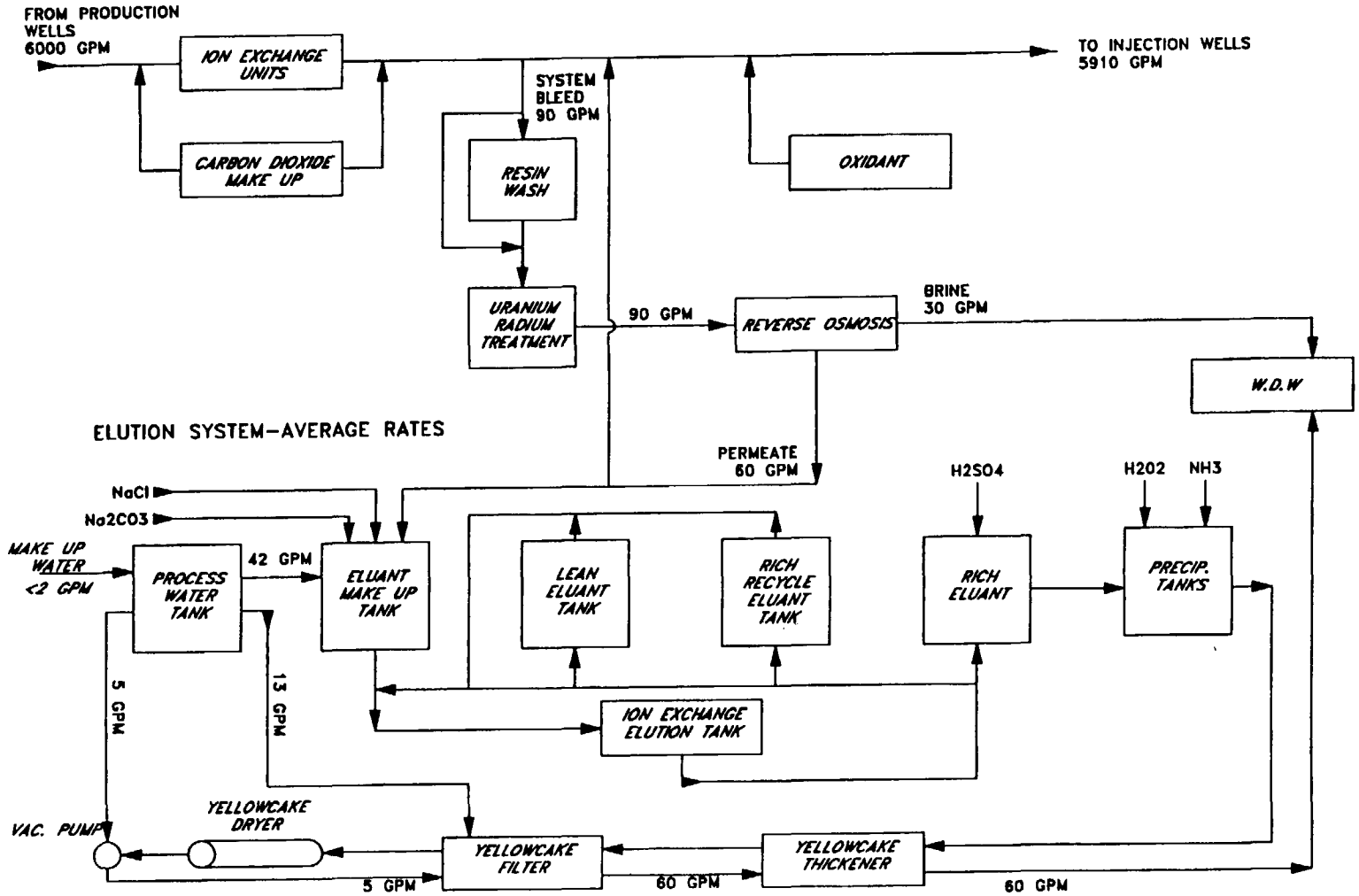
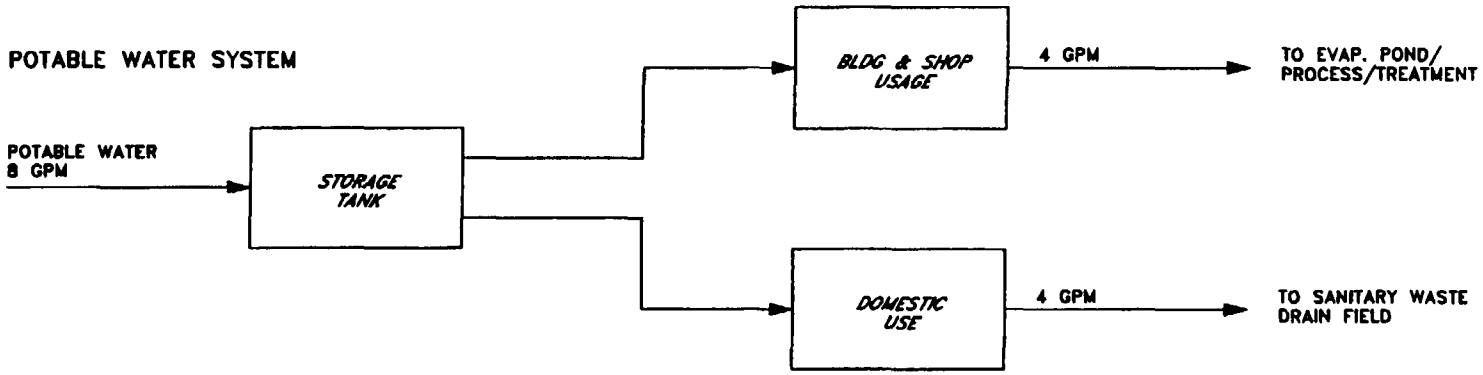
Figure 4-3
RECOVERY PLANT FLOW RATES
Main Flow Through Ion Exchange Systems @
6,000 GPM
Wellfield Purge @ 90 GPM (1.5% Bleed)



Note: The flow shown above represents an example capacity for the facility, and does not represent any design or regulatory limit imposed on the facility.

Figure 4-3 (cont'd)



Note: The flow shown above represents an example capacity for the facility, and does not represent any design or regulatory limit imposed on the facility.

SCALE: 1" = 1000.0'

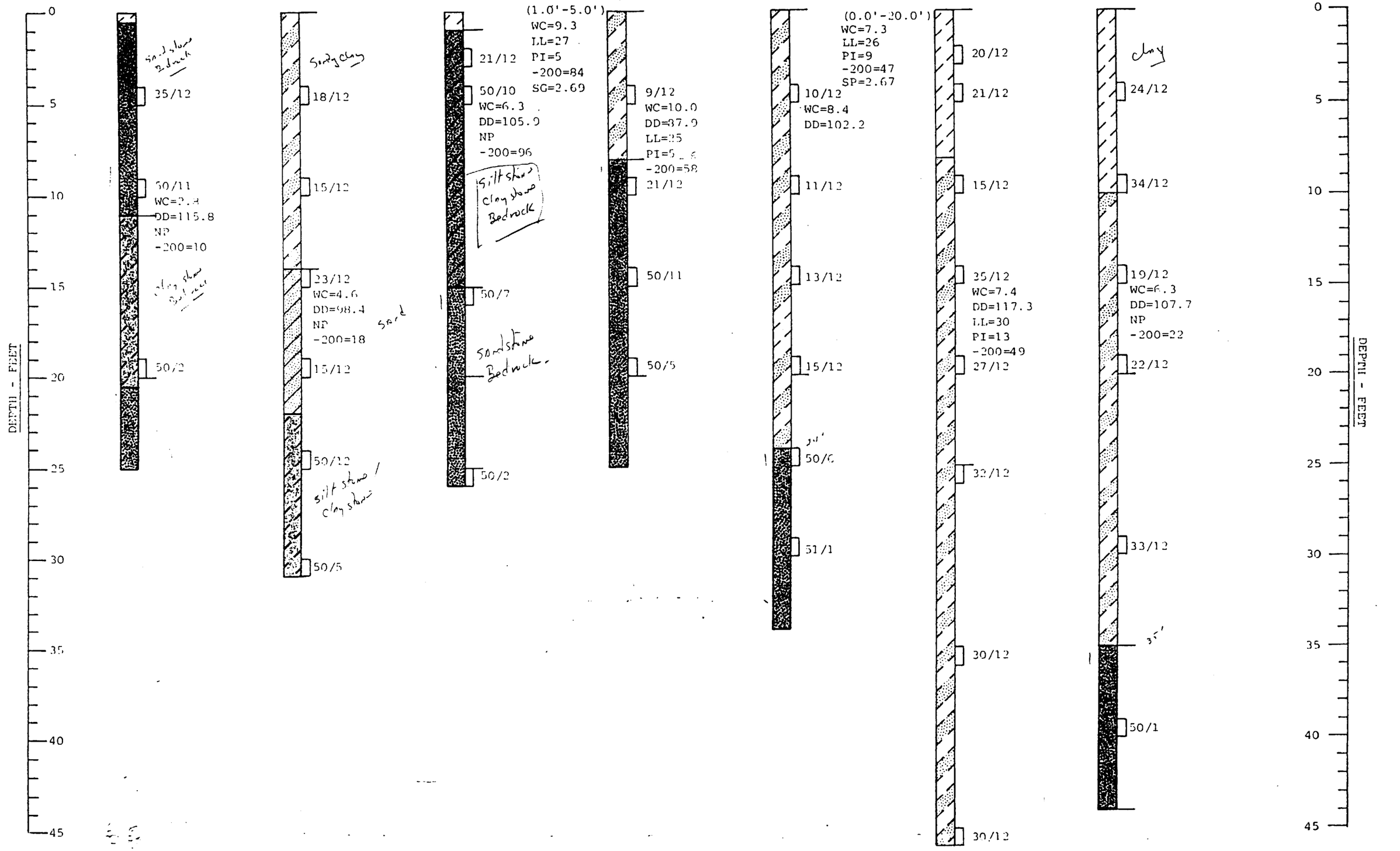
SA25-3
SA25-2
SA25-1
SA36-7
SA36-5
SA36-4
SA36-6
SA36-3
SA36-2
SA36-1
SA23-1

T36N - R74W
CONVERSE COUNTY
WYOMING

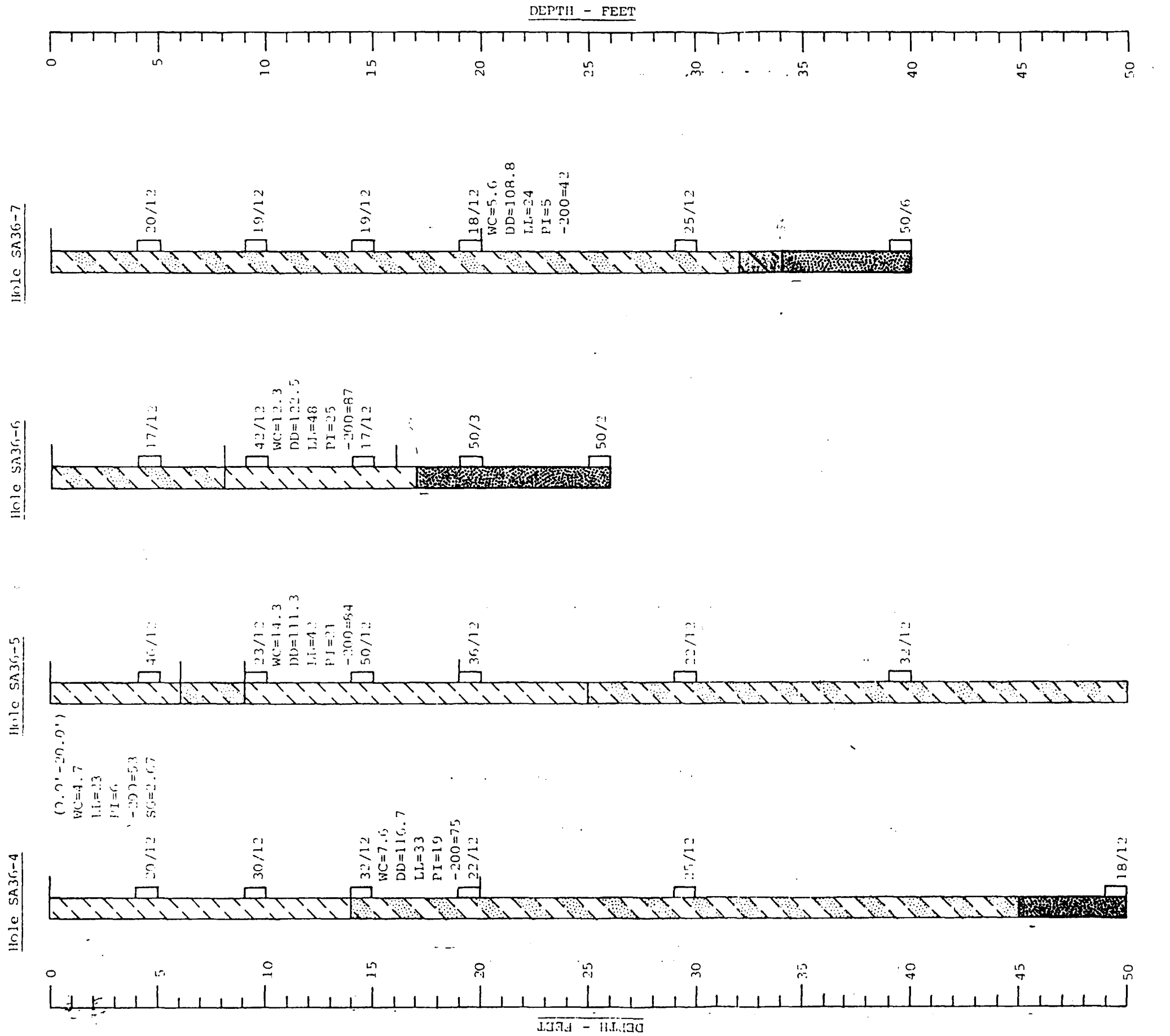
24
25
30
31
23
26
35

OWS-6
OWD-2
OWD-1
OWS-8
OWS-7
OWD-3
OWS-5
OWD-5
OWS-4
OWD-4
TW-2
BILL SMITH MINE

#3-123-86	Chen & Associates		LOCATION OF EXPLORATORY HOLES	Fig. 4-4



#3-123-86 | **Chen & Associates** | LOGS OF EXPLORATORY HOLES | Fig. 4-5



#3-123-86	Chen & Associates	LOGS OF EXPLORATORY HOLES	Fig. 4-6

Legend:

Clay (CL), sandy to very sandy, stiff to very stiff, brown, slightly moist to moist.

Sand (SM), silty, occasional clay lenses, medium dense, brown, slightly moist.

Clay and Sand (CL-SC), very sandy clay to very clayey sand, stiff, brown, slightly moist to moist.

Claystone Bedrock, medium hard to very hard, grey to dark brown, moist.

Sandstone Bedrock, hard to very hard, massive, slightly cemented, light brown to orange-brown, dry to slightly moist.

Siltstone-Claystone Bedrock, medium hard, grey-brown, moist.

Siltstone-Sandstone Bedrock, occasional claystone layers, firm to hard, slightly cemented, brown to multicolored.

Undisturbed drive sample. The symbol 10/12 indicates that 10 blows of a 140 lb. hammer falling 30 inches were required to drive the sampler 12 inches.

Indicates depth interval from which a disturbed soil sample was obtained from auger cuttings.

Notes:

(1) Test holes were drilled June 5 through June 11, 1986 using 4-inch diameter continuous flight power auger.

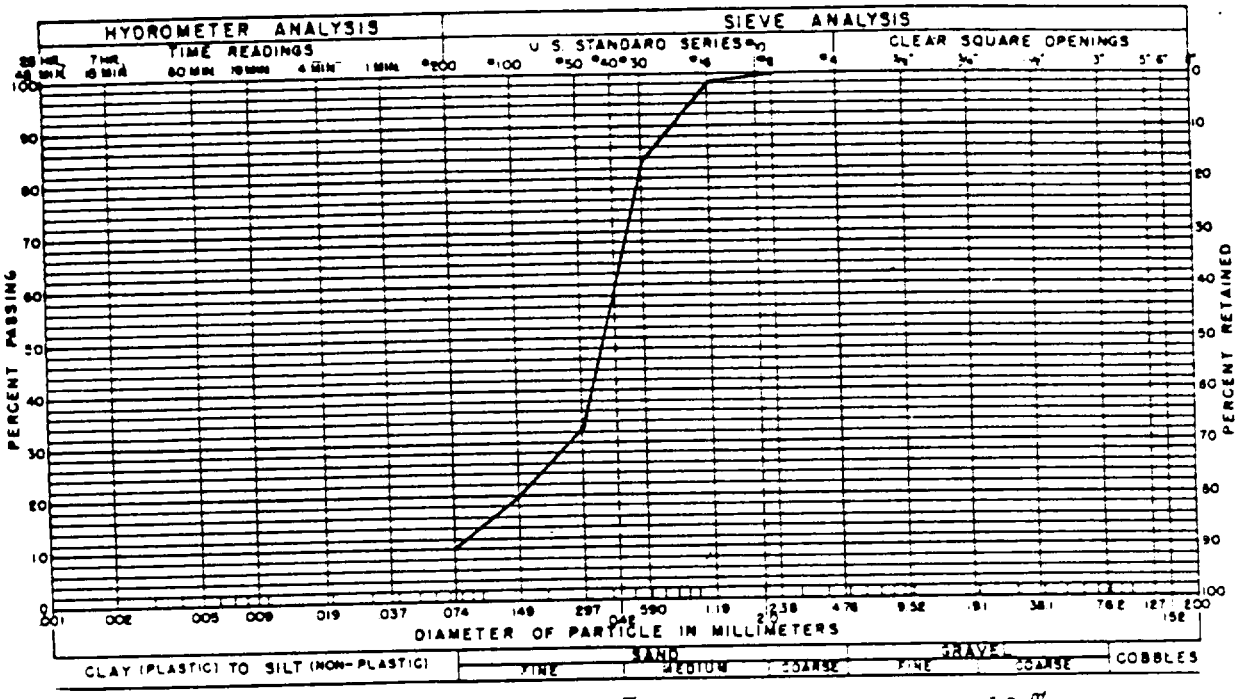
(2) Test holes were drilled at locations determined in the field by personnel with the Bill Smith Mine.

