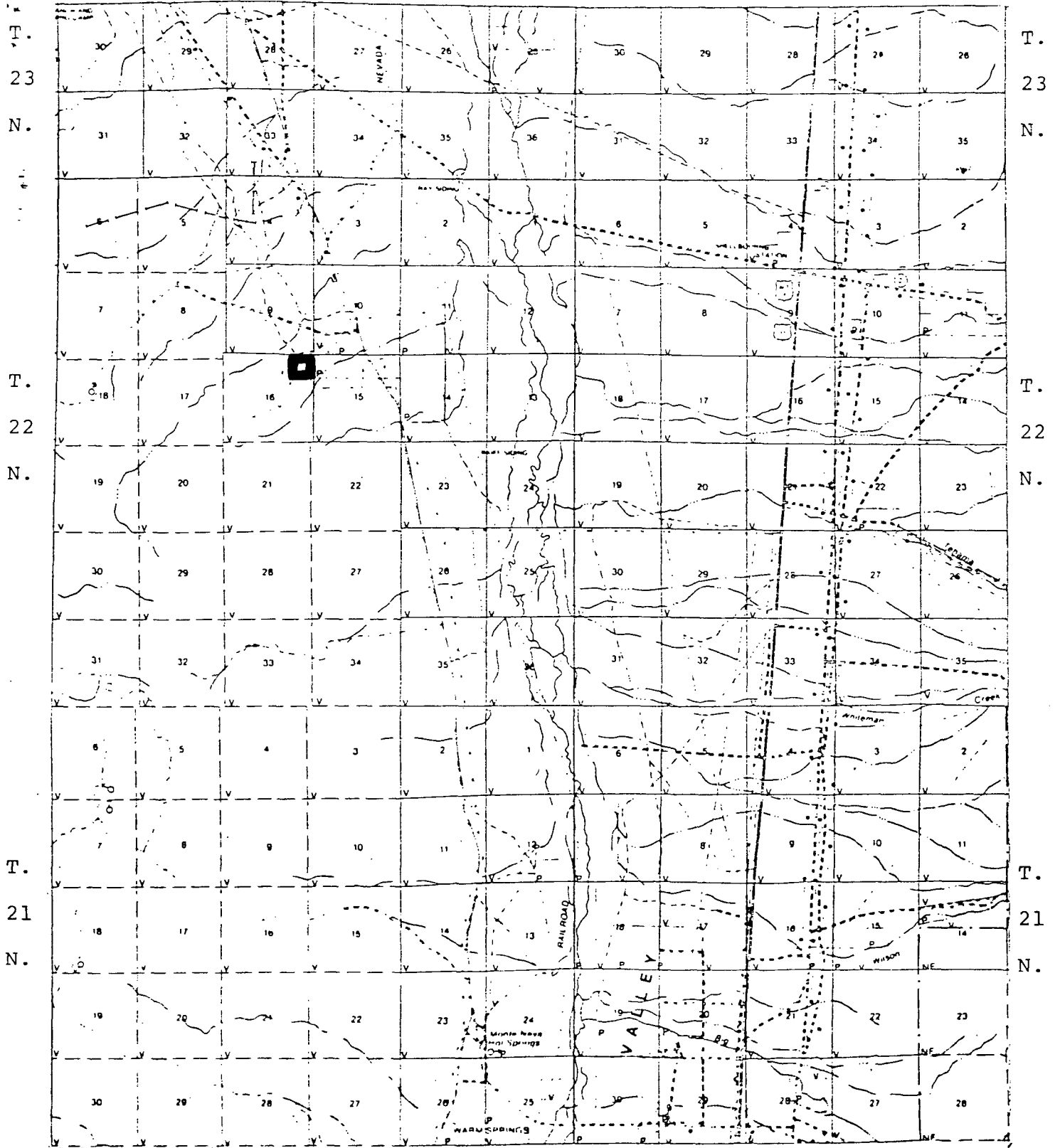
SCHELLBOURNE ANOMALY
Monte Neva Prospect
White Pine Co., Nevada

WATER SUPPLIES AND ROAD BUILDING MATERIALS

1. Location of supply sources to be selected and approved.

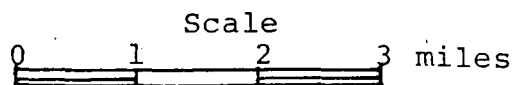
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R. 63 E.

R. 64 E.



POSSIBLE WATER SUPPLY
(Private)