(3) Elevations of borings were not determined and logs of test holes are drawn to depth.

(4) The lines between materials shown on the boring logs represent approximate boundaries between material types; transitions may be gradual.

(5) No water was encountered in the exploratory borings during drilling.

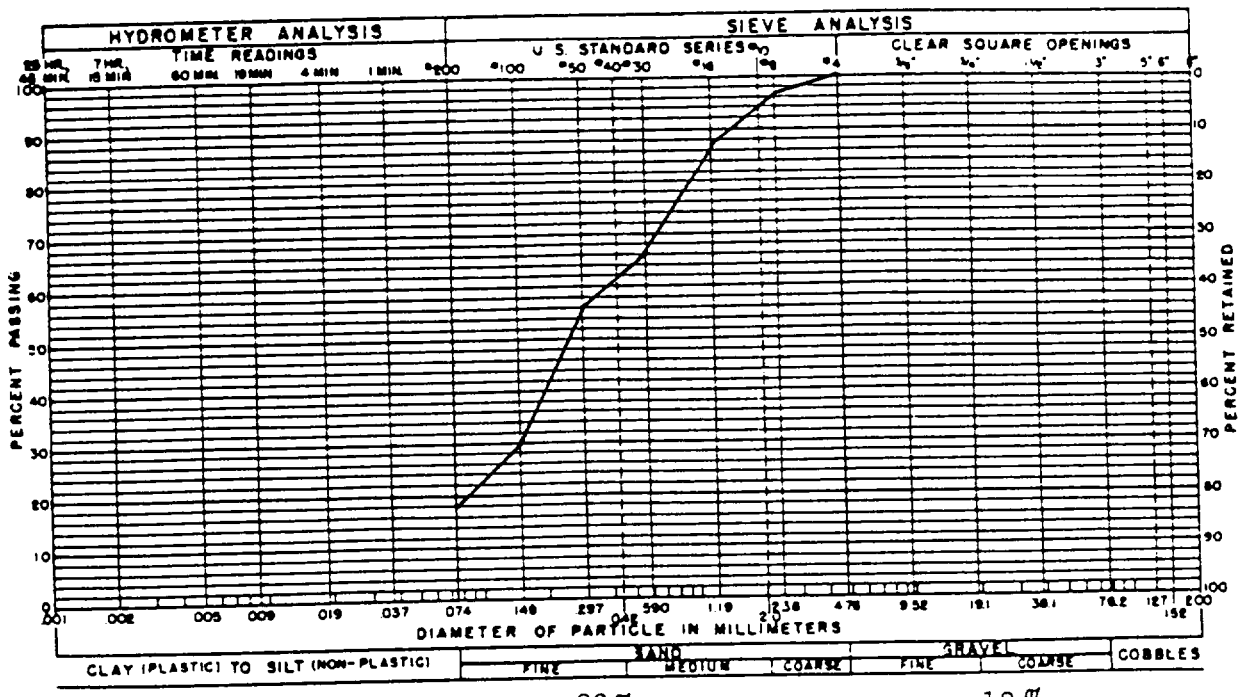
(6) WC = Water Content (%)
DD = Dry Density (pcf)
LL = Liquid Limit (%)
PI = Plasticity Index (%)
NP = Non-plastic
-200 = Passing No. 200 Sieve (%)
SG = Specific Gravity



GRAVEL 0 % SAND 90 % SILT AND CLAY 10 %

LIQUID LIMIT % PLASTICITY INDEX NP %

SAMPLE OF Sandstone Bedrock FROM Hole SA23-1 at depth 9.0'



GRAVEL 0 % SAND 82 % SILT AND CLAY 18 %

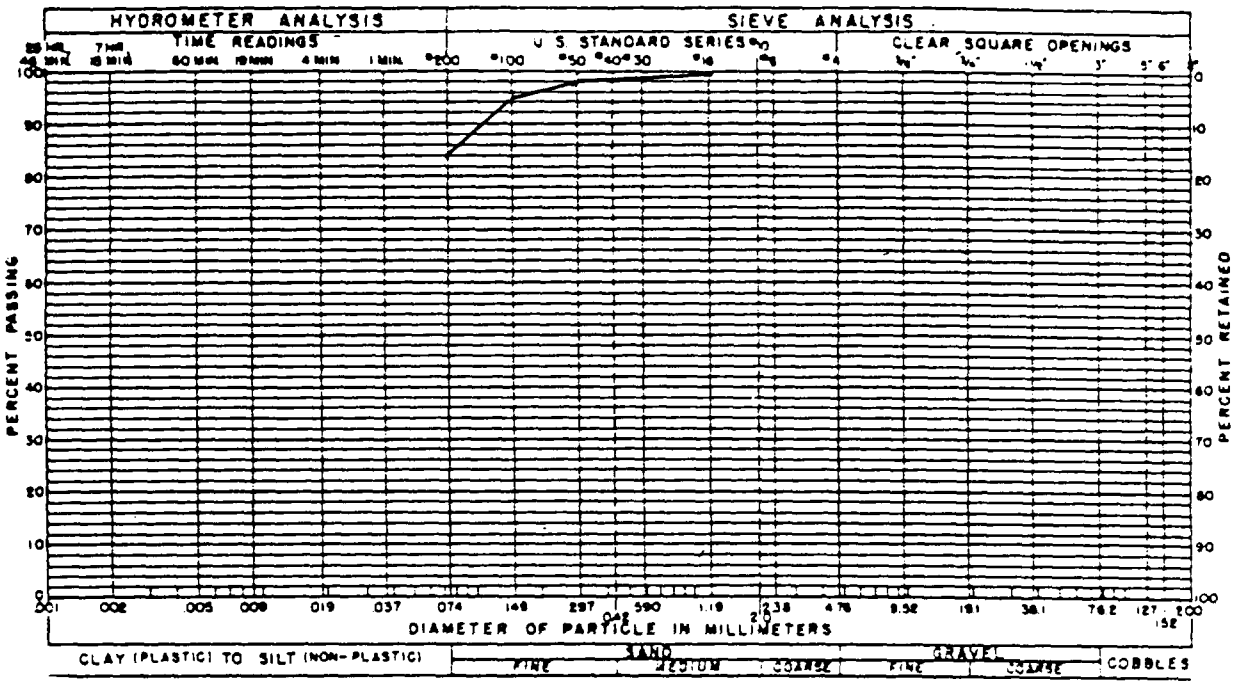
LIQUID LIMIT % PLASTICITY INDEX NP %

SAMPLE OF Silty Sand FROM Hole SA25-1 at depth 14.0'

#3-123-86

GRADATION TEST RESULTS

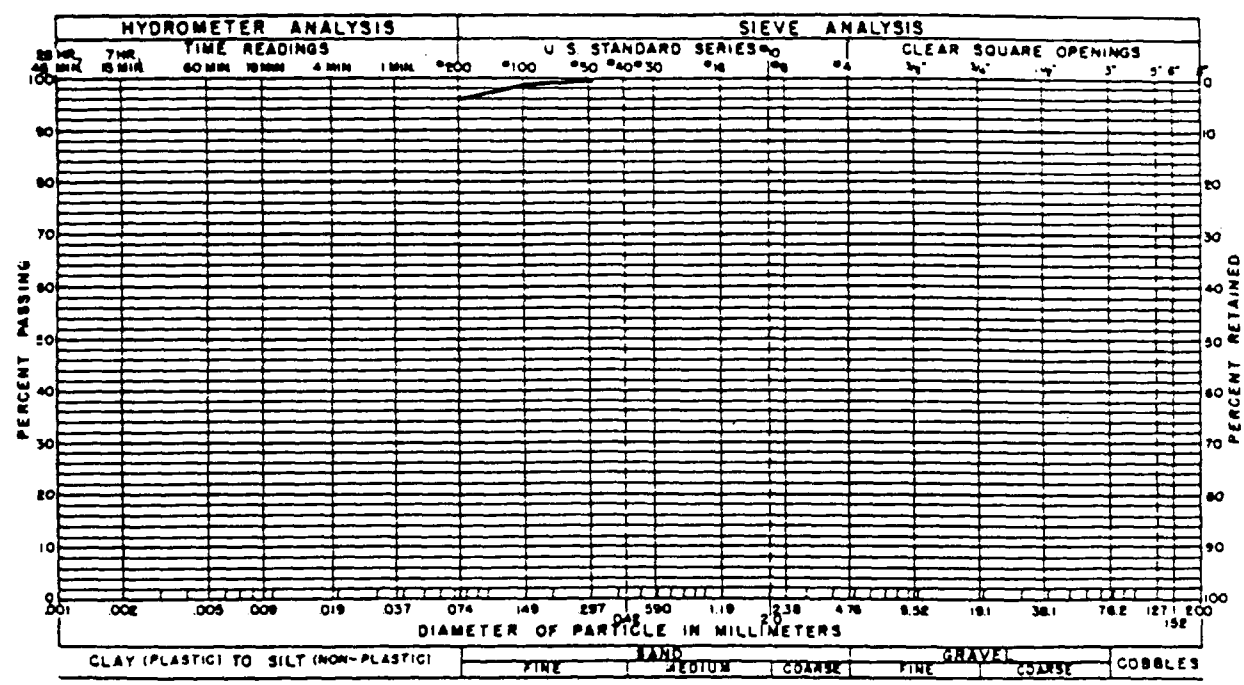
Fig. 4-8



GRAVEL 0 % SAND 16 % SILT AND CLAY 84 %

LIQUID LIMIT 27 % PLASTICITY INDEX 5 %

SAMPLE OF Siltstone Bedrock FROM Hole SA25-2 at depth 1.0' to 15.0'



GRAVEL 0 % SAND 4 % SILT AND CLAY 96 %

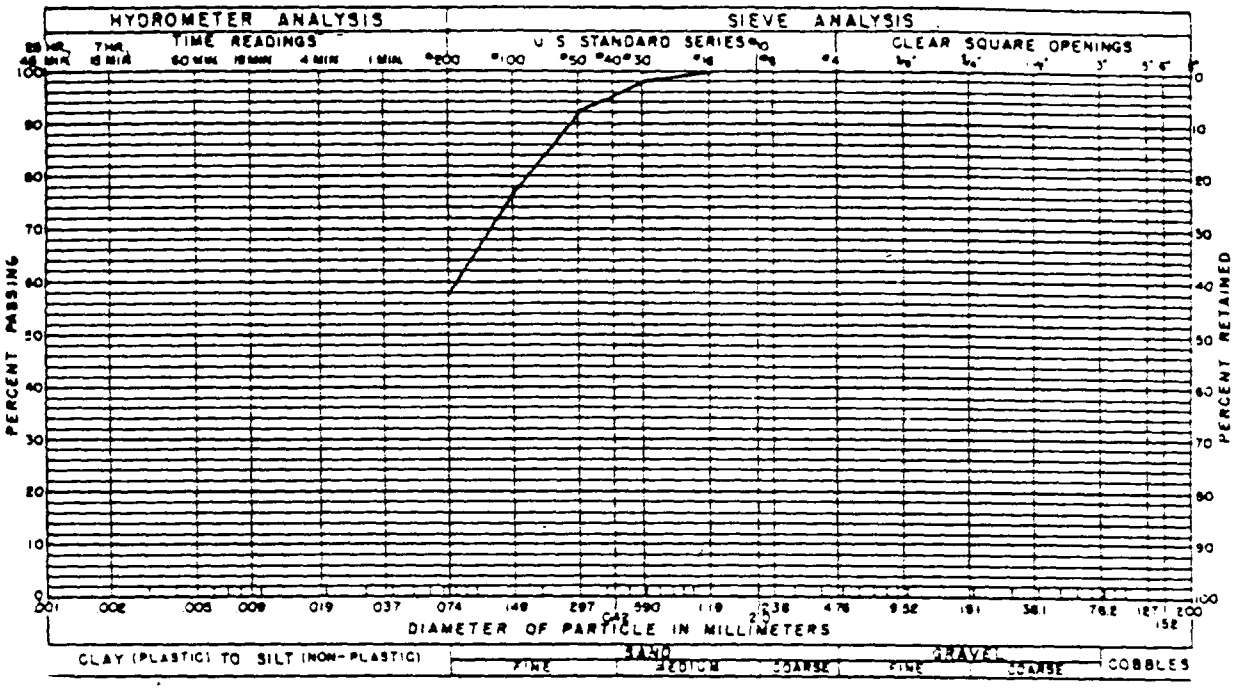
LIQUID LIMIT % PLASTICITY INDEX NP %

SAMPLE OF Siltstone Bedrock FROM Hole SA25-2 at depth 4.0'

#3-123-86

GRADATION TEST RESULTS

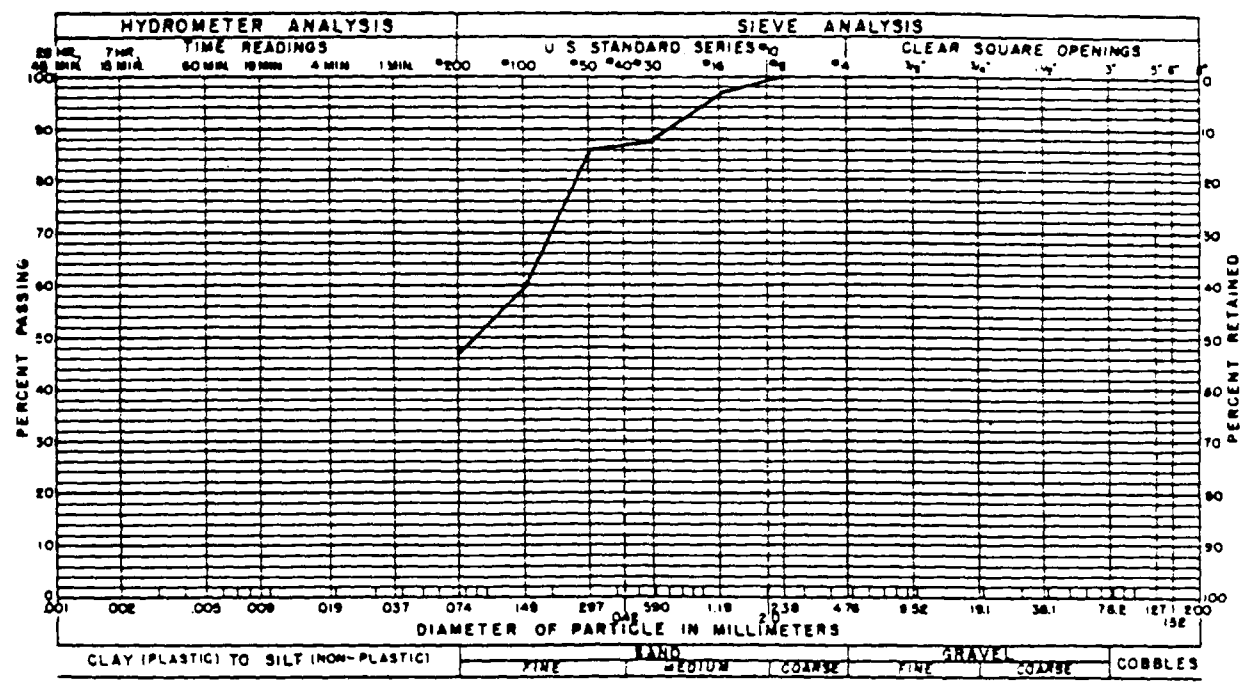
Fig. 4-9



GRAVEL 0 % SAND 42 % SILT AND CLAY 58 %

LIQUID LIMIT 25 % PLASTICITY INDEX 5 %

SAMPLE OF Very Sandy Clay-Silt FROM Hole SA25-3 at depth 4.0'