SHELLBOURNE AREA
Steptoe Valley
White Pine Co., Nevada

SUPPORT FACILITIES

1. Storage yard at Schellbourne Station.
2. All other support facilities at McGill and Ely, Nevada.

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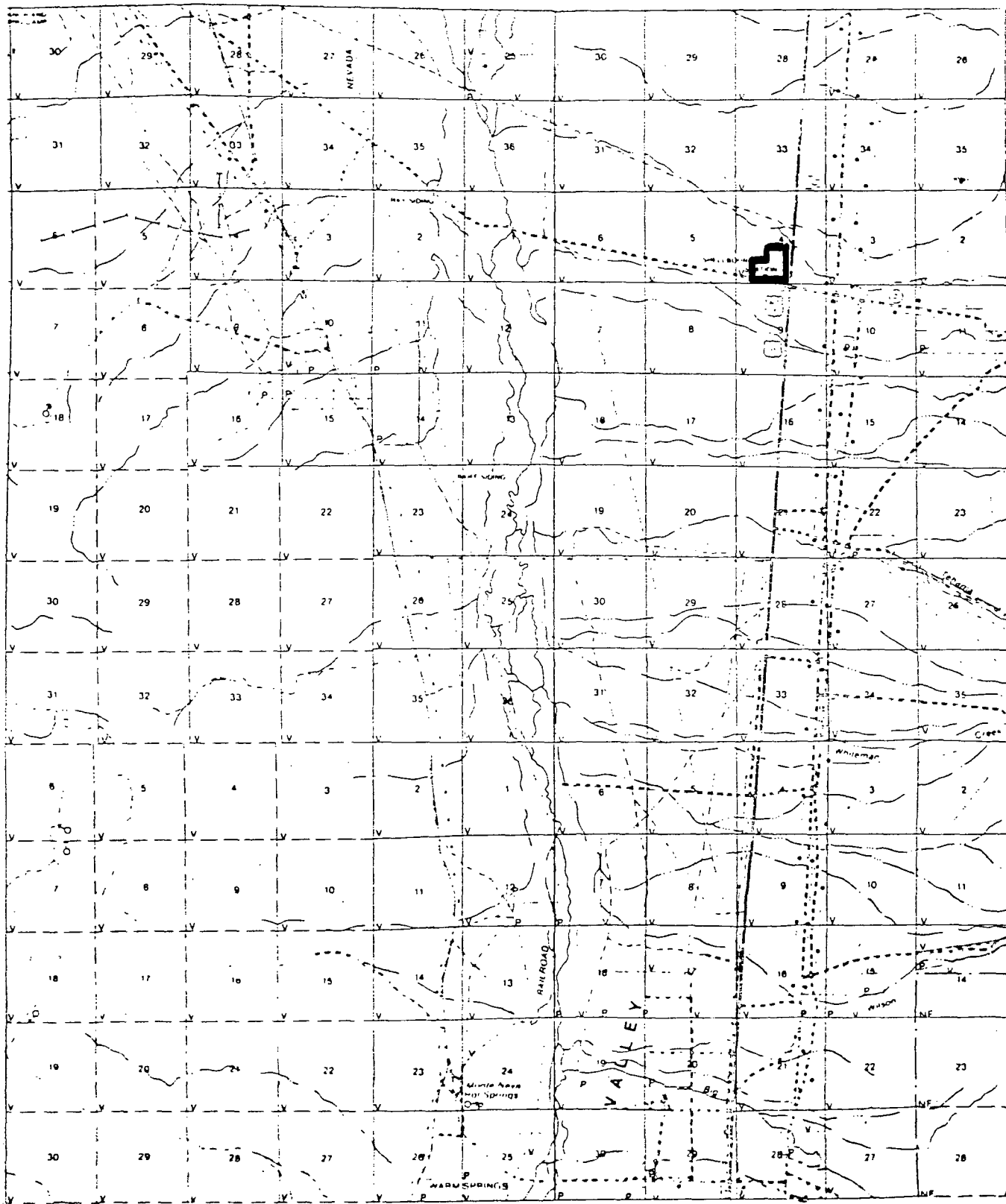
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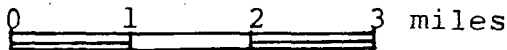
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R. 63 E.

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Scale



STORAGE YARD

SHELLBOURNE AREA

Steptoe Valley

White Pine Co., Nevada

TOPOGRAPHIC FEATURES, DRAINAGE PATTERNS

R. 63 E.

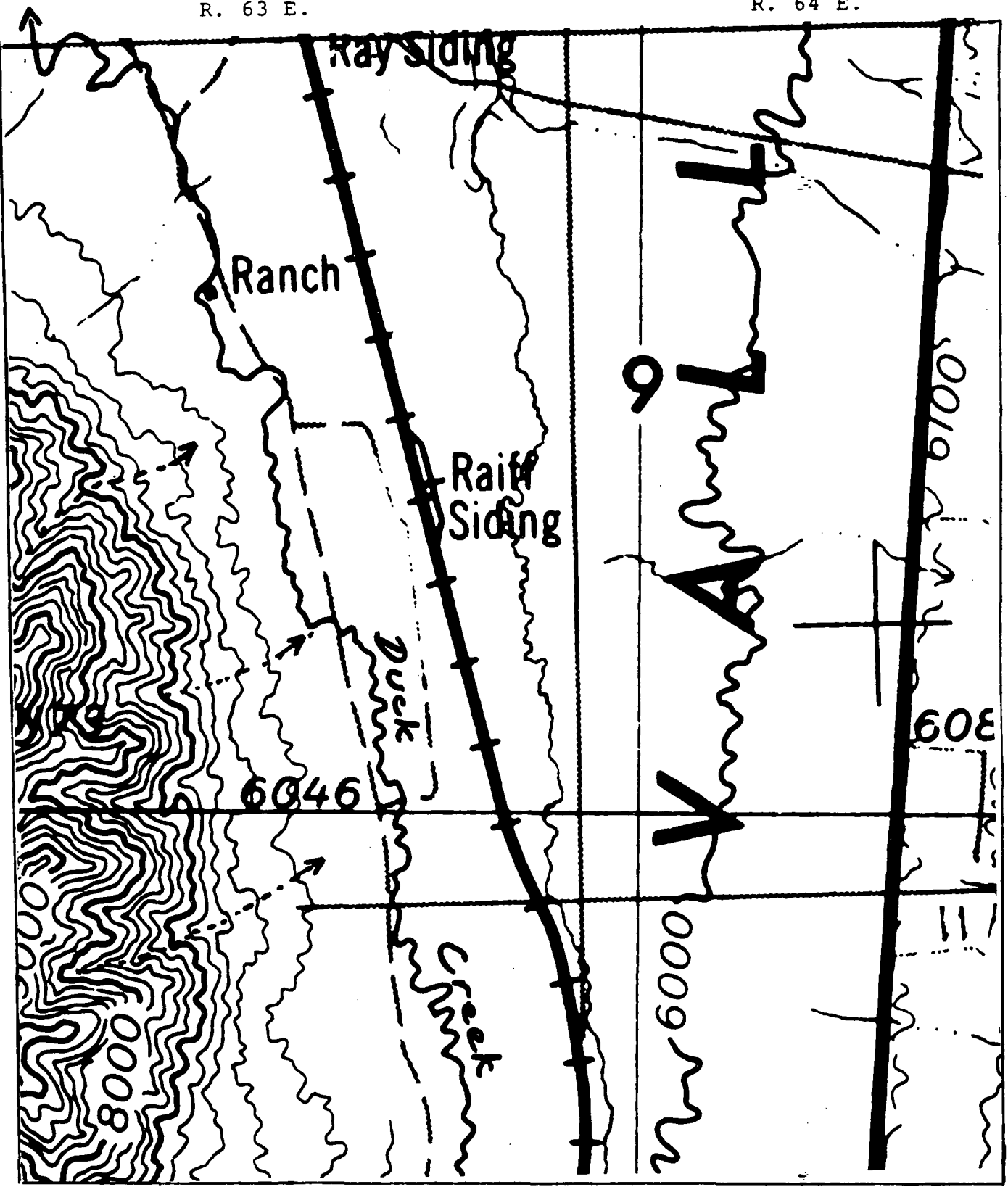
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R. 63 E.