GRAVEL 0% SAND 53 % SILT AND CLAY 47 %

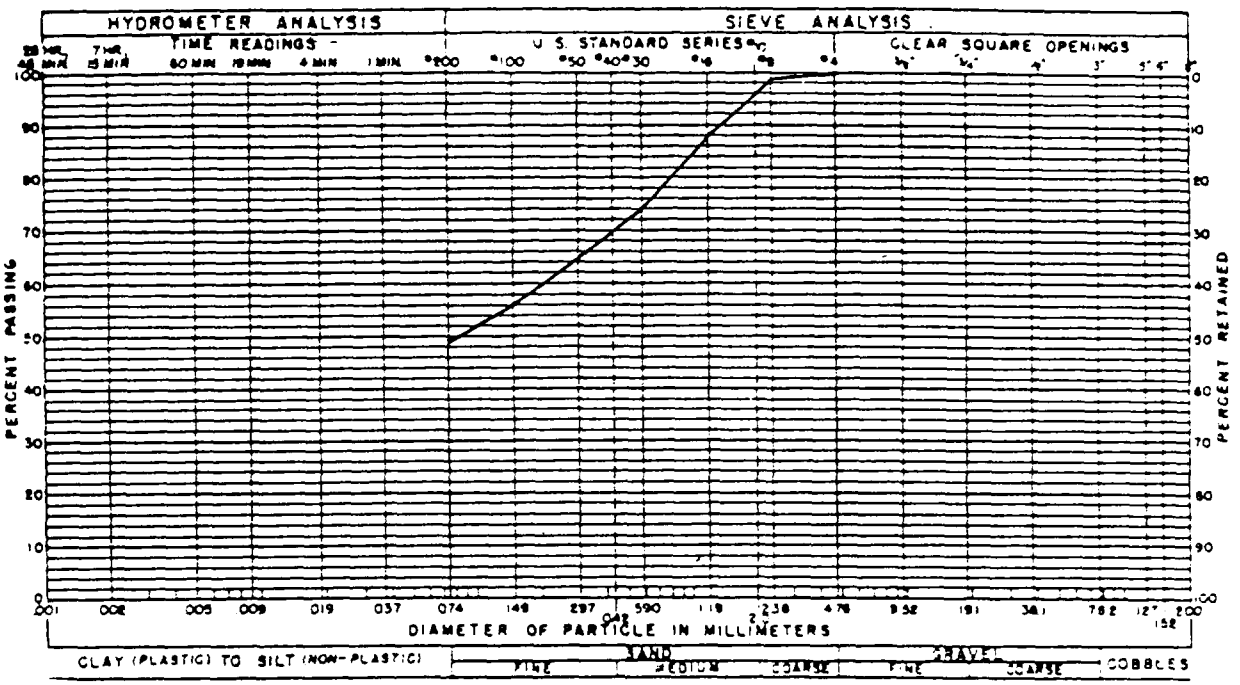
LIQUID LIMIT 26 % PLASTICITY INDEX 9 %

SAMPLE OF Very Clayey Sand FROM Hole SA36-1 at depth 0.0' to 20.0

#3-123-86

Fig. 4-10

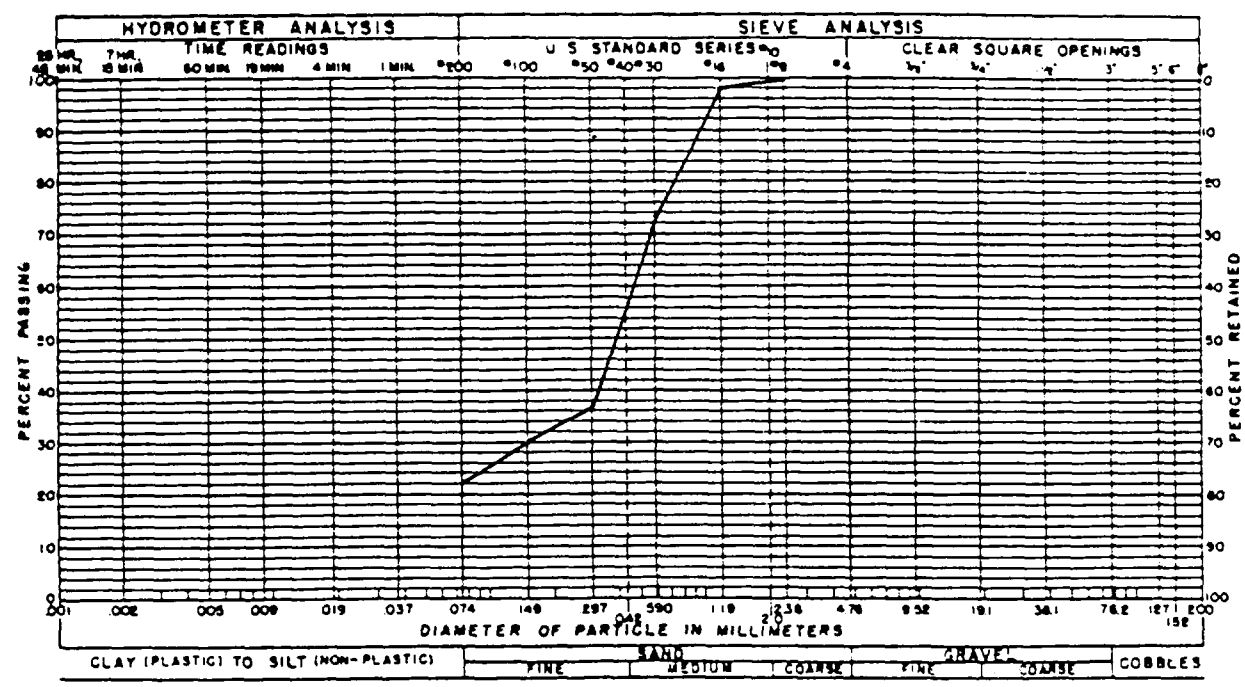
GRADATION TEST RESULTS



GRAVEL 0 % SAND 51 % SILT AND CLAY 49 %

LIQUID LIMIT 30 % PLASTICITY INDEX 13 %

SAMPLE OF Very Clayey Sand FROM Hole SA36-2 at depth 14.0'



GRAVEL 0% SAND 78 % SILT AND CLAY 22 %

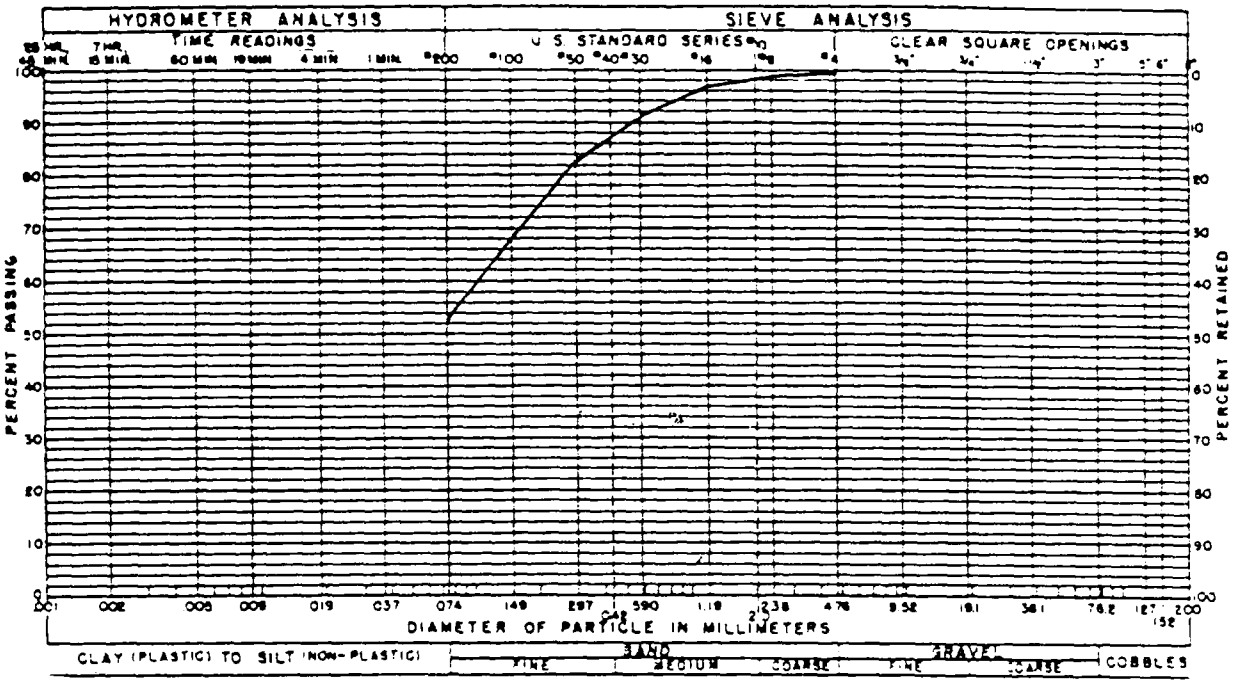
LIQUID LIMIT % PLASTICITY INDEX NP %

SAMPLE OF Silty Sand FROM Hole SA36-3 at depth 14.0'

#3-123-86

GRADATION TEST RESULTS

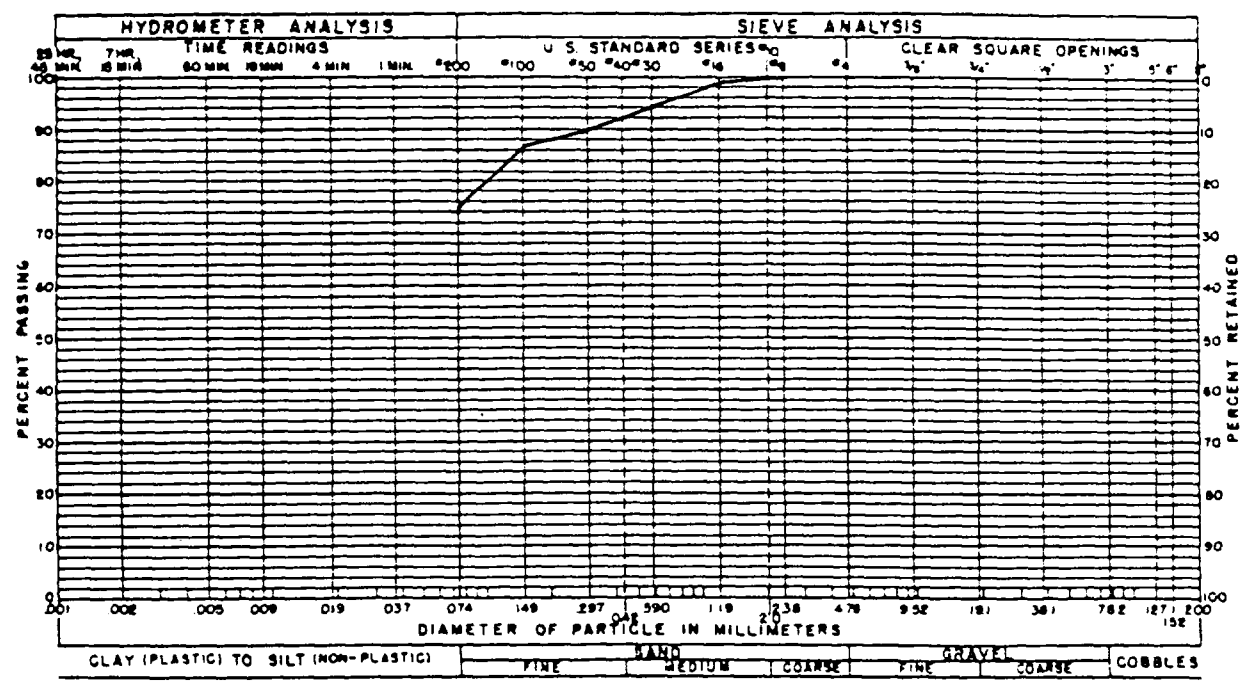
Fig. 4-11



GRAVEL 0 % SAND 47 % SILT AND CLAY 53 %

LIQUID LIMIT 23 % PLASTICITY INDEX 6 %

SAMPLE OF Very Sandy Clay-Silt FROM Hole SA36-4 at depth 0.0' to 20.0'



GRAVEL 0 % SAND 25 % SILT AND CLAY 75 %

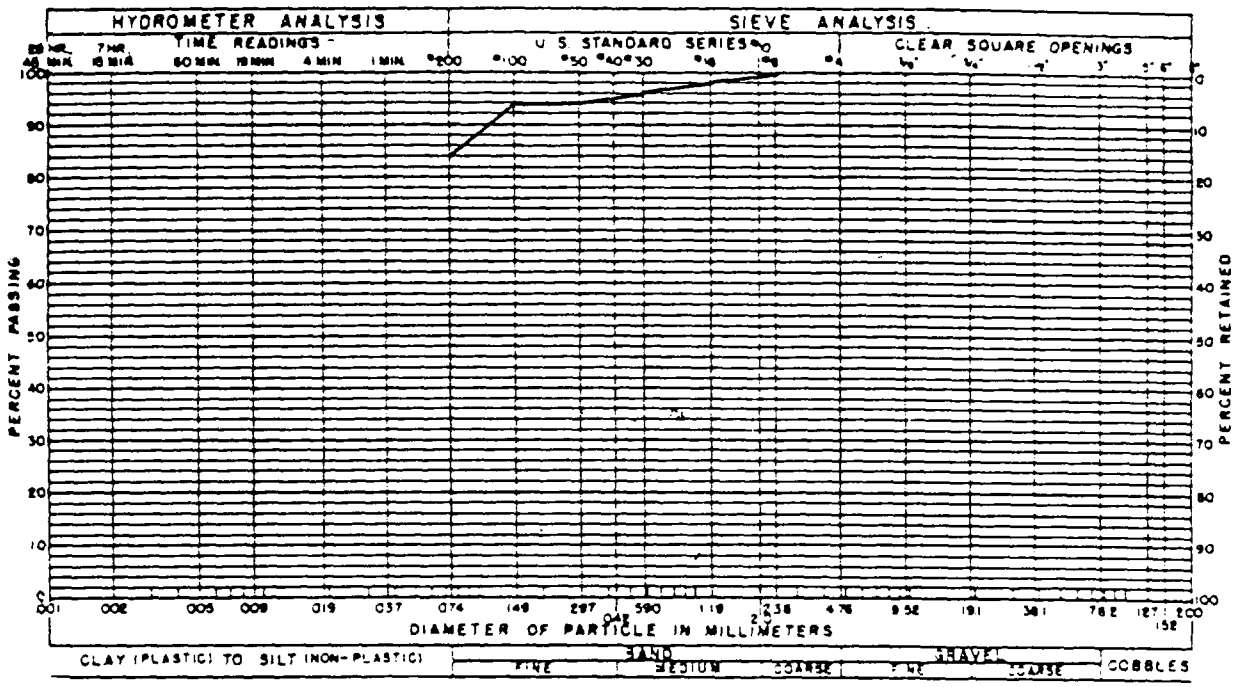
LIQUID LIMIT 33 % PLASTICITY INDEX 19 %

SAMPLE OF Very Sandy Clay FROM Hole SA36-4 at depth 14.0'

3-123-86

GRADATION TEST RESULTS

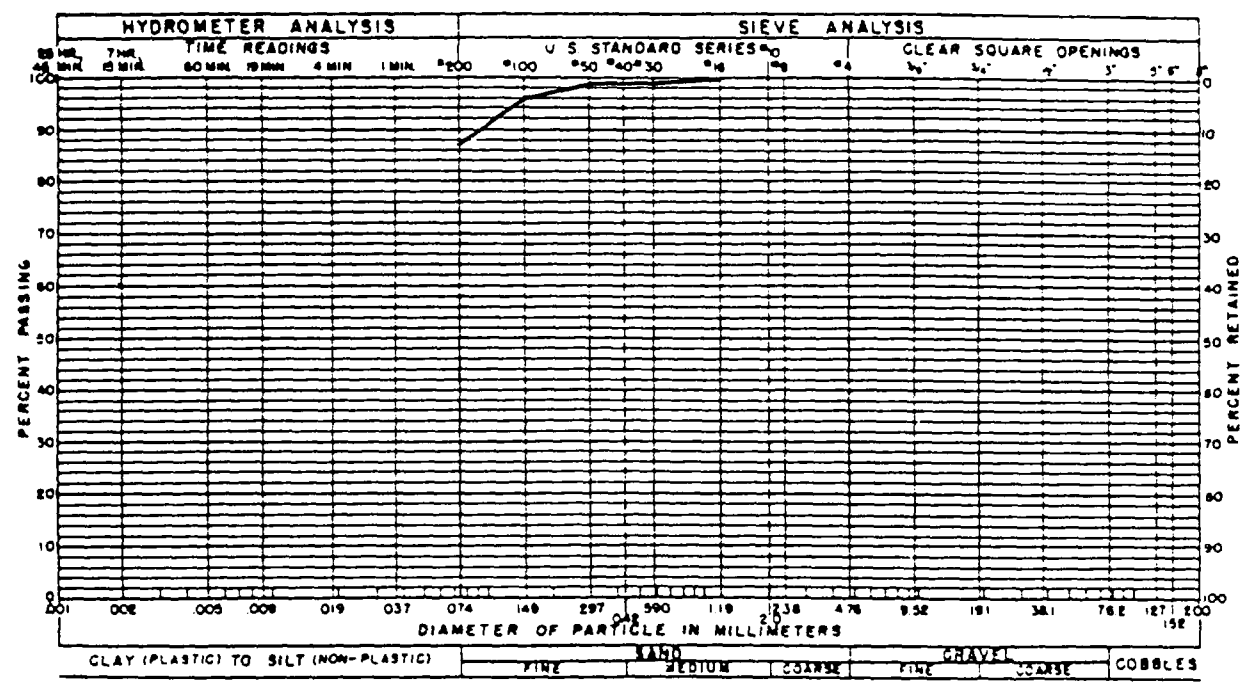
Fig. 4-12



GRAVEL 0% SAND 16 % SILT AND CLAY 84%

LIQUID LIMIT 42 % PLASTICITY INDEX 21 %

SAMPLE OF Sandy Clay FROM Hole SA36-5 at depth 9.0'