R. 64 E.

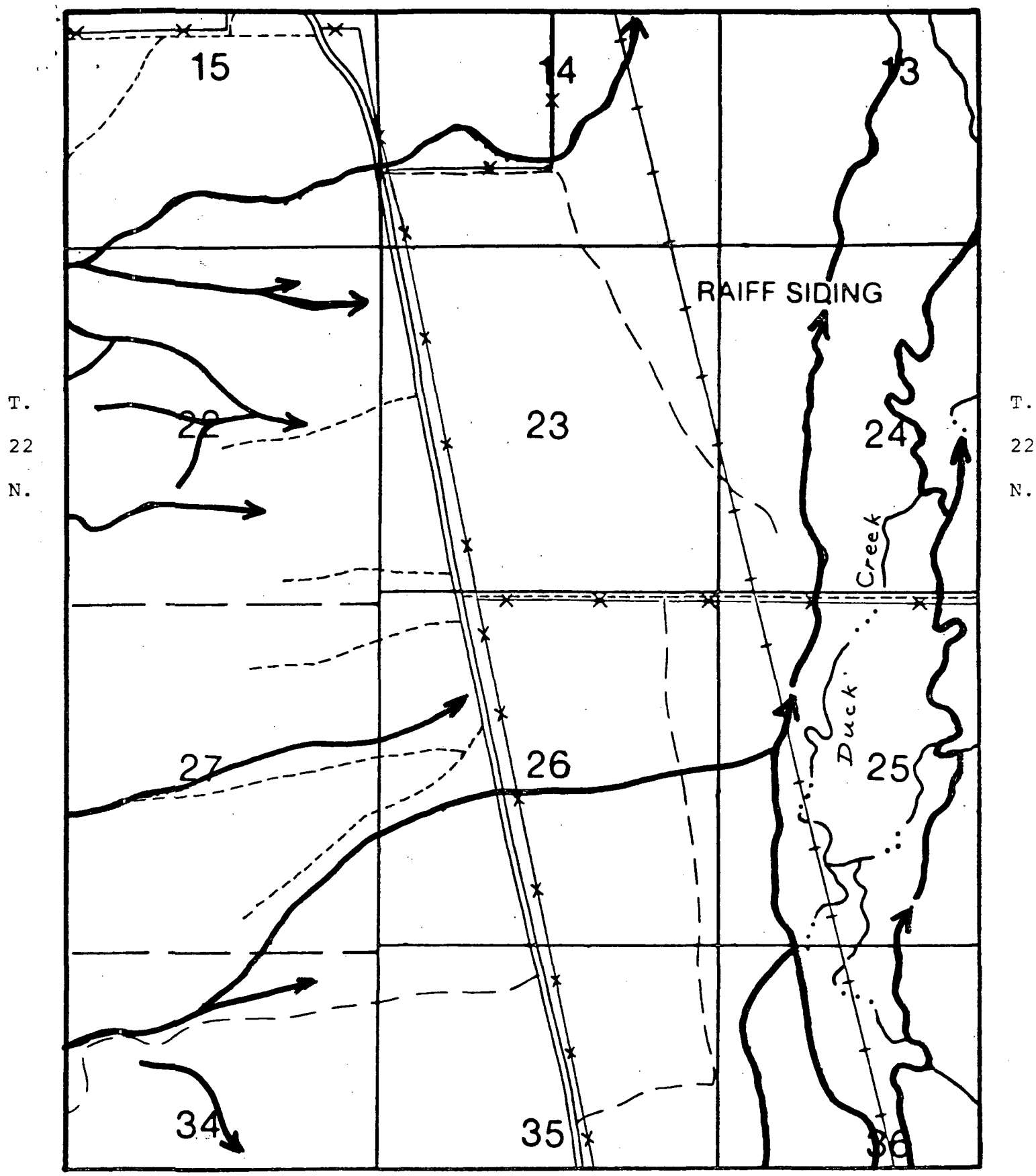
Scale
1" = 1 mi.

TOPOGRAPHIC FEATURES AND
DRAINAGE PATTERNS

SHELLBOURNE AREA
Steptoe Valley
White Pine Co., Nevada

Note: map enlarged
from 1:250,000 topo.

R. 63 E.



R. 63 E.

Scale: 1" = 2,000'

DRAINAGE PATTERNS
(from air photos)

SCHELLBOURNE ANOMALY
Monte Neva Prospect
White Pine Co., Nevada

CRITICAL ENVIRONMENTAL AND CULTURAL RESOURCES

1. No critical environmental resources known in prospect area (BLM EAR N-8673).
2. Cultural resources, if any, will be outlined in addendum.