GRAVEL 0 % SAND 13 % SILT AND CLAY 87 %

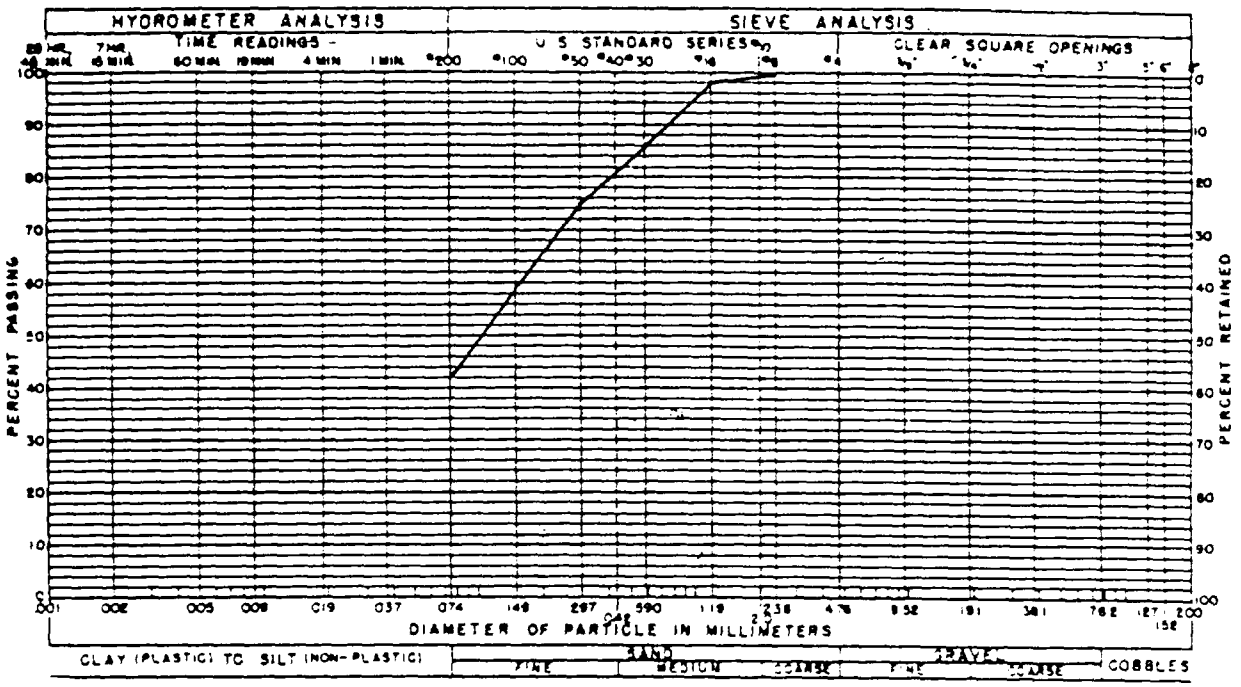
LIQUID LIMIT 48 % PLASTICITY INDEX 25 %

SAMPLE OF Sandy Clay FROM Hole SA36-6 at depth 9.0'

#3-123-86

GRADATION TEST RESULTS

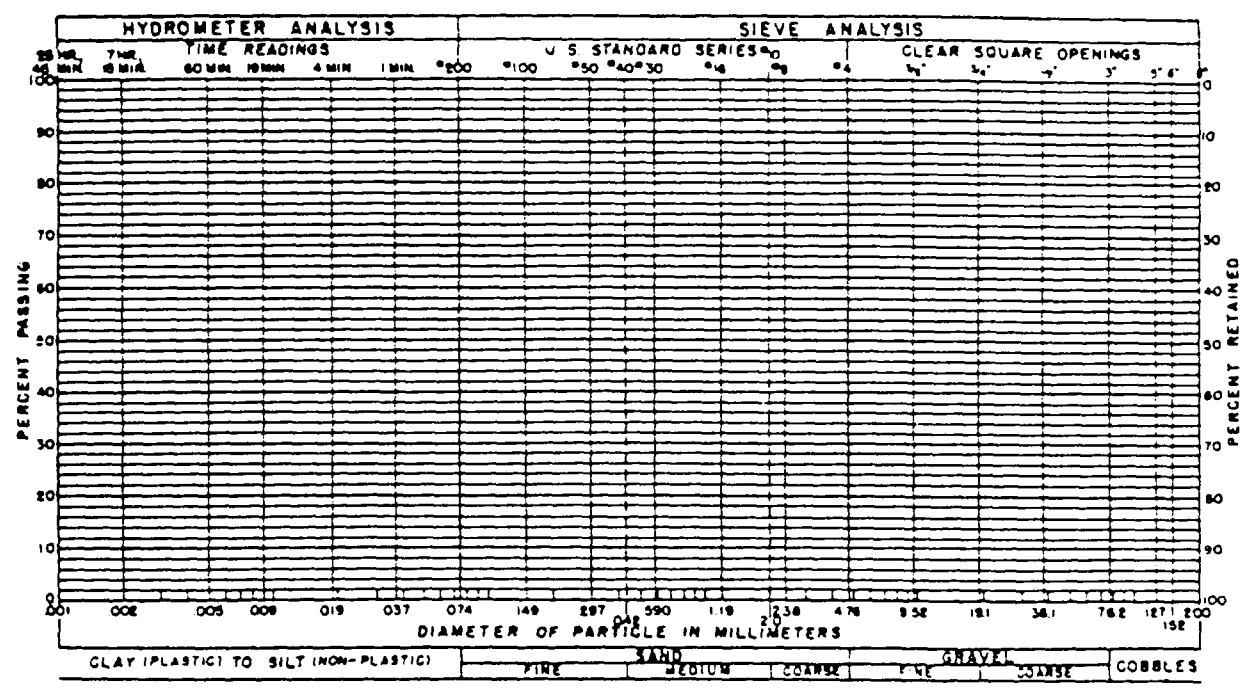
Fig. 4-13



GRAVEL 0 % SAND 58 % SILT AND CLAY 42 %

LIQUID LIMIT 24 % PLASTICITY INDEX 5 %

SAMPLE OF Very Silty-Clayey Sand FROM Hole SA36-7 at depth 19.0'



GRAVEL % SAND % SILT AND CLAY %

LIQUID LIMIT % PLASTICITY INDEX %

SAMPLE OF FROM

#3-123-86

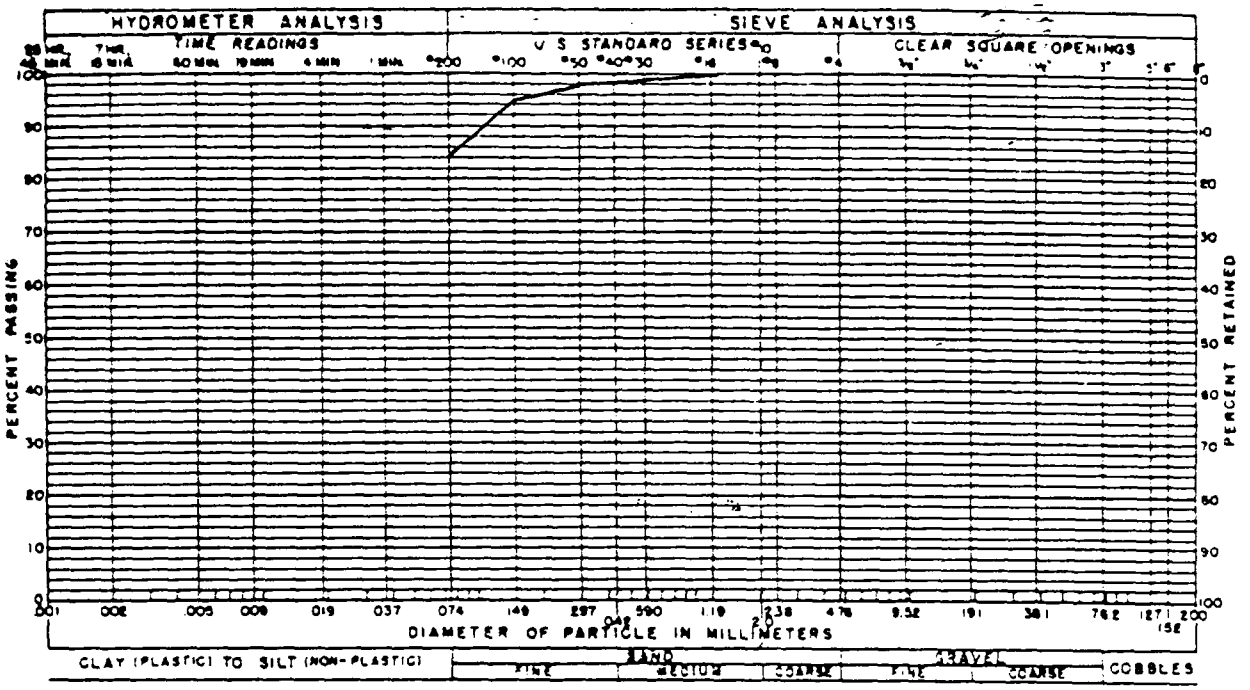
GRADATION TEST RESULTS

Fig. 4-14

CHEN AND ASSOCIATES

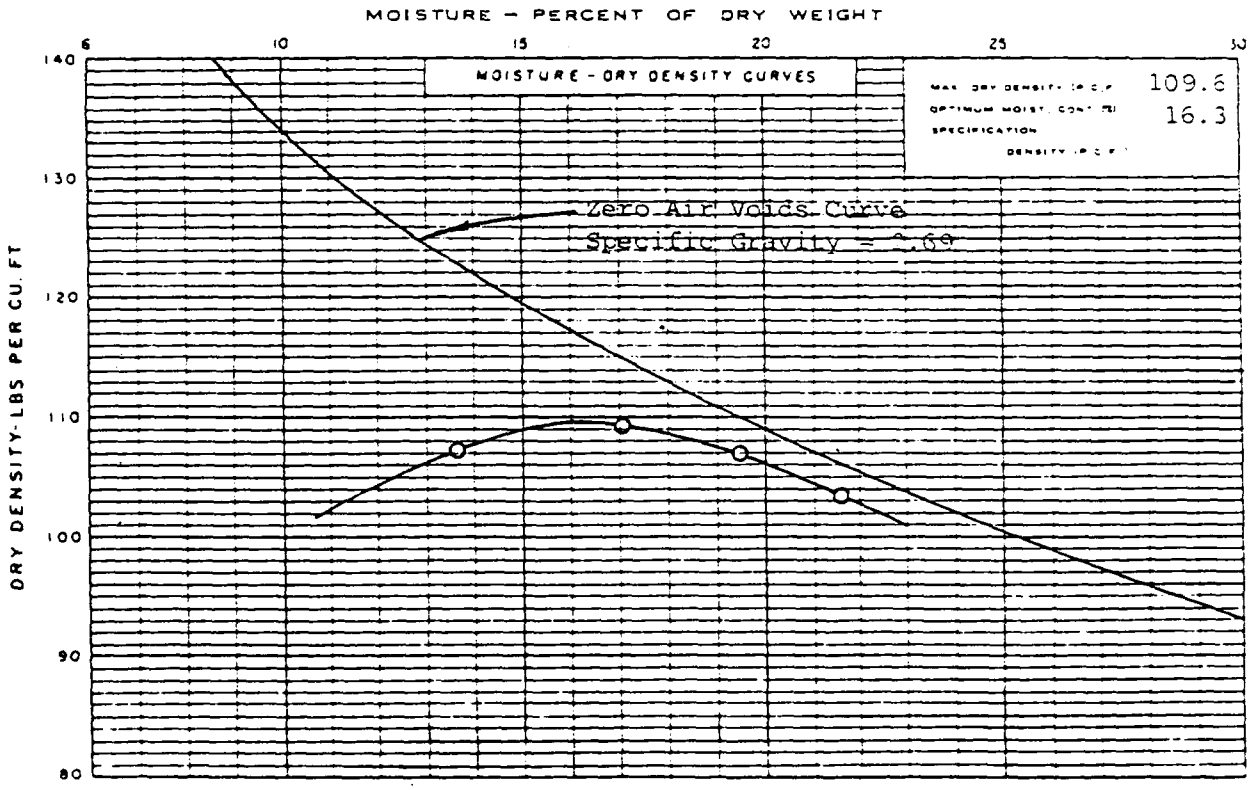
Consulting Engineers

Soil and Foundation Engineering



GRADATION TEST RESULTS

GRAVEL	0%	SAND	16 %	SILT AND CLAY	84 %
LIQUID LIMIT	27 %	PLASTICITY INDEX	5 %		



COMPACTION TEST RESULTS

COMPACTION TEST PROCEDURE ASTM D698-78, Method "A"

SAMPLE OF Siltstone Bedrock

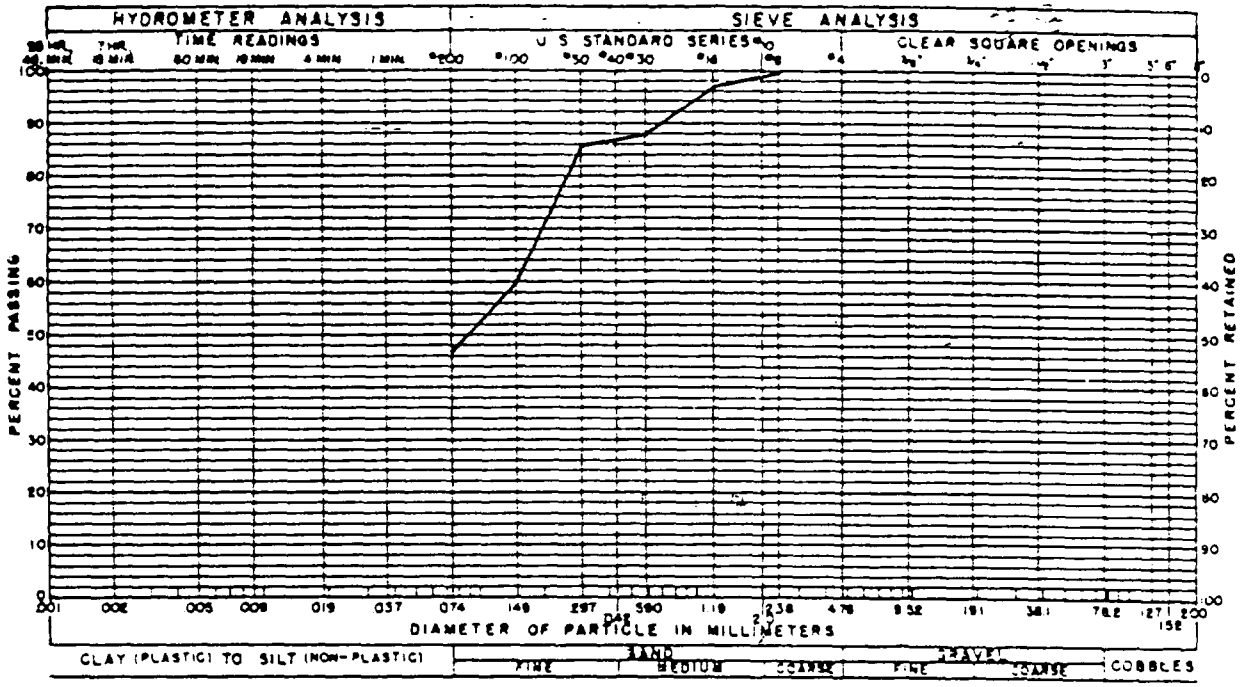
#3-123-86 FROM Hole SA25-2 DEPTH 1.0' to 15.0'

Fig. 4-15 CA-3

CHEN AND ASSOCIATES

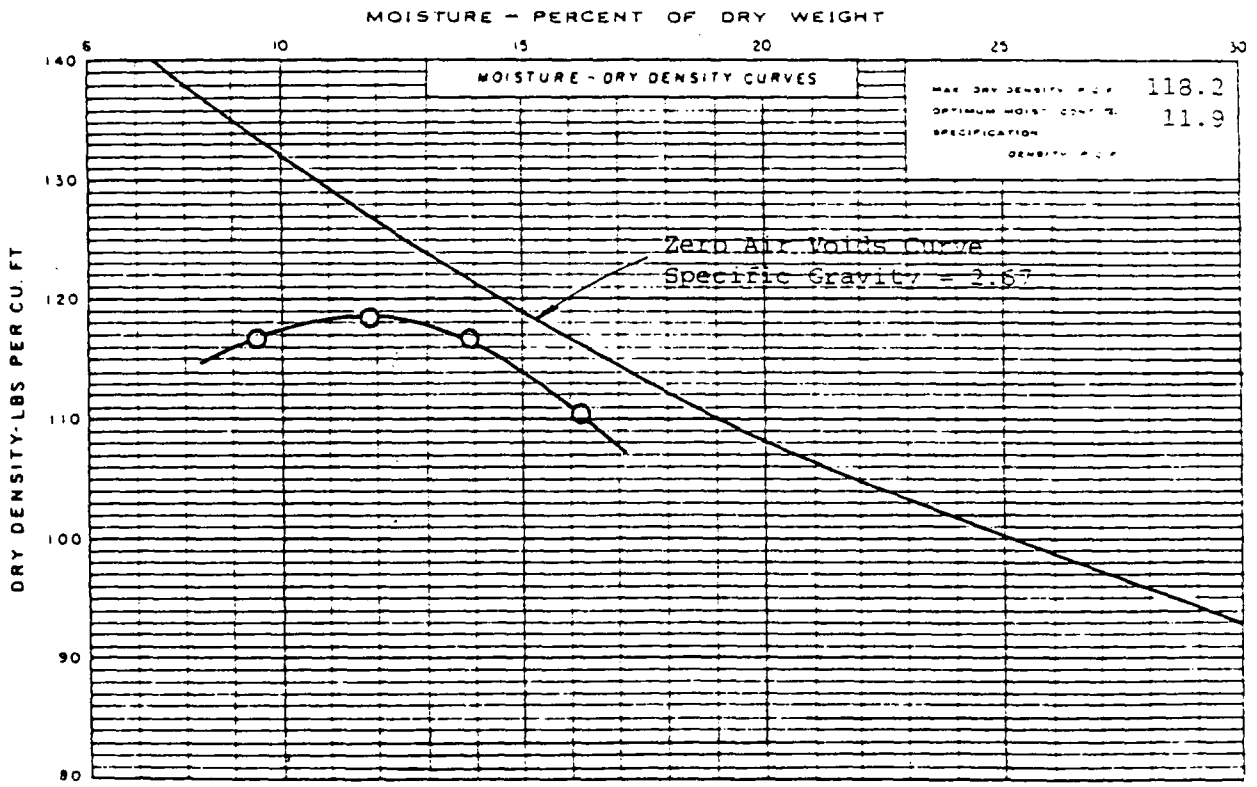
Consulting Engineers

Soil and Foundation Engineering



GRADATION TEST RESULTS

GRAVEL	0 %	SAND	53 %	SILT AND CLAY	47 %
LIQUID LIMIT	26 %	PLASTICITY INDEX	9 %		



COMPACTION TEST RESULTS

COMPACTION TEST PROCEDURE ASTM D698-78, Method "A"

SAMPLE OF Very Clayey Sand

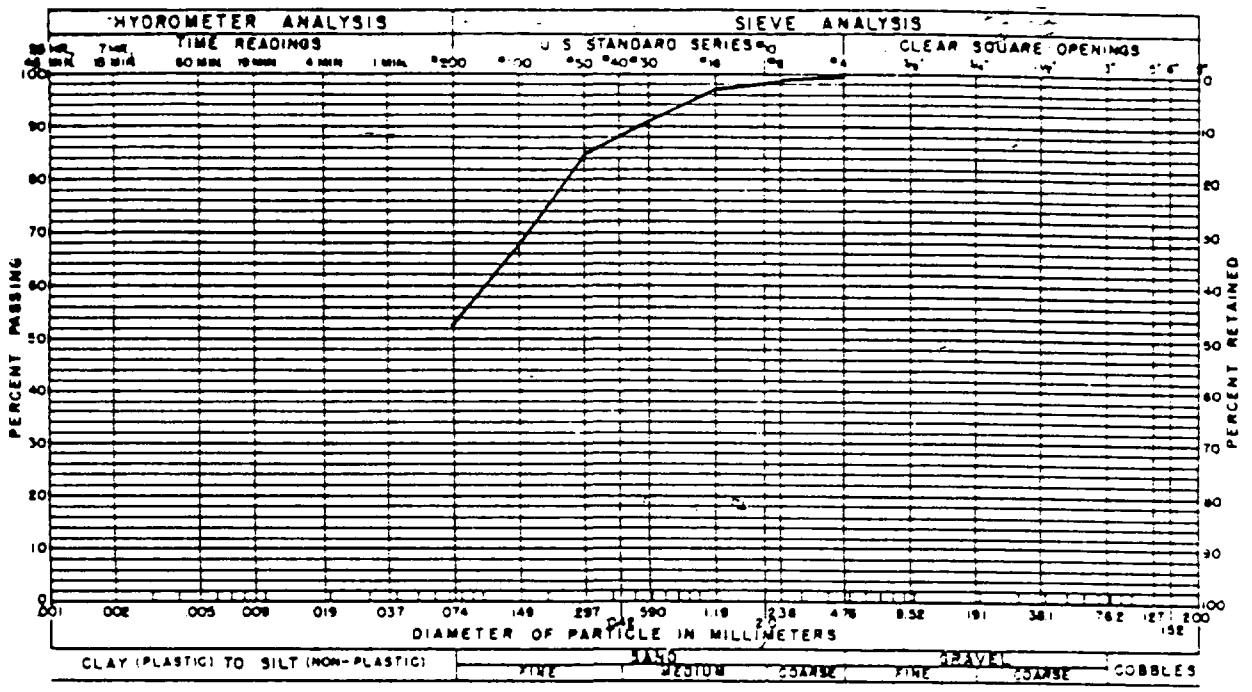
#3-123-86 FROM Hole SA36-1 DEPTH 0.0' to 20.0'

Fig. 4-16 CA-3

CHEN AND ASSOCIATES

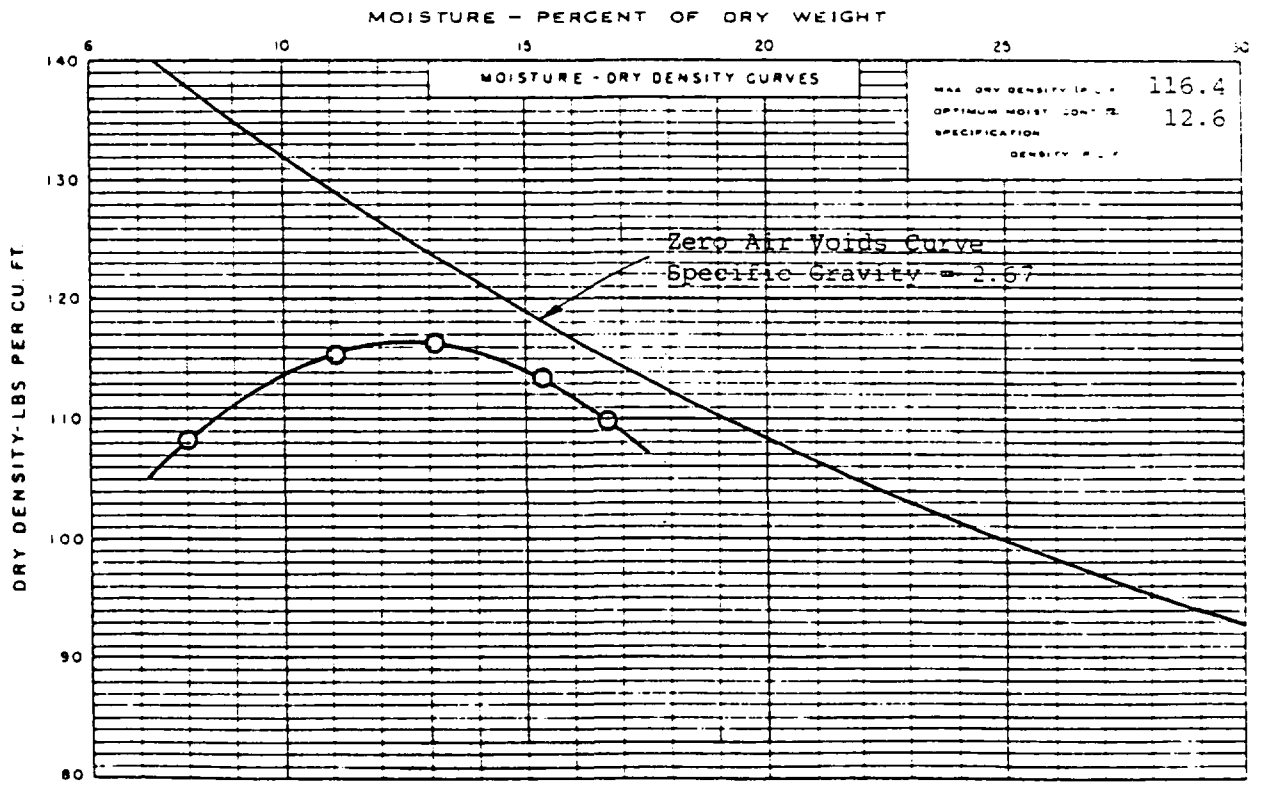
Consulting Engineers

Soil and Foundation Engineering



GRADATION TEST RESULTS

GRAVEL	0 %	SAND	47 %	SILT AND CLAY	53 %
LIQUID LIMIT	23 %	PLASTICITY INDEX	6 %		



COMPACTION TEST RESULTS

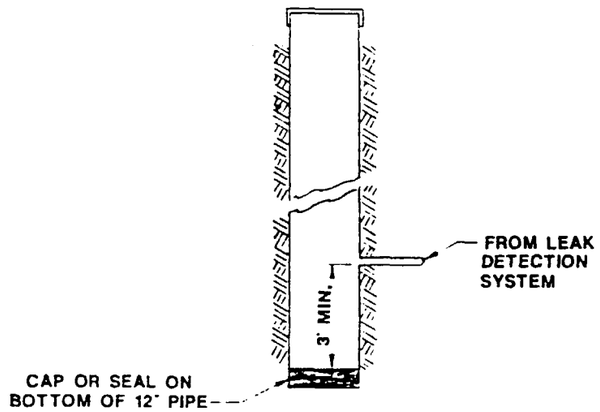
COMPACTION TEST PROCEDURE ASTM D698-78, Method "A"

SAMPLE OF Very Sandy Clay-Silt

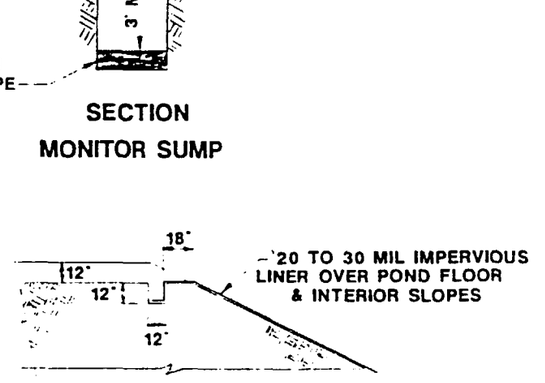
#3-123-86 FROM Hole SA36-4 DEPTH 0.0' to 20.0'

Fig. 4-17

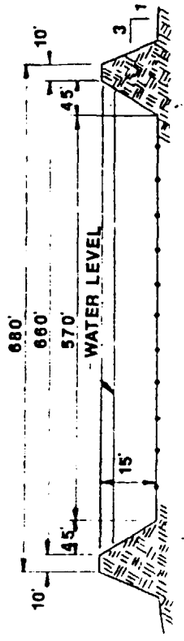
CA-3



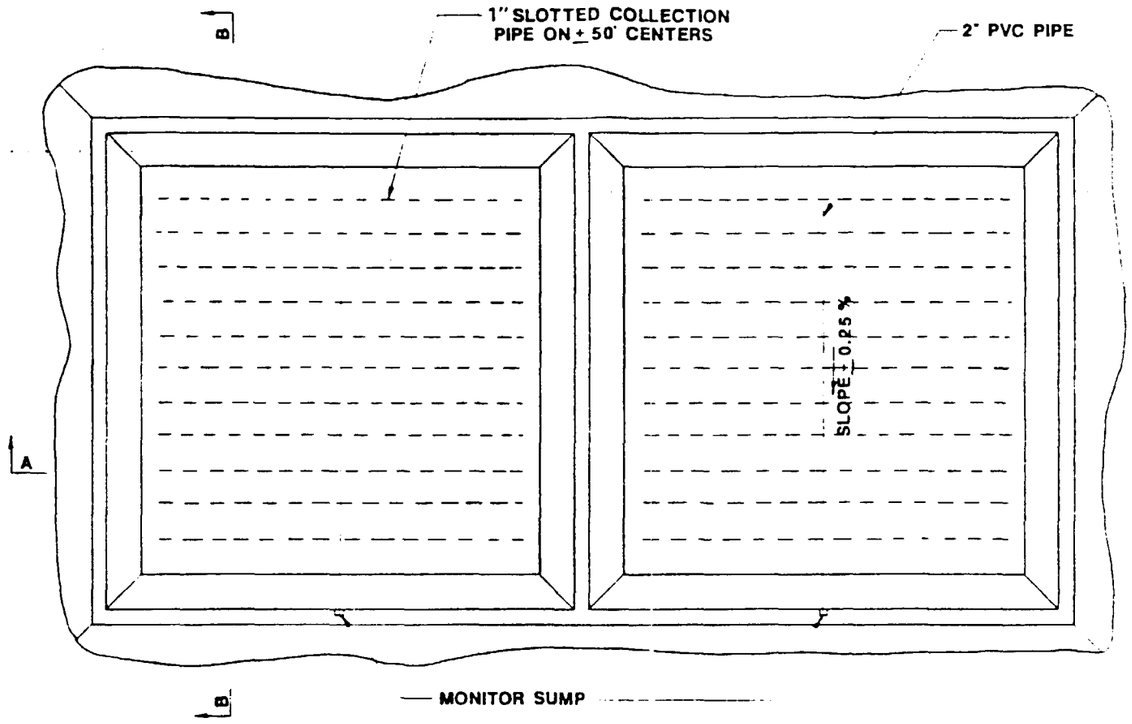
SECTION
MONITOR SUMP



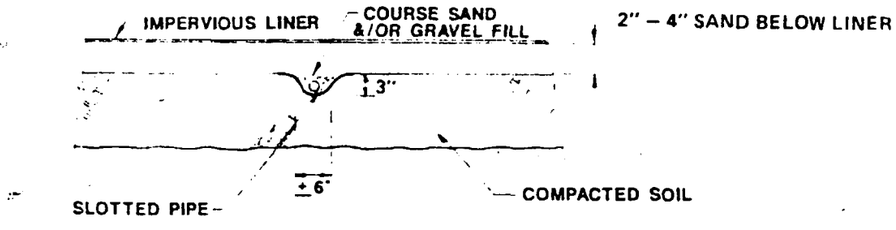
TYPICAL
LINER EDGE INSTALLATION



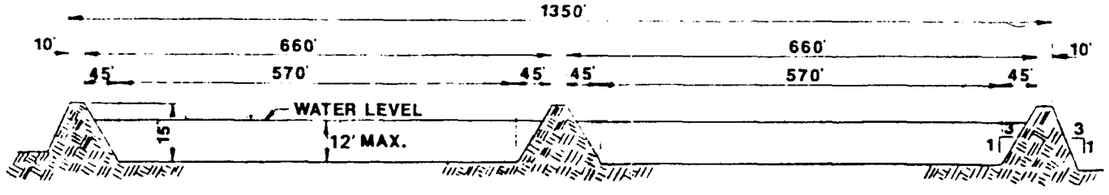
SECTION B-B
1" = 50' HORZ.
1" = 10' VERT.



PLAN
1" = 100'



TYPICAL TRENCH DETAIL
FOR LEAK DETECTION



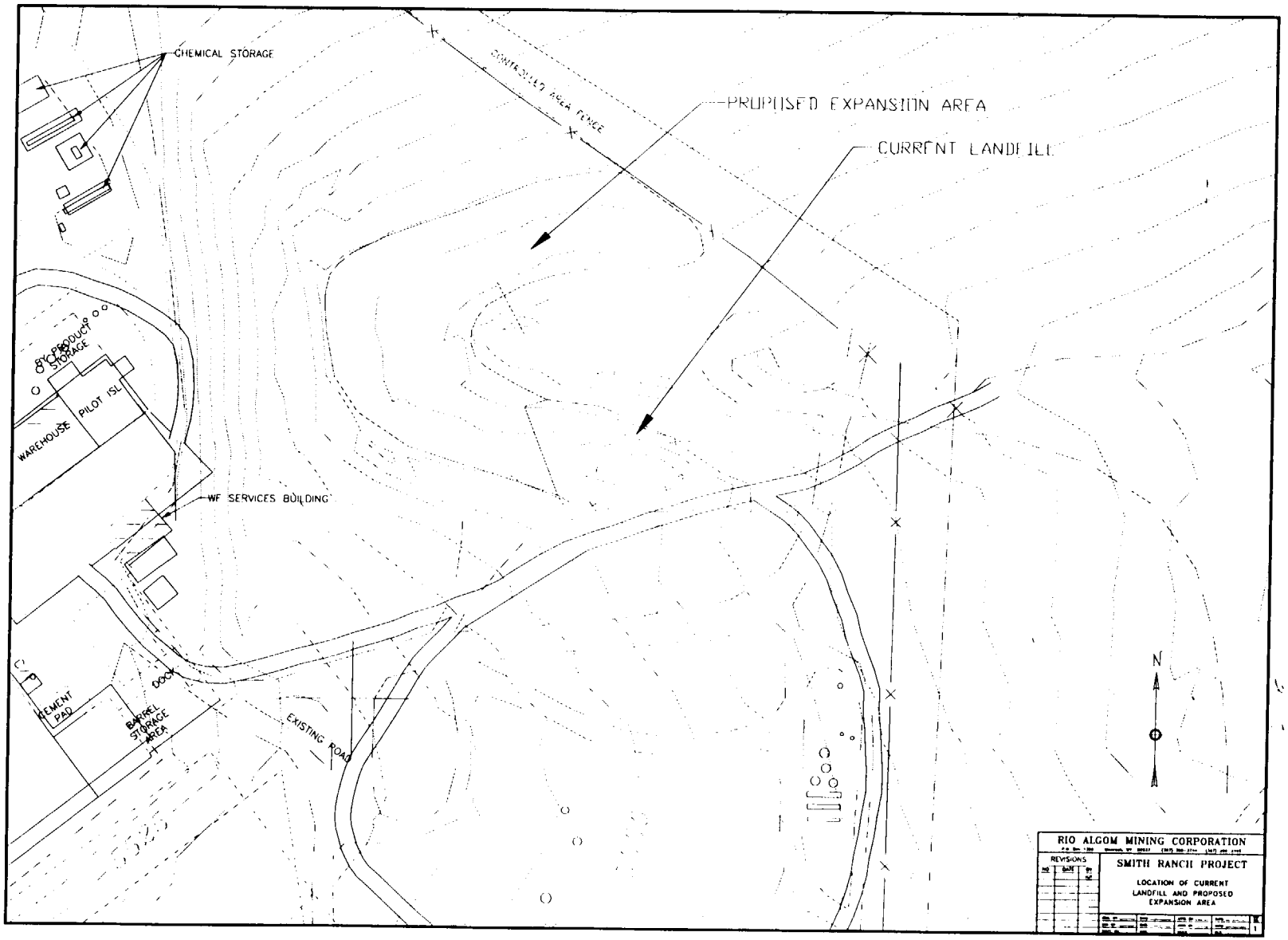
SECTION A-A
1" = 100' HORZ.
1" = 20' VERT.

FIGURE 4-18

REVISIONS		
NO.	DATE	BY
1	3-SEP-86	GWR

TYPICAL
EVAPORATION POND DESIGN
SOUTH POWDER RIVER BASIN
CONVERSE COUNTY, WYOMING
SEQUOYAH FUELS CORP.