CRITICAL WILDLIFE AREAS

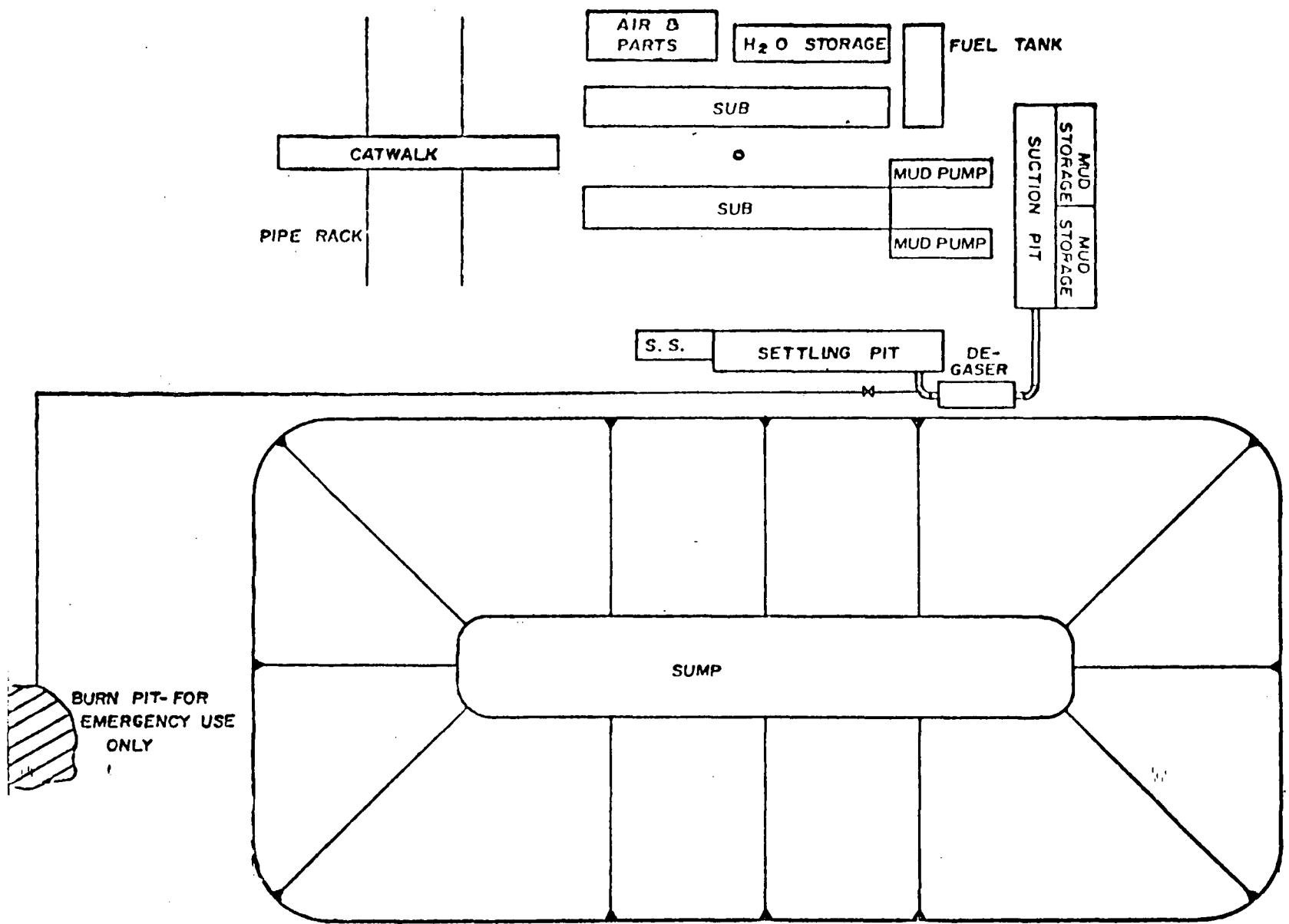
1. Sage Grouse strutting area (BLM EAR N-8673).
2. No other critical areas known in prospect.

POTENTIAL SURFACE DISTURBANCE AREAS

1. None known at this time other than drill sites and access roads.

B. SITE OF OPERATIONS LAYOUT

04 11 4



TYPICAL RIG LAYOUT

SCALE: Approx. 1" = 30'

C. SPECIAL MAPS

1. Detailed plans will be submitted as an addendum once final drill site is selected.

III. ENVIRONMENTAL PROTECTION MEASURES

III. ENVIRONMENTAL PROTECTION MEASURES

A. The following measures are proposed for the prevention or control.

1. Fires

Every effort will be made to minimize the possibility of fire. Fire fighting equipment including fire extinguishers and picks and shovels will be on hand any time crews are in the area. Water trucks and/or water pumps will be on site during drilling operations. Firebreaks, if they exist, will be maintained. Any road improvement or construction will be done according to clearance specifications of the surface management agency.

2. Soil erosion

Access to drill sites will be on existing roads and trails wherever possible. Culverts will be installed wherever necessary to maintain the natural flow of rainfall runoff. Any necessary road construction will be engineered to minimize disturbance to natural terrain, vegetation, etc.

The drill site will be stripped of vegetation but will be engineered to balance cuts and fills. Natural drainage will be maintained with culverts if necessary. Drilling waste ponds will be lined with clay.

All road and site construction will be performed in accordance with recognized engineering requirements as specified by the surface management agency.

3. Water pollution

All necessary precautions will be taken to prevent contamination of streams or bodies of water. Drilling mud will be contained and disposed of so as not to contaminate any natural surface waters. Only approved drilling fluids will be used.

Recognized and approved drilling techniques will be used to prevent contamination of any natural groundwaters encountered during drilling operations.

4. Fish and wildlife

All requirements of the area regulatory agencies will be complied with to avoid dislocation of wildlife and/or contamination of waters.

Bureau of Land Management EAR N-8673, Cherry Creek Planning Area, identified known sage grouse strutting grounds within the lease area (see map, section II-B-6). Activities would be kept to required minimum in critical areas from April through July.

5. Air and noise pollution
All equipment operations will comply with Air Pollution Control Standards. If necessary, water will be used for dust control during construction and drilling operations.

Noise levels will be maintained within guidelines specified by Federal Occupational Safety Health Act standards.

6. Public health and safety
Every effort will be made to protect persons from health and/or safety hazards. Measures to be taken include supervisory personnel on site during operations, securing of all unattended equipment of a hazardous nature, and posting of warning signs where necessary.

Drilling operations will comply with all requirements for casing and blowout prevention.

B. 30 CFR 270.34 (g), (i), (g)

1. Waste disposal
The area will be kept clean and all solid waste will be removed to an approved dump. Drilling wastes will be contained in ponds built to approved requirements. Sanitary facilities will be provided on site in accordance with all regulations.

2. Potential environmental impact

Any pertinent information that will help delineate potential environmental impacts will be submitted as addenda to this Plan. Such information may be gathered from studies both in progress and planned.

3. Monitoring methods

Detailed descriptions of monitoring devices and methods will be submitted with the Application for Permit to Drill as a part of the Drilling Program. Fluids and solids produced during drilling and drilling mediums will be monitored according to recognized and approved drilling practices. Other mediums such as air and noise will be monitored if deemed necessary.

C. Clarifying information

Any information and/or data which will clarify or add to this proposed Plan will be submitted as it is generated.