FIGURE 4-19
LOCATION OF CONSTRUCTION/DEMOLITION WASTE MATERIAL LANDFILL



CHAPTER 5

OPERATIONAL/ENVIRONMENTAL MONITORING

The primary concerns of an in situ leaching project monitoring program are protection of existing groundwater supplies, keeping employee and public exposure to ALARA, and preventing and/or mitigating the impact of any surface contamination that could result due to a leak or spill of process solutions. The program to keep employee and public exposure to ALARA is discussed in Chapter 9. The remaining pre-operation and operational monitoring programs are discussed in this chapter.

5.1 Pre-Operational Data Collection

Pre-Operational data will be collected on a wellfield basis and will include: 1) a plan map of the anticipated final configuration of the wellfield; 2) east-west and north-south geologic cross sections through the unit; 3) baseline water quality data for the wellfield; 4) baseline data for the associated monitor wells; 5) a pump test a) to demonstrate communication between the mining areas and the production zone monitor wells; b) to demonstrate isolation of the ore zone from overlying and underlying zones; and, 6) a pre-mining gamma survey of the wellfield area. The above baseline data for the will be submitted to NRC and DEQ a minimum of 60 days prior to injection of leach solutions in the subject wellfield. No injection will begin in the subject wellfield without approval from WDEQ.

5.1.1 Baseline Water Quality

Baseline water quality of a wellfield will be established on the basis of the wellfield as a whole. To determine the groundwater quality restoration goals for a wellfield, RAMC will collect baseline samples

from representative injection and recovery wells at a density of ten wells for the first ten acres and one well for every two acres thereafter per acre of wellfield under pattern, distributed uniformly over the wellfield. A total of four samples from each well will be collected, a minimum of twelve (12) days apart, and will be analyzed for the parameters listed in Table 5-1. Table 5-1 was revised on 9/15/1997 to include Ra^{228} as well as Ra^{226}.

5.1.2 Monitor Well Baseline Data and UCL's

Monitor wells for a wellfield will be completed in the production zone in a circular pattern around the wellfield and in the overlying and underlying aquifers as specified in Chapter 3. All monitor wells will be completed only in the zone to be monitored and the completion interval will be limited to the total thickness of the completion zone of adjacent injection and recovery wells (plus/minus five feet). In instances where there are multiple ore horizons, RAMC will confer with DEQ to determine the appropriate interval. Additional samples may be collected and analyzed for excursion parameters chloride, conductivity, and total alkalinity. The excursion parameters will be reported in the following units:

UCL Parameter	Units
Chloride	mg/l as Cl
Conductivity	µmhos/cm @25°C
Total Alkalinity	mg/l as $CaCO_3$

Excursion upper control limits values (UCLs) for the wellfield will be submitted to NRC and DEQ with the monitor well baseline data. The UCL for a given parameter and type of well for a wellfield will be defined as the mean of baseline plus five standard deviations from the mean as determined after outlier screening. However, for situations where

chloride values are very low and show little variation during baseline data collection, the UCL for chloride will be set at the average baseline value plus 15 mg/l if that value is greater than the average baseline value plus five standard deviations. In determining outliers and the representative baseline high value, all analyses for a UCL parameter for that class of well, i.e. production zone, overlying aquifer, etc., will be treated as a group for that wellfield.

Outliers will be detected using the tolerance limit test (Loftis et. al., 1987) suggested in WDEQ-LQD's Guideline 4. Any data point that falls outside the tolerance limits set by the following calculation will be treated as a potential outlier and removed from the data set:

$\pm$ ks where: = sample mean
k = tolerance limit factor;
alpha = 0.05, p = 0.99
s = sample standard deviation

The final baseline mean will then be calculated with all outliers excluded from the data set. If a majority of the baseline values for a well are excluded as outliers under the above procedure, a separate UCL will be established for that well.

A pre-mining pump test to demonstrate hydraulic communication between the production zone monitor wells and the mining area will be conducted for each wellfield. After completion of the monitor wells for a unit, one or more production wells centrally located in the unit will be pumped at a rate and length of time sufficient to stress the groundwater system at the perimeter monitor wells, thereby overcoming any natural or mining induced water level variability. Prior to the test, fluid levels in all production zone monitor wells, all overlying and underlying monitor wells, and representative production zone wells

will be recorded at sufficient intervals to determine any water level trends or variability. Fluid levels for the same wells will be recorded during the test, at the end of the test and after the test at intervals sufficient to determine communication or isolation. The data will be summarized and any abnormal responses discussed in the submittal to NRC and WDEQ. If the area tested is remote from areas previously tested or if the particular aquitards have not previously been tested a representative number of wells will be monitored to determine the site specific aquifer parameters. This remote area testing will include a Neuman-Witherspoon, or similar analysis of the aquitard hydraulic characteristics.

5.1.3 Baseline Gamma Survey

Prior to beginning solution mining in a wellfield, a gamma survey of the wellfield production area will be conducted. The survey will be based on a north-south, east-west grid system using a 200 foot spacing between grid lines. Pre-mining gamma readings will be taken near the intersections of all north-south, east-west grid lines within the projected mining area. The readings will be taken using a MESA I millirem meter or similar instrument. The data will be converted to microrems and plotted on a map of the wellfield.

5.2 Operational Monitoring

Operational monitoring programs include sampling and monitoring programs for gaseous effluents, liquid effluents, and solids which could potentially result in release of contaminates to the environment.

5.2.1 Gaseous Effluents

Since only liquids are brought to the surface during solution mining, the only gaseous effluents of significance are the release of radon-222 from the produced solution and limited vapors emitted in the process plant. Control and monitoring for these parameters in the recovery plant are discussed in Chapter 9 of this document.

Some radon will be released from the leaching solution and will be vented from the building to the atmosphere. Based on the pilot experience, Table 5-2, the release will be relatively small and potential exposures would be well below allowable limits. To monitor for radon and ensure the releases are not significant, a continuous passive radon monitoring station will be established approximately 1000 feet down wind of the recovery plant buildings. The radon sensor chip will be removed and sent in for analysis quarterly.

5.2.2 Wellfield Monitoring

During operation, the primary purpose of the wellfield monitoring program is to detect and correct any condition which could lead to an excursion of leaching solution or detect such an excursion should one occur. The systems employed to achieve this objective are the monitor wells, recording individual well rates and pressures, and monitoring the flow and pressure in the main pipelines to and from the recovery plant.

To ensure the leaching solutions are contained within the designated area of the aquifer being mined, the production zone, overlying aquifer, and underlying aquifer monitor wells will be sampled twice per month at approximately two week intervals (but not less than 10 days apart) and the samples will be analyzed for and compared against

the excursion parameter UCL values. The excursion parameters shall be chloride, specific conductance and total alkalinity. In addition, the fluid level in each monitor well will be measured and recorded prior to each sampling and reported to the DEQ with the water quality analytical reports. Water levels will not be used as an excursion indicator.
If indications of leach solution appear in any of the monitor wells, the production and injection rates will be adjusted as needed to move solutions back to the wellfield production area. If any two or more excursion parameters exceed the upper control limits (UCLs) then the analysis will be repeated within twenty-four hours of receipt of analytical data. If the second analysis does not indicate that the UCLs have been exceeded, another sample will be collected within forty-eight hours of receipt of the second sampling data. If neither the second or third analyses indicate excess of the UCLs were exceeded, the first sample shall be considered in error. If confirmed by the second or third analysis, the well will be considered on excursion status and this fact will be reported by telephone to the WDEQ within 24 hours. RAMC will immediately implement a fluid recovery (pump back) plan for that area as soon as possible. The sampling frequency of the affected wells will be increased to weekly until the excursion is controlled. If the excursion lasts for more than thirty days a suite of WDEQ Guideline 8 parameters will be analyzed. In the case of a confirmed excursion, a suite of WDEQ Guideline 8 parameters will be analyzed at the time the UCLs are no longer exceeded.

A written report to NRC and DEQ will be completed within seven days of confirming an excursion describing the conditions, corrective action taken, and results obtained. Progress reports will be submitted to NRC and DEQ monthly until the monitor well(s) are no longer on excursion status. A final report submitted within thirty days after the excursion is terminated will summarize the excursion data including at

least two separate samples taken before and after the excursion.

If corrective actions are not effective in controlling the excursion within sixty days of confirming an excursion, injection of leach solution in the adjacent injection wells will be suspended until a definite decline trend in the concentrations of the excursion parameters that exceed the UCL values is established. After a decline trend is established, injection in the area may be resumed; however, the production and injection rates will be regulated such that the net withdrawal is sufficient to maintain the decline trend. After all parameters in the well(s) on excursion have been reduced to below the UCL values, a final report will be submitted and normal operations resumed.

The pressures and flow for each operating well in the wellfield will be read and recorded each day. These data will be used in evaluating the production-injection balance for the wellfield and ensuring a net bleed is maintained and that the injection pressure limits are not exceeded.

5.2.3 Pipeline Monitoring

Pressure and flow indicators on the main pipelines to and from the recovery plant will also be read and recorded daily to ensure the pressures and flows are maintained within the safe working limits of the pipeline.

5.2.4 Liquid Effluents

The liquid effluent streams to be monitored during operations include the bleed stream (combination bleed/restoration during restoration) and the liquids routed to the lined evaporation ponds or disposal well. The bleed stream volume will be metered and will be sampled monthly. The bleed stream sample will be analyzed for bicarbonate, chloride, sodium, sulfate, uranium, arsenic, selenium and pH.

If the restoration liquids are to be discharged under the NPDES permit, the restoration bleed stream will be metered and sampled monthly. Only water meeting the limitations in the NPDES permit will be discharged. The restoration effluents will be sampled for bicarbonate, chloride, sodium, sulfate, uranium, arsenic, selenium and pH. Prior to mixing with other water, the fluid will have been routed through an IX column to remove uranium and treated in a separate system to reduce the radium-226 to meet permit levels. The restoration stream leaving the radium removal system will be sampled quarterly and analyzed for radium-226, thorium-230 and uranium.

The liquid effluent to the lined evaporation ponds or for irrigation will be metered and the solutions in each pond will be sampled semi-annually and analyzed for bicarbonate, calcium, chloride, sodium, sulfate, TDS, uranium, radium-226, and thorium-230.

In the initial operations for the "O" sand pilot, the bleed waste stream will be mixed with other process waste waters and be sent to the deep disposal well. All sampling of this stream will be done in accordance with the deep disposal well permit issued to the Smith Ranch Project.

Surface water is monitored downstream of the recovery facility for potential liquid effluents. This monitoring is performed on Sage Creek on an annual basis if water is present and is required under the NRC Source Material License and 10 CFR Part 40.65. Additionally, in compliance with the general stormwater discharge permit (WYR000648), quarterly sampling of water in the drainage immediately downstream of the recovery facility is performed. The sampling is reported to WDEQ - Water Quality Division, and is monitored for Total Suspended Solids (TSS), Chemical Oxygen Demand (COD), and Nitrate plus Nitrogen.

5.2.5 Lined Evaporation/Treatment Ponds

Each lined evaporation or treatment pond will be constructed with a leak detection system consisting of a network of perforated pipes in a sand layer beneath the liner with the pipes draining to a collection sump. Should a leak in the liner occur, the water will flow through the sand, enter a perforated pipe, then flow to the sump, which is normally a six-inch to twelve-inch diameter pipe. The monitoring program for the lined ponds will include either a fluid level sensor in each pond sump with an alarm displayed at the recovery plant or a daily inspection of each sump by an operator. The evaporation ponds will also be inspected daily for visual indications of leaks or embankment deterioration by an individual instructed in proper inspection procedures. The pond inspections shall be recorded and initialed by the inspector.

If six inches or more of fluid is detected in any leak detection system sump, it will be sampled and analyzed for chloride and specific conductance. If analyses indicate a pond leak, and the analyses are confirmed, the appropriate agencies will be notified by telephone within forty-eight hours of receiving the confirming analyses and the water

level in the pond with the indicated leak will be lowered by transferring the contents to another cell. If water continues to flow to the sump, samples will be collected every seven days and analyzed for chloride and specific conductance. Once per month a sample will also be analyzed for bicarbonate, uranium, and sulfate. A written report will be filed with the appropriate agencies within thirty days of the notification of the suspected leak and every thirty days thereafter until the leak is repaired. The reports will include the available analytical data, the corrective actions taken, and results of the actions.

A freeboard of at least three (3) feet will be maintained in each pond to prevent loss of solutions by wave action and to allow for holding the contents of another pond on a temporary basis in the event of a leak.

5.2.6 Solids Monitoring

Non-radioactive solid wastes such as rags and packing material will be disposed in the existing solid waste disposal facility. Monitoring of this facility consists of non-scheduled inspections to ensure the materials are being properly covered to prevent paper, etc. from being blown out of the disposal pit.

Solids suspected of being potentially radioactive will be scanned and any found to have a contamination level requiring controlled disposal will be placed in drums or other suitable containers and stored in a designated area. Final disposal of these materials to an NRC licensed facility will be documented.

5.2.7 Documentation and Reporting of Monitoring Activities

Documentation of the above monitoring when specified will be maintained on site with records kept for a minimum of five years. Results of the monitor well sampling program, bleed stream sampling, evaporation pond samples, etc. will be included in the annual report to be submitted to NRC and DEQ.

5.3 Environmental Water Sampling Procedures

5.3.1 Monitor Well Sampling Procedure

The monitor wells are used to ensure solution confinement during mining. Wells are spaced in a circular pattern around the mining area, and within the overlying and underlying aquifers.

All monitor wells will be sampled twice per month; however, in the event of an excursion, the sampling frequency for the affected monitor well(s) will increase to once every seven (7) days until the excursion has been corrected as described in Section 5.2.2.

Each monitor well will be equipped with a downhole pump and the pump discharge will be at the well head or piped to a monitor well header in the wellfield header house. The monitor well header will be equipped with a flow meter and totalizer to measure the amount of water pumped from a well prior to collecting a sample. Each monitor well coming into the header will be individually controlled with an ON-OFF control switch on the motor control panel and each line will have a valve where the samples are collected manually. For wells not connected to a header house a portable generator and temporary meter will be used to collect the sample.

Prior to collecting a sample to assure that formation water is being sampled, three casing volumes will be evacuated from the well. Prior to the removal of the third casing volume, the operator will begin monitoring pH and conductivity of the water being evacuated. These readings will be taken until the well stabilizes. The well will be considered stabilized when three consecutive readings, taken within no less than ten minutes have been recorded and are within 20% of each other. Once the well has stabilized the sample will be collected.

Water level measurement will be taken with an electric sounder. The water levels are to be recorded to the nearest 0.1 feet. The surface reference point is the top of the casing and the water level is reported as feet A.M.S.L.

5.3.2 Evaporation Pond sampling Procedures

5.3.2.1 Safety Precautions

Company furnished coveralls, rubber boots and gloves, as well as a life preserver belt, will be worn while obtaining samples from evaporation ponds. Any pond fans or sprinklers are to be turned "off" before sampling. The sample is to be obtained using a plastic pail tied to a line of sufficient length to reach the ponds fluid from an anchored position on the berm. On completion of sampling, personnel shall scan themselves for possible contamination.

5.3.2.2 Evaporation Pond Samples

The evaporation ponds are to be sampled on a semi-annual basis. The samples will be field preserved and analyzed in accordance with "Standard Methods for the Examination of Water and Wastewater," 19th

Edition, APHA-AWWA-WPCF, 1995. As stated previously in section 5.2.4, each pond sample will be analyzed for bicarbonate, calcium, chloride, sodium, sulfate, TDS, uranium, radium-226 and thorium-230.

5.3.2.3 Leak Detection System Samples

Each cell of the evaporation pond is equipped with a leak detection system. This consists of a buried perforated PVC pipe under the pond liner connected to a collection sump. Routine inspection of the sumps for the presence of liquid and of the pond embankments for problem areas is required. The inspection shall be recorded and signed by the inspector in the inspection log book.

If six inches or more of fluid is found in a sump, a one (1) liter sample is to be collected, labeled, dated and sent to a lab for analysis. The inspector is to also initiate the following:

(1) Notify the Plant Supervisor, Project Superintendent or Radiation Safety Technician.

(2) Measure the fluid level in the sump and record the level and time of the reading.

(3) Turn off all discharges to the cell where the leak is indicated. If the fluid level in the sump is high or rising rapidly, obtain a pump and begin pumping water from the sump to another cell.

(4) If it is determined from the quality of the water that a leak exists, samples shall be collected at 7 day intervals from the sump(s) and sent to the lab. Sampling at 7 day intervals will

continue until the leak is repaired and for a minimum of two weeks after repair.

5.3.3 Bleed Stream Sampling Procedure

The production bleed waste water will be generally routed to the permitted deep disposal well, along with other waste streams from the process. All sampling will be done in accordance with the deep disposal well permit issued to the Smith Ranch Project. Bleed may also be routed to lined evaporation ponds. The fluids will then be sampled as is described in Section 5.2.4.

5.3.4 Wildlife Monitoring Program

Baseline wildlife inventories have established the presence and population of wildlife in the area. Operational monitoring is discussed in Appendix D-9, Wildlife Monitoring and Protection Plans, of this application.

5.4 Environmental Radiological Monitoring Program

RAMC will conduct a detailed sampling program to monitor any radiological releases from the Smith Ranch operations to the environment. The program will involve the monitoring of air, groundwater, surface water, soils, vegetation, direct radiation and effluents from the yellowcake vacuum dryer stacks. The program is designed to meet the requirements of NRC's 10 CFR 40.65.

Table 5.3 provides the details of the environment radiological monitoring program proposed for the Smith Ranch. Figure 5-1 shows the locations of the proposed sample locations as defined in Table 5.3.