D. Crew size and facilities

Crew size may vary from about five to twenty persons on site at any given time depending on the type of operation in progress. Crew facilities at the drill site will be minimal: generally only one or two small office trailers and sanitary facilities will be provided on site. Schellbourne Station on Highway 93 and the town of McGill have limited facilities. Most crew members will probably be housed in Ely.

IV. ENVIRONMENTAL CONCERNS

IV. ENVIRONMENTAL CONCERNS

A. Regional and local geology

The area of interest is in the Basin and Range province in eastern Nevada. Steptoe Valley trends north-south and is flanked by the Egan Range on the west and the Schell Creek Range on the east. The prospect lies on the west side of Steptoe Valley against the east flank of the Egan Range. The reader is referred to the following publications for maps and discussions of the local geology:

Hose, R. K. and Blake, M. C. Jr., 1976, Geology and mineral resources of White Pine County, Nevada: Nevada Bureau of Mines, Bulletin 85.

Fritz, William H., 1968 Geologic map and sections of the southern Cherry Creek and northern Egan ranges, White Pine County, Nevada: Nevada Bureau of Mines, Map No. 35.

B. Potential geological engineering hazards

Most of the prospect area is on the flat of Steptoe Valley and geologic hazards essentially do not exist. However, the western part of the prospect extends up the alluvial fans and into the rugged Egan Range. Some of the proposed locations are located on the alluvial fans but no severe problems are anticipated. The potential for landslides will be examined if necessary.

The area is not known to be anymore active seismically than the rest of the eastern Nevada region. Geologic studies and seismic lines run by Hunt Energy Corp. indicate that no range-front fault exists on the east side of the Egan Range. No recent faults are known in the prospect area.

C. Regional and local hydrology

Steptoe Valley is drained by the northward flowing Duck Creek which, except during flooding, disappears into the valley alluvium 20 to 30 km north of the prospect. It is assumed that groundwater movement is also northward. Recharge is from snowmelt in the Egan and Schell Creek Ranges. Springs issue from the base of alluvial fans at several places along the west side of the valley. Monte Neva Hot Springs is about 8 km south of the prospect.

No detailed hydrologic studies have been conducted as yet by Hunt Energy Corporation.

D. Regional and local meteorology

No meteorological data have been gathered by Hunt Energy Corporation. No impact anticipated from this operation.

E. Soil studies

Refer to BLM EAR N-8673 for discussion of soils. Negligible impact from this operation. Special studies will be conducted if deemed necessary on a site-specific basis.

F. Biota

Refer to BLM EAR N-8673 for complete discussion. No threatened or endangered species have been identified in the area of operations. A sage grouse strutting area has been identified in T. 22 N, R. 63 E., section 15, and a special stipulation restricting operations during certain months has been added to the lease. Appropriate restrictions by the surface management agency will be followed.

It is anticipated that this operation will have little or no impact on the sparse wildlife in this area.

G. Recreational areas

There are no recreational areas in the vicinity.

H. Cultural resources

As specified in each geothermal lease, an approved competent archaeologist will examine all proposed well locations for historic and cultural resources. The final report, providing an inventory and evaluation of archaeological and cultural values of the area, will be submitted as an addendum to this Plan. All recommendations will be followed in regards to the construction of drill sties and roads.

I. Land uses and local economy

Refer to BLM EAR N-8673 for discussion. Very little of the prospect area is currently in use. The primary use is grazing and this is generally restricted.

This operation would have no impact on present uses. The logistics and high costs of drilling should have a positive impact on the local economy.

Should a geothermal resource be discovered, studies could be conducted to evaluate developmental impact on land use and local economy.

J. Other concerns

No major concerns have been identified at this time.

Hunt intends to drill as many wells as necessary to confirm the existence of an economic geothermal resource. If a resource is not found by drilling about 3-6 wells, any existing wells will be plugged and abandoned and the area restored. Should a discovery be made, a few additional wells will be drilled to confirm and delineate the resource. Long term tests will be conducted and a Plan of Development will be submitted. Most environmental concerns need be considered only if a discovery is made and every effort will be made to identify and mitigate any problems at that time.

V. EMERGENCY CONTINGENCY PLAN

A. Accidental Spills

1. Introduction

a. Potential locations for accidental spills are:

Drilling Rigs
Water ponds, or mud pits
Pipelines at well or drillsites

b. Drilling Fluids (Muds):

These are a mixture of water, chemicals, and solid particles used in drilling operations. Mud is pumped down the drill pipe, through the bit and carries drilled cuttings to the surface. The cuttings are screened out and the mud recirculated. A small amount of mud is spilled into the sump, along with water used to wash down the rig floor, etc. The sump is designed to be large enough to contain all cuttings, mud and water that will accumulate during the drilling of the well. The sump is an earthen pit whose bottom is lined with Bentonite to prevent any percolation. The sump is positioned in such a manner as to prevent flooding from runoff water from a heavy rainstorm.

Although the danger is slight, a spill could occur by the sump overflowing, the wall breaking or through fluid seepage. Some mud is spilled onto the area immediately round the well bore during normal drilling operations, but these volumes are small. A spill could occur if circulation were lost at a very shallow depth and mud channeled back to the surface.

c. Lubrication or fuel oils and petroleum products- a discharge of this type would probably be very small and from equipment used in the field.

Potential locations for accidental spills are:

Drilling equipment and machinery at and around drilling locations.

Other miscellaneous equipment and machinery at well sites and on roads.

d. Construction/maintenance debris-Minor consideration, usually able to be cleaned up on the job. Potential locations are the same as for lubricating or fuel oils, (C), above

2. Possible water quality affects

a. Condensate or drilling muds

Contaminate water possibly making it unsuitable for human or wildlife consumption

Possible detrimental affect to flora of area

Increase turbidity of water by particulates in fluid or by soil erosion

- b. Petroleum products
 - Contaminate water
 - Cover wildlife and plant life

- 3. Plan for clean-up and abatement
 - In the event of discharges of condensate, drilling muds, petroleum products or construction debris, the overall contingency plan is as follows:

The person responsible for the operation will make an immediate investigation, then call the Field Drilling Foreman and advise him of spill. The Field Drilling Foreman will in turn call out heavy equipment, regulate field operations, or do other work as applicable for control and clean-up of spill. If spill is small (i.e., less than 250 gallons) and easily containable without endangering watershed, Field Drilling Foreman will direct and supervise clean-up and return to normal operations.