The results of this environmental effluent monitoring are reported semi-annually to the NRC as required under 10 CFR 40.65. A copy of this report will be provided to the WDEQ/LQD.

5.5 Environmental Reporting Requirements

5.5.1 Pre-operational Data Collection Reporting Requirements

A minimum of 60 days prior to injection of leach solutions in the subject wellfield, baseline data as described in Section 5.1 shall be submitted to WDEQ and NRC. No injection will begin without the approval from WDEQ. (moved from section 5.1)

5.5.2 UIC Reporting Requirements

RAMC will submit on a quarterly basis the results of the Mechanical Integrity testing for injection and production wells in each wellfield. In addition RAMC will also submit the monitor well water quality data and water levels quarterly.

5.5.3 Spill Reporting Requirements

Any spill which enters a water of the state, any spill in excess of 420 gallons or any spill that threatens to enter a water of the state, comprised of lixiviant, pregnant liquor, acid, solvent, process waste water or any similar stream shall be reported to DEQ/WQD and DEQ/LQD within 24 hours of the incident followed with a written report within 7 days. For purposes of this document, a water of the state includes dry draws, playas, and wetlands, as well as streams, rivers and lakes.

All reportable spills will be recorded in a spill log or file located at the facility. The NRC will be notified within 48 hours for all significant spills that may have a radiological impact on the environment, and such notification shall be followed within 7 days with a written report. A significant spill of radiological impact can be defined in two ways. 1.) the level of radiological contamination exceeds the decommissioning standard for the top 15cm of soil as described in 10 CFR Part 40 Appendix A Criterion 6(6); or 2.) a release of source or byproduct material to the environment outside of a controlled area as defined in 10 CFR 20.1003.

NRC and WDEQ will be notified immediately by telephone of any release which results in a significant uncontrolled release of radioactive material or conditions which, if not corrected, could lead to such a release. A release from an evaporation pond failure, break or rupture of the pipelines between the well field and recovery plant, or some similar feature could result in such a release. A written report detailing conditions leading to the incident, corrective actions taken, and results achieved shall be submitted within seven (7) days.

5.5.4 Excursion Reporting Requirements

If analyses confirm a monitor well is identified to be on excursion through the appropriate monitoring as outlined in Section 5.2.2, WDEQ will be notified by telephone within 24 hours of receipt of the confirming data. A written report to NRC and WDEQ will be completed within seven days of confirming an excursion describing the conditions, corrective action taken, and results obtained. Progress reports will be submitted to NRC and DEQ monthly until the monitor well(s) are no longer on excursion status. A final report submitted within thirty days after the excursion is terminated will summarize the excursion data

including at least two separate samples taken before and after the excursion.

5.5.5 Evaporation Pond Leak Reporting

If analyses indicate a pond leak, and the analyses are confirmed, the appropriate agencies will be notified by telephone within forty-eight hours of receiving the confirming analyses. A written report will be filed with the appropriate agencies within thirty days and every thirty days thereafter until the leak is repaired. The reports will include the available analytical data, the corrective actions taken and results of the actions.

TABLE 5-1

GROUNDWATER SAMPLING PROGRAM RECOMMENDATIONS

MONITORED CONSTITUENT	SAMPLE TYPE	SAMPLE FREQUENCY	DENSITY	ANALYSIS
Monitor Wells: (Perimeter Ore Zone Upper and Lower Aquifers)	Baseline	4 Samples no less than 12 days apart	All Monitor Wells	One Sample- Assay Suite A[1] Two Samples - Assay Suite B[2] One Sample - Assay Suite B plus any detects from suite A
Monitor Wells: (Perimeter Ore Zone Upper and Lower Aquifers)	Operational Monitoring	Twice Per Month (10 Days or More Between Samples)	All Monitor Wells	Assay Suite C[3]
Mining Unit Wells: (Ore Zone)	Baseline	4 samples no less than 12 days apart	Ten Wells for the first 10 acres plus 1 well for each 2 acres thereafter.	Two Samples - Assay Suite A[1] Two Samples- Assay Suite B[2]

[1] Assay Suite A = Wyoming Department of Environmental Quality, Land Quality Division Guideline No. 8 - Table 1. (Dec., 1990) suite of parameters plus uranium, vanadium, radium 226, and ***radium 228***.

[2] Assay Suite B = TDS, SO4, Cl, pH, As, Se, U, Ra-226, ***Ra-228,*** conductivity and Total Alkalinity.

[3] Assay Suite C = Cl, Conductivity, Total Alkalinity

Table 5-2

BOUNDARY RADON-222 & GAMMA SURVEY DATA
Q-SAND AND O-SAND PILOT PLANT
CONVERSE COUNTY, WYOMING

	Average Radon-222 pCi/l (in Air)		Direct Gamma μR/hr	
	Upwind Location	Downwind Location	Upwind Location	Downwind Location
Baseline	1.1	1.3	-	-
1st Qtr. 1982	0.4	0.7	6	6
2nd Qtr. 1982	0.6	0.3	20	30
3rd Qtr. 1982	0.5	0.8	20	26
4th Qtr. 1982	1.5	2.1	20	25
1st Qtr. 1983	0.8	0.8	20	22
2nd Qtr. 1983	1.0	0.7	20	22
3rd Qtr. 1983	0.2	0.3	21	23
4th Qtr. 1983	0.2	0.2	21	25
1st Qtr. 1984	0.3	0.2	20	26
2nd Qtr. 1984	0.4	0.8	20	24
3rd Qtr. 1984	0.4	0.9	20	24
4th Qtr. 1984	0.5	0.6	16	19
1st Qtr. 1985	0.8	0.7	16	11
2nd Qtr. 1985	0.9	1.0	14	12
3rd Qtr. 1985	(4)	(i)	14	12
4th Qtr. 1985	(5)	0.7	11	14
1st Qtr. 1986	-	0.7	12	25
2nd Qtr. 1986	-	1.0	12	16
3rd Qtr. 1986	-	1.2	14	16
4th Qtr. 1986	-	0.5	20	20
1st Qtr. 1987	-	0.3	11	14
2nd Qtr. 1987	-	1.2	11	14

[4] Contractor terminated service; license amendment terminating requirement requested.

[5] Deleted per License Amendment No. 14 (SUA-1387)

TABLE 5-3

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM
(10 CFR§40.65)

Type of Sample	Sample Collection					Sample Analysis
	Number	Location	Method	Frequency	Frequency	Type of Analysis
AIR						
Particulates	Three	Nearest Downwind Resident (Vollman Ranch)	Continuous air sampler	filter changes monthly	Quarterly composite of filters	Natural Uranium Thorium-230 Radium-226, Pb-210
		Downwind Restricted Area Boundary (Fence Line)	Same	Same	Same	Same
		Upwind Control (Dave's Water Well)	Same	Same	Same	Same
Radon	Three	Same as for Particulates	Continuous (Terradex cups)	Quarterly	Each Sample	Rn-222
WATER						
Groundwater	(Progresses with Operations)	Operating Livestock or domestic wells within 1 km of operating wellfields	Grab	Quarterly	Each Sample	Natural Uranium Ra-226
Surface Water	Two from Sage Creek	One upstream, one downstream from restricted area (when flow is available)	Grab	Quarterly	Each Sample	Natural Uranium Ra-226
	One	Outfall from treatment plant	Grab	Same	Each Sample	Same

TABLE 5-3 (Continued)

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM
(10 CFR§40.65)

Type of Sample	Sample Collection					Sample Analysis
	Number	Location	Method	Frequency	Frequency	Type of Analysis
SOIL	One	Downwind restricted area air sampling station	Grab	Annual	Annual	Natural Uranium Ra-226, Pb-210
VEGETATION	One	Animal grazing areas in direction of prevailing wind	Composite of dominant vegetation present	Annual	Annual	Natural Uranium Ra-226, Th-230 Pb-210
DIRECT RADIATION	Three	Air sampling stations	Continuos (dosimeter)	Quarterly	Each TLD	Gamma Exposure rate, μR/hr
	One	Evaporation pond area, downwind	Same	Same	Same	Same
	One Each	Mining Units	Same	Same	Same	Same

Reference: Figure 5-1

OVERSIZE PAGE(S)

****

NOT CONVERTED INTO ELECTRONIC IMAGE FORM.

****

PAPER COPY IS AVAILABLE IN NRC FILE CENTER.

CHAPTER 6
RECLAMATION PLAN

The objective of the reclamation plan will be to return the affected surface and groundwater to conditions such that they are suitable for uses for which they were suitable prior to mining. The methods to achieve this objective for both the affected groundwater and the surface are described in the following sections.

6.1 Groundwater Restoration

6.1.1. Water Quality Criteria

To achieve the objective stated above, the primary goal of the restoration program will be to return the condition and quality of the affected groundwater in a mined area to background (baseline) or better. In the event the primary goal cannot be achieved, the condition and quality of the affected groundwater will at a minimum be returned to the pre-mining use suitability category (Reference: LQD Rules and Regulations, Chapter XXI, Section 3 (d) (I)).

For the purposes of this application, the use categories are those established by the Wyoming Department of Environmental Quality, Water Quality Division. The final level of water quality attained during restoration is related to criteria based on the pre-mining baseline data from that wellfield, the applicable use suitability category and the available technology and economic. Baseline as defined for this project shall be the mean of the pre-mining baseline data, taking into account the variability between sample results (baseline mean plus or minus tolerance limits, as defined in Section 5.1.2, after outlier removal).

6.1.2 Restoration Criteria

The restoration criteria for the groundwater in a mining unit will be based on the mining unit production-injection wellfield as a whole, on a parameter by parameter basis. All parameters are to be returned to as close to baseline as is reasonably achievable. Restoration target values shall be established for all parameters affected by the mining process. The restoration target values for the mining units shall be the mean of the pre-mining values. If during restoration, the average concentration of a parameter in the designated production area wells of a mining unit is not reduced to the target value within a reasonable time, a report describing the restoration method used, predicted results of additional restoration activities, and an evaluation of the impact, if any, that the higher concentration has on the groundwater quality and future use of the water will be prepared and submitted to the applicable regulatory agencies.

6.1.3 Restoration Method

The primary restoration technique will be a combination of groundwater sweep and clean water injection, the technique used in the successful restoration of the Q-Sand pilot wellfield. Groundwater sweep involves withdrawing water from selected production and injection wells which draws uncontaminated natural groundwater through the leached area displacing the leach solutions. Clean water injection involves the injection of a better quality of "clean" water in selected wells within the production area while pumping other production and/or injection wells which again displaces the leach solutions with the better quality water. The source of the clean water may be from an EDR or RO type unit, water produced from a mining unit that is in a more advanced state of restoration, water being exchanged with a new mining unit being

placed in operation, or a combination of these sources. Water withdrawn from the production zone during restoration will first be processed through an ion exchange unit to recover the uranium, then will be treated and reused in the project, treated and discharged under the existing NPDES permit, or routed to a holding pond for future treatment and/or disposal.

It is expected that an average of about six pore volumes of water will have to be displaced to achieve restoration of a mining unit. During restoration of the initial mining units, it is expected that near the midpoint of the process a chemical reductant will be added to approximately one pore volume of clean water injection to accelerate stabilization of trace metals.

Chemical reductants are beneficial because several of the metals, which are solubilized during the leaching process, are known to form stable insoluble compounds, primarily as sulfides. Primary among such metals is uranium, which occurs at the site because of the naturally occurring reduced state of the ore body. The introduction of a chemical reductant into the mine zone at the end of mining phase is designed to expedite the return of the zone to its natural conditions and to return as many of the solubilized metals to their original insoluble state as possible. By effecting this partial restoration directly within the formation (in-situ), the external impact of groundwater restoration is minimized.

The chemical reductant would be added above ground to the clean water stream being injected into selected wells. Based on the historical success reported by other ISL uranium mining companies, the reductant would be a sulfur compound such as gaseous hydrogen sulfide (H_2S) or dilute solutions of sodium hydrosulfide (NaHS) or sodium sulfide (Na_2S). If RAMC should desire to utilize any reductant other than these three

sulfur compounds, DEQ approval will be obtained prior to use. Dissolved metal compounds that are precipitated by such reductants include those of arsenic, molybdenum, selenium, uranium, and vanadium. All of these may be present in concentrations above baseline levels at the conclusion of mining.

The reductant would be introduced during the midst of the restoration process because the introduction of sulfur and sodium increases the total dissolved solids (TDS) level of the injected fluid. once the reducing conditions are re-established, an oxygen free clean water can be injected to effect the final reduction in TDS.

If gaseous hydrogen sulfide is chosen for use, a program for its safe handling would be prepared and submitted to the appropriate agency prior to its use.

6.1.4 Restoration Sampling

When sampling results indicate that restoration has been achieved, the designated production area wells will be sampled and analyzed for the full suite of parameters listed in Table 5-1 as Suite A. If the data confirm restoration is complete this will initiate the stability demonstration period. In the stability demonstration period the full suite assays will be repeated for those same wells at approximately the six month and one year periods. Between these periods the wells will be sampled at six week intervals with the samples analyzed for a short list of key parameters developed for that specific mining unit. The short list of key parameters will be submitted to and approved by WDEQ/LQD in advance of its use. This sampling plan will provide for a minimum of nine samples within a one year period to demonstrate restoration success.

When the sampling data indicates that the mining unit aquifer has been restored and stabilized, a report documenting this will be filed with the appropriate regulatory agencies along with a request for certification of restoration. Plugging of wells and surface reclamation of the mining unit will commence after receipt of restoration certification.

During restoration, sampling of monitor wells for that mining unit will continue at the same frequency and for the same parameters as during mining. However, during stability monitoring the monitor well sampling frequency will be reduced to only once every two months and the sampling will be terminated at the end of the stability demonstration period. Unless requested otherwise and approved by the applicable regulatory agencies, the production area wells in a mining unit to be sampled for determining restoration and stability shall be wells used for collecting pre-mining baseline data for that unit.

6.1.5 Well Plugging Procedures

Wells no longer needed for operations or restoration and stability demonstration will be plugged in accordance with the guidelines and requirements established by the Wyoming Department of Environmental Quality. The pumps and tubing will be removed from the wells and each well will be filled from total depth to within five feet of the surface with a DEQ approved abandonment mud or a cement slurry. Typically, a dual plug procedure will be used, whereby a cement plug will be set using a slurry of a weight of no less than 12 lb/gal into the bottom of the well which will extend across and 50 feet above the first overlying aquitard. The remaining portion of the well will be plugged using a bentonite/water slurry with a mud weight of no less than 9.5 lb/gal. A

10-foot top plug of cement slurry will be set 3 feet below the surface to seal the well at the surface, and prevent surface water intrusion into the well. The casing will then be cut off a minimum of two feet below the surface and a cement plug will be placed at the top of the casing. The area will then be backfilled, smoothed to blend with the natural terrain, and reclaimed per the approved surface reclamation plan.

6.2 Surface Reclamation and Decommissioning

6.2.1 Introduction

All lands disturbed by the mining project will be returned to their pre-mining land use of livestock grazing and wildlife habitat unless an alternative use is justified and is approved by the state and the landowner, i.e. the rancher desires to retain roads or buildings. The objectives of the surface reclamation effort will be to return the disturbed lands to production capacity of equal to or better than that existing prior to mining. The soils, vegetation and radiological baseline data will be used as a guide in evaluating final reclamation.

An exception to the above will be the reclamation of any surface disturbance created by RAMC on Glenrock Coal Company's reclaimed surfaces within RAMC's permit boundary (T35N, R75W; Sections 13, 18 and 24). Specifically, if disturbed by RAMC, RAMC will reclaim these previously reclaimed areas to coal standards as specified in Glenrock Coal Company's Permit to Mine No. 291.

6.2.2 Surface Disturbance

The primary surface disturbances associated with solution mining are the sites for the recovery plant and evaporation ponds. Surface disturbances also occur during the well drilling program, pipeline installations, road construction. These disturbances, however, involve relatively

small areas or have very short-term impacts.

The recovery plant will be located within the Bill Smith Mine site, therefore plant construction will not create any new disturbance areas. Disturbances associated with the evaporation ponds, ion exchange satellites and field header buildings, will be for the life of those activities and topsoil will be stripped from the areas prior to construction. Disturbance associated with drilling and pipeline installation will normally be limited, and will be reclaimed and reseeded in the same season. Vegetation will normally be reestablished over these areas within two years. Disturbance for access roads will be also limited as a network of roads is already in place to most of the well field areas and throughout the project area.

The on-site construction waste landfill site will be closed in a manner that is consistent closure requirements for Construction/Demolition Landfills provided in the WDEQ Solid and Hazardous Waste Rules and Regulations. All current and closed disposal cells located onsite have been or will be closed with six (6)-inch evenly compacted soil cover and a 3 feet of loose soil cover. Any newly constructed construction and demolition waste disposal landfill will be closed in a similar manner as the existing landfill.

6.2.3. Topsoil Handling and Replacement

For any construction, soil will be removed and salvaged. The soil disturbances caused by the mining operation will be kept to a minimum especially in areas of steep terrain. No new surface disturbance will be required for the recovery plant as the facility will be located in the site used for the Bill Smith Mine. Topsoil from the mine site was stockpiled and the piles have been seeded with a cover crop to control erosion. Topsoil from future disturbance areas such as evaporation

ponds, will be removed and stockpiled. The stockpiles will be located, shaped, seeded with a cover crop and crimp mulched to minimize loss to erosion. Topsoil signs will also be placed on each topsoil stockpile.