If spill is larger than 250 gallons, or is not easily contained, or endangers or has entered watershed, Field Drilling Forman will proceed to take necessary action to curtail, contain and clean-up spill, and notify personnel as follows:

Call out heavy equipment, regulate field production, etc.

Call for contract vacuum trucks or water pump trucks

Brief his immediate supervisor on the situation and course of action under way

Specific Procedures:

For Drill Water:

Contain spillage with dikes if possible haul to disposal sump or well by vacuum or water trucks

For Drilling Mud:

Repair sump or contain with dikes

Haul liquid to another sump or available tank or approved disposal site

Dry and solidify other material, compact and bury solids where possible

For Petroleum Products:

Contain spill with available manpower

Use absorbents and dispose of same in County approved area

For Construction Debris:

Pick up or otherwise contain and remove to disposal area

Have source of spill repaired at earliest practical time

Continue working crews, equipment and vacuum trucks on clean-up until all concerned agencies are satisfied

Notify the following agencies or regulatory bodies as soon as practical and work closely with them in all phases of operations

United States Geological Survey District
Geothermal Supervisor

United States Geological Survey
Conservation Division-Western Region Area
Geothermal Supervisor
2465 E. Bayshore Rd.
Suite 400-Second Floor
Palo Alto, California 94303 (415) 323-8111

Bureau of Land Management
Department of Interior
District Manager

United States Forest Service-District Ranger
(If on Forest lands or if Forest lands included)

U.S. Fish & Wildlife Service

Any livestock owners or landowners, if spill affects stock or property

4. Confirm telephone notification to agencies and regulatory bodies

Telephone notification shall be confirmed by the District Drilling Superintendent in writing within two (2) weeks of telephone notification, containing:

- Reason for discharge or spillage
- Duration and volume of discharge
- Steps taken to correct problem
- Steps taken to prevent re-occurrence of problem

B. Hydrogen sulphide and other toxic gases

1. Introduction

Hunt Energy Corporation (HEC) recognizes that hydrogen sulfide gas (H_2S) could be encountered during the drilling of geothermal wells. Although dangerous amounts of this toxic gas have not been associated with other wells drilled in this area, HEC will be prepared by their Contingency Plan to protect all personnel in the event dangerous amounts of hydrogen sulfide are encountered. The Plan will provide safety programs for personnel, safety drills, and up-to-date instructions on rescue techniques. The overall Plan will be directed by consultants who have specialized in these emergency procedures. Each person participating in the drilling of the wells will know the location of all safety equipment and will be responsible for its maintenance. Accordingly, the effectiveness of this Plan is dependent upon the cooperation and efforts of each person who participates in drilling the well.

2. General Information

All personnel involved with the mechanics of drilling, evaluating and testing the wells will be thoroughly trained in the recognition of warning signals for H₂S, the operation of breathing equipment and their individual and group responsibilities in case of emergency rescue and/or first aid.

Devices for the detection and measurement of H₂S concentration and audio or visual and audio alarms will be provided depending on the drilling phase. The drillsite shall have two briefing areas so situated that one would be upwind from the well at any given time. Before drilling has begun, all personnel will be advised of an escape route other than the drillsite access road, and will be instructed as to evacuation procedures. If danger to life becomes extreme, all non-essential personnel will be evacuated.

Should hazardous amounts of H₂S be encountered, all personnel when arriving on the drillsite will be intercepted and the HEC Supervisor or the Drilling Contractor's Supervisor will assign breathing apparatus and provide for instruction and orientation briefing. Each person must verify that he has read and understands the "H₂S Contingency Plan".

List of phone numbers of agencies and personnel to be contacted in case of an emergency (see section of this Plan) will be posted in the Drilling Contractor Supervisor's trailer, the drilling crew's dog house and the briefing area.

The following Tables A and B list the specific effects of H₂S and the characteristics of several toxic gases.

TABLE A

TOXIC EFFECTS OF HYDROGEN SULFIDE

<u>%</u>	<u>0 to 2 minutes</u>	<u>15 to 30 minutes</u>	<u>30 minutes to 1 hour</u>
0.001	Detected by rotten-egg smell.	Detectable.	Detectable. Maximum allowable concentration for 8 hour exposure without protective mask.
0.01	Coughing, slight irritation of eyes. Loss of sense of smell.	Disturbed respiration. Pain in eyes. Sleepiness.	Throat and eye irritation.
0.025	Loss of sense of smell.	Throat and eye irritation.	Throat and eye irritation.
0.035	Irritation of eyes. Loss of sense of smell.	Irritation of eyes and respiratory tract.	Painful secretion of tears, weariness, may cause death in longer exposure
0.045	Irritation of eyes. Loss of sense of smell.	Difficult respiration. Irritation of eyes.	Increased irritation of eyes and nasal tract. Dull headache. Serious respiratory disturbances.
0.09	Coughing, unconsciousness. Serious respiratory disturbances.	Respiratory disturbances. Eye irritation. Unconsciousness.	Serious eye irritation. Slow pulse, rapid, shallow breathing. Respiratory paralysis, convulsions, asphyxis and death.
0.01	Unconsciousness.	Death.	Death.

TABLE B

CHARACTERISTICS OF VARIOUS TOXIC GASES

<u>Common Name</u>	<u>Chemical Formula</u>	<u>Specific Gravity (SG) SG Air = 1</u>	<u>Threshold¹ Limited</u>	<u>Hazardous² Limited</u>	<u>Lethal³ Concentration</u>
Hydrogen Cyanide	HCN	0.94	10ppm	150 ppm/hr.	300 ppm
Hydrogen Sulfide	H ₂ S	1.18	10 ppm ⁴ 20 ppm ⁵	250 ppm/hr.	600 ppm
Sulfur Dioxide	SO ₂	2.21	5 ppm	_____	1,000 ppm
Chlorine	Cl ₂	2.45	1 ppm	4 ppm/hr.	1,000 ppm
Carbon Monoxide	CO	0.97	50 ppm	400 ppm/hr.	1,000 ppm
Carbon Dioxide	CO ₂	1.52	5,000 ppm	5%	10%
Methane	CH ₄	0.55	90,000 ppm (9%)	Combustible above 5% in air	

¹Threshold Limit- concentration at which it is believed that all workers may be repeatedly exposed day after day without adverse effects.

²Hazardous Limit- concentration that may cause death.

³Lethal Concentration-concentration that will cause death with short term exposure.

⁴Threshold Limit= 10ppm-
1972 ACGIH (American Conference of Governmental Industrial Hygienists.)

⁵Threshold Limit= 20ppm-
1966 ANSI acceptable ceiling concentration for eight-hour exposure (based on 40-hour week) is 20 ppm. OSHA Rules and Regulations (Federal Register, Volume 37, No. 202, Part II, dated October 18, 1972).

3. Safety, Training, Procedures and Equipment

A. Drills with breathing equipment may be conducted for each crew and for each person associated with the operation at the drillsite. These persons include, but are not limited to:

1. Rig Crew
2. Drilling contractor's supervisor
3. Mud logger(s)
4. Mud engineer
5. HEC drilling supervisor
6. HEC geologist
7. Service company personnel

B. Drill Procedure

1. All personnel will be informed that a drill is to be staged.
2. The mud logger will activate an alarm or stimulate a potentially dangerous show of H₂S gas.
3. The rig crew, mud logger, drilling supervisors and mud engineer will put on breathing equipment. Other personnel will report to the proper briefing station.
4. The driller will pull off bottom, shutdown and mud pumps and check for flow from the well.
5. The driller will proceed as if the well were flowing and simulate proper well shut-in and well killing procedures.
6. Mud logger will continue to monitor his equipment.
7. Mud engineer will check mud for weight, viscosity and run a "Hach Test" to determine the H₂S concentration.
8. Drilling supervisors will observe the performance of all personnel involved in the drilling for evaluation or any corrections.

C. Safety Equipment

The presence of H₂S gas will be detected by monitoring devices while drilling below the surface casing shoe. When drilling with mud, a monitor will be used to detect and measure H₂S concentrations of mud going in and circulating out of the hole. This monitor will have an audio alarm in the mud logger's trailer, which will be occupied 24-hours a day. During air drilling, monitoring devices with both audio and visual alarms will be operated on the rig floor and at the base of the rig. Measurements of H₂S concentrations will also be taken of the flow exiting the bloopie line and potentially dangerous concentrations of gas there will activate the alarm in the logging trailer. All alarms will have signals such that they cannot be confused with the monitoring alerts of any other drilling operation. Approved hand-held H₂S detectors will be available for spot checking.

OSHA-approved self contained breathing apparatus for a crew of 8 and oxygen resuscitators will be readily available for emergency use while drilling below the surface casing shoe. A first aid kit sized for 8 will be available.

Blowout prevention equipment designed to shut-in the well in any emergency will be installed, maintained and regularly tested.

A de-gasser will be provided if needed. The gas discharged from this apparatus will be vented to a burn pit located downwind of the rig.

Adequate air circulation in critical areas will be provided through the use of large explosion proof electric fans if needed. Wind socks or streamers will be positioned so as to be readily visible from the rig floor, day or night.

Warning signs will be available for posting on the access road to the location. "No smoking" signs will also be posted.

4. Procedure of Operation After H₂S Detection

CONDITION I = POTENTIAL DANGER

Alarm in mud logger's trailer would indicate any predetermined concentration of H₂S less than 10 ppm. Though this alert is in effect, there is no danger to personnel as long as concentration remains below 10 ppm.

General Action

1. Be alert for any increase in H₂S concentration.
2. Check all safety equipment, monitors and alarms for proper functioning.
3. Conduct drills and familiarization programs.

CONDITION II = MODERATE DANGER

Horn or siren is activated at 10 ppm.

General Action

1. The following personnel will immediately put on their breathing equipment:
 - a. All personnel on rig floor.
 - b. All personnel in area of mud pits.
2. Notify drilling supervisor.
3. Follow instructions of drilling supervisor.
4. Immediately begin to ascertain the source of the H₂S and take the required steps to suppress the H₂S. Drilling will not proceed until the source is determined, the well is circulated and the gas is controlled.
5. The supervisor will make sure all non-essential personnel are out of the potential danger area.
6. Check all gas monitoring devices and increase gas monitoring activities with the portable hand operated H₂S detector units.
7. The HEC Drilling Supervisor will assess the situation, outline a control program and assign duties to each person or group as required to bring the situation under control.
8. Signs will be posted on the access road to location indicating:

and/or "DANGER - POISONOUS GAS - H₂S"
 "DANGER - POISON GAS"
9. Access to drillsite to be limited to authorized personnel only.
10. Notify: (to be provided before operation begins)

Business:

Residence - night:

Weekends:

CONDITION III = EXTREME DANGER TO LIFE

Alarm - horn or siren; blinking lights.

Characterized by:

Poisonous gas above threshold levels (as defined under Toxicity of Various Gases and well-controlled problems.

General Action

1. All personnel will put on their protective breathing equipment.
2. All personnel not required for well control will proceed to upwind briefing area for evacuation instructions.
3. Follow instructions of drilling supervisor.
4. The HEC supervisor will assess the situation, outline a control program and assign duties to each person or group as required to bring the situation under control.
5. Notify: (to be provided before operation begins)

The above person will:

- a. Brief his immediate supervisor of the situation:

(to be provided before operation begins)

- b. Notify Bureau of Land Management:

Dan Jaquet
Bureau of Land Management
1050 East William Street
Carson City, Nevada 89701
Business: (415) 882-1631

- c. Notify United States Geological Survey:

Bernie Muroz
Reno District Geothermal Supervisor
63 Keystone Avenue, Suite 102
Reno, Nevada 89503
Business: (702) 784-5676

6. Extreme Emergency

- a. If there is no hope of containing well under prevailing conditions, and there is a definite threat to human life and property:
1. Initiate Emergency Evacuation Plan (to be submitted).
 2. Refer to and carry out Contingency Plan for Uncontrolled Blowout (to be submitted).
 3. Time and circumstances permitting, the District Office should be notified of the situation.
 4. As a last resort, the well is to be ignited (Poison Gas).
- b. Instruction For Igniting The Well
1. Two people are required for the actual igniting operation. Both men will wear self-contained breathing units and will have 200-foot retrieval ropes tied around their waists. One man is responsible for checking the atmosphere for explosive gass with Explosimeter. The other is responsible for lighting the well. Keep personnel not assigned special duties within the "Safe Briefing Area." Those in the "Safe Briefing Area" will be alert to the needs of the two men assigned to ignite the well. Should either of these men be overcome by fumes, they will immediately pull him to safety by the retrieval ropes.
 2. The primary method for igniting the well is a 25mm meterortype flare gun. It has a range of approximately 500 feet. If this method fails or well conditions are such that a safer or better method is apparent, then the alternate should be used.

-CONTINUED-

3. If the well is ignited, the burning H_2S will be converted to sulfure dioxide, which is also poisonous; therefore, DO NOT ASSUME THAT THE AREA IS SAFE AFTER THE GAS IS IGNITED. CONTINUE TO OBSERVE EMERGENCY PROCEDURES AND FOLLOW THE INSTRUCTIONS OF SUPERVISORS.

7. Initiate program to kill, plug and abandon well.

Personnel Rescue

While drilling operations have made extensive preparations for personnel safety, all personnel should be aware of First-Aid procedures in the event someone becomes careless. First-Aid for H₂S victims is based primarily on:

1. Move the victim to fresh air immediately.
 - a. WARNING - DO NOT jeopardize your own safety. Always wear a self-contained breathing apparatus while attempting rescue.
 - b. If victim is unconscious and not breathing, move the victim at once to the safe-breathing area and apply mouth-to-mouth artificial respiration until a resuscitator is available. Use the resuscitator until normal breathing is restored. Symptoms may pass rapidly; however, keep the victim warm and take him to a hospital and place under the care of a physician.

5. Emergency Action Procedures and Notification Lists

- A. If any injuries have occurred, arrangements will be made to care for the injured party (ies).

Hospitals

(to be provided before operation begins)

Ambulance Service

Ground: (to be provided before operation begins)

Air: (to be provided before operation begins)

First aid supplies will be available at the site.
At least one person on each crew will be trained in first aid.

- B. If there is a threat to local residents, the Sheriff and/or Police Department will be notified as soon as possible.

White Pine County Sheriff Department

(to be provided before operation begins)

Highway Patrol Emergency
Zenith 1200

- C. The HEC Drilling Supervisor will:

1. Brief his immediate supervisor on the situation and course of action underway.
2. The above, in turn, will contact the following regulatory bodies as soon as practicable:

Area Geothermal Supervisor
U.S. Geological Survey
Conservation Division
345 Middlefield Road MS-92
Menlo Park, California 94025
Business: (415) 323-8111 Ext. 2848

- D. All prescribed safety practices and procedures will be followed. All members of the drilling crew will perform duties assigned following specified safety practices.
- E. Any spills that may have occurred will be attempted to be contained.
- F. A pump truck will be in the vicinity, and earth moving equipment may be obtained from the following contractors if necessary:

(to be provided before operation begins)

C. Contingency Plan for uncontrolled blowout

When the means to shut in or control the flow from a well is lost, the Drilling Supervisor is to:

1. Initiate appropriate control procedures,
(Procedures will vary greatly depending on the magnitude of the problem)
 - a. If any injuries have occurred, dispatch all injured personnel to the nearest medical facility by the fastest transportation available
 - b. If there is a threat to any local residents the sheriff should be notified as soon as possible
2. Secure and maintain control of access roads to area to eliminate entry of unauthorized personnel
3. Initiate any further or supplemental steps which may be necessary or advisable based on consultation with the District Geothermal Supervisor
4. Put into motion plans for containment or confinement of the flow
5. Notify "Wild Well Control" specialists and apprise them of the problem:

Red Adair Company, Inc.
Houston, Texas
(713) 526-4717
(713) 562-1602

6. Construct sumps or dikes to contain fluid flow if necessary
7. Attempt to control well with rig personnel
8. Attempt to remove any damaged wellhead facility or blowout prevention equipment and install operable equipment
9. If contractor's personnel is unable to contain flow, notify "Wild Well Control" specialists
10. Maintain an inspection of the drillsite for any erosion that could undermine the rig structure
11. After the flow has been contained, prepare to return the area as nearly as possible to its original contour and reseed with approved vegetation

D. Injuries

In the event of injuries that may occur, standard procedures will be followed, with specific and immediate attention given to proper air and/or transportation to a medical facility as required. Refer to Emergency Phone Numbers, Emergency Personnel and Services. Copies of the accident reports will be submitted to the following:

United States Geological Survey
Area Geothermal Supervisor
Conservation Division
345 Middlefield Road
Menlo Park, California 94025

United States Geological Survey
District Geothermal Supervisor

E. Rescue

While drilling operations have made extensive preparations for personnel safety, all personnel should be aware of first aid procedures in the event someone becomes careless. First aid for H₂S victims is based primarily on:

2 Move victim to fresh air immediately.

Warning-Do not jeopardize your own safety.

Always wear a self-contained breathing apparatus while attempting to rescue

If victim is unconscious and not breathing, move the victim at once to the safe breathing area and apply mouth-to-mouth artificial respiration until a resuscitator is available. Use the resuscitator until normal breathing is restored. Symptoms may pass rapidly, however, keep the victim warm and take him to a hospital and place under the care of a physician.

F. Emergency personnel and services

(The following list of personnel & services shall be submitted as an addendum to the Plan of Operations)

<u>SERVICE OR INDIVIDUAL</u>	<u>LOCATION</u>	<u>PHONE NUMBERS</u>
Doctors (local)		
Hospitals (local)		
Ambulance Service (ground)		
Ambulance Service (air)		
U.S.G.S. District Supervisor		
U.S.G.S. Area Geothermal Supervisor		
BLM Representative		
U.S. Forest Service District Ranger		

Sheriff Department
Highway Patrol
Any others needed to be notified