Within the well fields, topsoil from the A and E horizons , or in areas where the A and E horizons are less than 4 to 6 inches, no less than the top 4 to 6 inches of soil will be removed from new access roads to the header houses and from any other roads that will be used during production that are not considered light use roads and will be stockpiled. The depth of the A and E horizons may be determined using drill pits adjacent to the areas to be stripped. A record of the depth stripped will be maintained at the site and included in the annual report, to demonstrate that appropriate care was taken in stripping topsoil. In addition topsoil from well header building sites will also be stockpiled as discussed above. If unanticipated high traffic roadways are developed, the topsoil on such roadways would be subject to the same program of removal, stockpiling, seeding and mulching to control erosion. For areas where only limited temporary disturbance occurs, such as for well sites and pipeline construction, the topsoil will be bladed to one side and then re-spread over the area as soon as construction is completed. These areas will be stubble mulched as soon as practical. If topsoil stockpiling or re-topsoiling of an area is completed in the winter or spring, a stubble crop of oats will normally be planted with the final grass seed mix or a long-term cover seed mix planted in the stubble in the fall. The long term cover crop seed mix is discussed in Section 6.2.4. The long-term cover grass mix will be used to protect topsoil stockpiles and/or re-topsoiled areas which are expected to remain in place for longer than one (1) year prior to final seeding. These practices which were tested and proven effective in the pilot programs, will provide the needed protection for the topsoil and will minimize losses to wind and water erosion. Topsoil will not be placed in draws or areas where it will erode into drainages. If

necessary, a containment barrier will be constructed to ensure the topsoil will not erode into drainages.

Additional measures taken to protect the topsoil in the well field areas will be to restrict normal traffic to designated roads and keep required traffic in other areas of the well field to a minimum. Disturbed areas in a well field not needed for normal access will be seeded with a cover crop as soon as practical to minimize erosion.

After contouring for final reclamation has been completed, the remaining access roads or hard packed areas will be ripped prior to topsoiling. Topsoil will then be spread evenly over the disturbed areas and will be seeded with a cover crop of oats. Final contouring will blend with the natural terrain and will establish drainage and eliminate depressions that would accumulate water.

6.2.4. Revegetation Practices

During mining operations the topsoil stockpiles, and as much as practical of the disturbed well field and pond areas will be seeded with a cover crop to minimize wind and water erosion. After topsoiling for the final reclamation, an area will normally be seeded with oats to establish a stubble crop, then reseeded with grasses the next growing season using the following mix of pure live seed:

	lbs/acre
western wheat grass (Rosana)	3.0
Streambank wheatgrass	3.0
canby bluegrass	1.0
Sheep Fescue(Covar)	2.0
Indian rice grass	2.0
Yellow blossom Sweet Clover	0.5
winterfat	2.0
Lupine (candatus)	1.0
Total	13.5

Note: Quantity to be doubled for broadcast seeding for all species except Streambank wheatgrass and Yellow sweetclover

Alternate Species, if any of the species listed above are not available, are as follows:

prairie junegrass	0.5
green needlegrass	2.0
Blue Flax	1.0
Other Lupines	1.0
scarlet globe mallow	1.0
prairie sandreed	2.0

Reseeding will normally be accomplished by broadcasting seeding or drilling with seeding completed before May 1 or after October 15, during the year in which the topsoil is replaced. The area will then be harrowed or raked.

Vegetation in larger reclaimed areas will be protected from livestock grazing by fencing the livestock out until the newly established plant community is capable of maintaining itself under normal management practices. No major attempt will be made to exclude wildlife; type III livestock fencing will be used. (see figure 6-1)

Periodic inspections of the newly reclaimed areas will be made within the first two growing seasons to check and record the success and progress of the reseeded plant community. Data collected during these inspections will be used to determine when the reseeded areas will be ready to sustain controlled livestock grazing and for the final evaluation of reclamation success.

Criteria for determining the success of the reclamation efforts will include 1) post-mining vegetation cover and production equal to that on an appropriate comparison area, 2) species composition and

diversity capable of supporting the planned post-mining use, and 3) a reclaimed vegetation community able to sustain grazing pressure at a rate equal to that of the surrounding native areas. All of the above will be achieved for a period of two consecutive years prior to full bond release.

Livestock grazing is critical to full bond release, however, unrestricted grazing at the wrong time could ruin revegetation efforts. Therefore, the determination of when and how domestic livestock grazing will be introduced on the revegetated areas will be mutually agreed upon by RAMC, the Land Quality Division and the landowner or land managing agency. The grazing plan agreed upon will include aspects of controlled grazing practices such as timed grazing, as well as limited and well distributed livestock numbers, so that newly reclaimed areas are not over-utilized. The limited and controlled amount of grazing may occur during the two consecutive years of evaluation prior to full bond release, but will be timed so that vegetation production data are not compromised by the grazing. Production estimates on the newly revegetated areas will be made using livestock exclosures, which also will assure that grazing practices will not compromise the annual biomass evaluation.

An extended reference area will be established which will include the primary vegetation types to be disturbed. The purpose of this area will be to establish a reference area as a source of quantitative data to be used for comparative purposes at the time of final bond release. The location of this site(s) will be mutually agreed upon by DEQ-LQD and RAMC.

6.2.5 Site Decontamination and Decommissioning

When groundwater restoration in the final mining unit is completed, decommissioning of the recovery plant site and the remaining evaporation ponds will be initiated. In decommissioning the recovery plant, the process equipment—will be dismantled and sold to another licensed facility or decontaminated in accordance with "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct or Source Materials - September, 198411 published by U.S. NRC. Materials that cannot be decontaminated to an acceptable level will be disposed in an NRC licensed facility. After decontamination, materials that will not be reused or that have no resale value, such as building foundations, will be buried on-site.

The plant site will then be contoured to blend with the natural terrain, surveyed to ensure gamma radiation levels are within acceptable limits, topsoiled, and reseeded per the approved reclamation plan.

After all liquids in an evaporation pond have evaporated or been disposed in a licensed facility, the precipitated solids and the pond liner will be removed and disposed in a licensed facility. The area will then be contoured to blend with the natural terrain, surveyed to ensure gamma levels are not exceeded, then topsoiled and reseeded per the approved plan.

Gamma surveys will also be conducted during the decommissioning of each mining unit. Material identified during the gamma surveys as having contamination levels requiring disposal in a licensed facility will be removed, packaged (if applicable), and shipped to an NRC licensed facility for disposal.

6.2.6 Final Contouring

Recontouring of land where surface disturbance has taken place will restore it to a surface configuration that will blend in with the natural terrain and will be consistent with the post mining land use. Since no major changes in the topography will result from the proposed mining operation, a final contour map is not included in the application.

6.2.7 Reclamation Cost Estimate

A detailed reclamation cost estimate has been prepared for all aspects of the project for the period of 1999 to 2000 as part of the proposed bond in June 1999. The attached tables describing the bond calculations represents only the most current version for review within the context of this license/permit application. The bond and detail amounts will be updated by Rio Algom and reviewed by the WDEQ and NRC on an annual basis.

The estimate includes the cost for reclaiming the existing disturbances such as the Bill Smith mine area and pilot ISL Q-Sand and O-Sand facilities, as well as proposed commercial scale facilities. The estimate includes a one-year forward estimate required by WDEQ for forecasted disturbances as well as a five-year forward estimate to cover all potential disturbances within the term of the NRC license. A 15 percent overall contingency has been applied to the total cost estimate, which is in 1997 dollars. The estimate will be updated on an annual basis for submittal to the WDEQ in the annual report. The estimate will also be provided to the NRC for their review. The reclamation cost estimate is summarized in Table 6-1, and is detailed in Appendices 1 through 11. A list of key details and assumptions used in the

reclamation estimate is provided as Table 6-2.

6.2.8 Reclamation Bonding

A reclamation bond will be maintained with the Wyoming Department of Environmental Quality - Land Quality Division, in the amount of the final approved reclamation cost estimate. In 1999, Rio Algom Mining Corp. currently maintains a self-bond in the amount of $8.029 million to cover existing liabilities at the Smith Ranch project. The surety mechanism to be used for the commercial estimate, which includes the existing liabilities, will either be a parental guaranty or letter of credit. RAMC will follow WDEQ and NRC guidelines when securing either the parental guaranty or letter of credit.

Table-6-1
WDEQ/NRC RECLAMATION SURETY
SMITH RANCH, CONVERSE COUNTY, WYOMING
RIO ALGOM MINING CORP.

1999-2000 PROPOSED WDEQ/LQD BOND

WORK UNIT	ONE YEAR FORWARD WDEQ/LQD & NRC 1999-2000 BOND AMOUNT
Ion Exchange Plant[1] (NRC Related Activity)	
Building	**40,116**
Tankage and Vessels	**39,913**
Piping	**13,224**
Pumps	**6,094**
Electrical	**9,470**
Foundations	**48,588**
Plant Site	**2,058**
Access Road	**1,054**
SUB-TOTAL	**160,517**
Central Processing Plant (NRC Related Activity)	
Buildings	**57,548**
Tankage and Vessels	**60,246**
Piping	**10,846**
Pumps	**10,965**
Electrical	**19,682**
Foundations	**69,719**
SUB-TOTAL	**229,006**
Dryer Area (NRC Related Activity)	
Buildings	**16,222**
Equipment	**14,739**
Foundations	**16,802**
SUB-TOTAL	**47,763**
Existing Facilities (NRC & WDEQ/LQD Related Activity)	
Buildings[2]	**95,635**
Structures[3]	**14,067**
Pilot Plant Equipment	**21,266**
Foundations[2]	**139,333**
Site Reclamation[2]	**105,785**
O-Sand Pilot	**41,435**
Q-Sand Pilot	**N/A**
Mine Water Treatment Ponds	**19,878**
SUB-TOTAL	**410,244**

WORK UNIT	ONE YEAR FORWARD WDEQ/LQD & NRC 1999-2000 BOND AMOUNT
Unit Header Site & Wellfields[4] (NRC & WDEQ/LQD Related Activity)	
Buildings	**57,932**
Header Piping	**102,289**
Secondary Electrical	**98,474**
Wells-Totals	**393,897**
Monitor Wells-Total	**54,230**
Site Reclamation	**37,111**
SUB-TOTAL	**743,933**
Associated Structures (NRC & WDEQ/LQD Related Activity)	
#1 Trunkline (5,000 ft ea)	**52,108**
#2 Trunkline (10,000 ft ea)	**104,216**
Radium Settling Ponds	**70,077**
Plugging & Aband. Disposal Well	**77,735**
Sand Mining Area	**13,173**
Land Fill	**1,500**
SUB-TOTAL	**318,809**
Groundwater Reclamation & RO Units (NRC & WDEQ/LQD Related Activity)	
Restoration	**2,771,087**
Health Physics and Radiation Surveys (NRC Related Activity)	
Monitoring	**168,470**
Whole Trucking (Remaining Fractional Units) (NRC & WDEQ/LQD Related Activity)	
Contaminated Trucking	**523**
Non-contaminated Trucking	**157**
Delineation Hole Reclamation (WDEQ/LQD Related Activity)	**396,808**
SUB-TOTAL OF ALL ABOVE	**5,247,317**
Overhead and Profit at 10%	**524,732**
Contingency at 15%	**787,098**
SUB-TOTAL OF ALL ABOVE	**6,559,147**
Inflation – 3.7% (4/97 CPI-160.2 through 5/99 CPI-166.2)	**242,688**
Restoration disposal capacity contingency[5]	**1,000,000**

WORK UNIT	ONE YEAR FORWARD WDEQ/LQD & NRC 1999-2000 BOND AMOUNT
TOTAL (in 1999$)	7,801,835
Current Bonding	8,029,100

(1) Represents the construction of one (1) satellite during 1997-1998 with another in 1999/2000.

(2) Incorporates new office annex building.

(3) Incorporates additional surface disturbances (10.46 acres) from commercial construction activities along with new items including fencing, water wells, and fuel storage area.

(4) Represents 1 year forward of 328 patterns to be restored.

(5) Represents costs expected to install additional disposal capacity to handle production flow and restoration capacity.

TABLE 6-2

LIST OF KEY DETAILS AND ASSUMPTIONS USED IN THE SMITH RANCH BOND ESTIMATE

1. The landfill for non-contaminated materials is the municipal landfill located in Casper, Wyoming. The landfill will be reached by an approximate 80 mile route through Douglas, WY, crossing the Platte River Bridge in Glenrock, WY.
2. The licensed disposal area for contaminated materials is Rio Algom's Quivira tailings facility, Ambrosia Lake, New Mexico, located approximately 800 miles to the south of the Smith Ranch project. This project is licensed by NRC Source Material License SUA-1473, which has been amended to allow the acceptance of byproduct materials from other licensees, including Smith Ranch.
3. All hourly labor costs are "loaded" costs and include a benefits burden.
4. All hourly equipment costs are loaded to include the operator, as well as a benefits burden.
5. References used for equipment rental rates, productivity, wages, etc. are as follows:

Equipment Rental Rates

- Russell Forgey Construction Co. - Casper, WY
  (307) 472-2173, Gail Beloon
- Petro Engineering & Construction, Inc. - Casper, WY
  (307) 234-6221, Mark Steinle - Project Manager

CY Transport - Casper, WY

(307) 266-1667

- Tri-State Trucking Company

Labor Rates

- Previous RAMC correspondence with WDEQ on 304C Annual Reports
- Northwinds of Wyoming, Inc.
  (307) 358-6550, Buck Underwood - President
- Automation Electronics - Casper, WY
  (307) 234-9311, Byron Stamm - President

General

- Richardson's Process Plant Construction Estimating Standards, 1987; Richardson Engineering Service, Inc., San Marcos, California.
- Means Site Work Cost Data, 1987; Construction Consultants and Publishers, Kingston, Maine.

6. Aquifer restoration of the "O" sand pilot will occur with the restoration of the first "O" sand commercial wellfield.

7. Building removal costs have all been factored from the actual cost and time involved in dismantlement and removal of a large building located at the 304C open pit mine area in 1988. An average cost of approximately $\$3.50/ft^2$ is derived when 10% for profit and overhead is added to the overall cost of the building reclamation,

then divided by the number of square feet of the building area. For example, the Appendix 1 building reclamation cost would amount to approximately $3.45 /ft2 if 10% for profit and overhead is added to the $36,174 total cost ($39,791), then divided by the 11,550 ft2 of building area. Appendix 2 building costs are $3.48/ft2 Appendix 3 - $3.55/ft2, and Appendix 4 - $3.63/ft2.

8. The basis for calculation of groundwater restoration costs is provided in Table 7.1, 7.2, and 7.3 of Appendix 7.

9. It has been assumed that 90% of all contaminated materials and equipment can be decontaminated to levels acceptable for unrestricted use or disposal. The exceptions to this are the yellowcake dryers, fluid ends of pumps, pond sludges and liners, and 3 inch diameter or smaller piping.

10. Decommissioning volumes for the tanks, vessels and other process equipment are based on actual engineered sizes planned for installation (see individual tables).

11. Wellfield patterns will be drilled approximately one year in advance of their proposed operation. Surface piping and pumps are not installed in the wells until the year of operation. In other words, the one year forward estimate in the Summary Table 61 includes the costs for plugging and abandoning 144 wellfield patterns, but no

costs are included for surface equipment or aquifer restoration.

12. For groundwater restoration, the following liabilities are assumed:

for any year, present liability is the sum of:

- patterns operating
- patterns depleted, awaiting restoration
- patterns in restoration
- patterns in stability

for any year, forward liability for the next year is:

new patterns placed in service during the next year less patterns completing stabilization during the next year

13. The initial IX plant will be located in the existing building adjacent to the central processing plant. The second IX satellite plant, planned for Section 27, will be placed in operation during the five-year forward period.

14. Surface reclamation costs (topsoil replacement and revegetation) are included in Appendix 4, Existing Disturbance, for the initial IX plant (Appendix 1), central processing plant (Appendix 2), and the dryer building (Appendix 3), as these are all existing buildings.

15. The tractor/trailer used for hauling non-contaminated materials is of a flatbed type with an attached crane, with load limit of 47,000#. The tractor/trailer used for hauling contaminated materials will typically be a closed van-type, with a load limit of 40,000#.

16. Increased Disposal Capacity for Restoration Bonding Amount: In a letter dated May 8, 1998 to WDEQ/LQD, RAMC committed to increasing the bonding amount for Permit #633 to reflect the installation of additional disposal capacity required for restoration. This commitment is a response to the first round comments for TFN 3 6/142 dated October 22, 1997. The comment was 0.3(c) regarding the water balance through the plant to include 6,000 gpm of production, the resulting bleed, and the ability to handle 1,000 gpm of restoration flow. The resulting water balance would be approximately 300 gpm of required wastewater disposal capacity. The current disposal well is permitted to accept a maximum average flow of 150 gpm. As RAMC receives approval to inject into Wellfield #3, the plant flow capacity will reach 6,000 gpm. In order to remain within the schedule presented in the mine plan, RAMC is currently evaluating methods of increasing disposal capacity to facilitate the restoration schedule. The additional disposal capacity can be in the form of a second waste disposal well, additional evaporation ponds, land application, discharge through the NPDES permit, or a combination of some or all of these methods. WDEQ requested that RAMC provide additional bonding to cover the costs of the additional disposal capacity. As a

result, the bonding will be increased by $1,000,000 to reflect the requirement to install a second waste disposal well or evaporation ponds to handle the additional water flows resulting from combined production and restoration operations.

Appendices - SURETY BOND DETAIL

This section presents the support details for the summary totals included in Table 6-1. Within this part, the bond detail is divided into ten (10) sections that encompass the mining activities at the Smith Ranch facility. These 10 divisions match each of the summary sections that are presented in Table 6-1.

These bond division areas include; ion exchange plants, central processing plant, dryer area, existing facilities, header sites and wellfields, associated structures, groundwater reclamation and RO Units, whole trucking, and delineation hole reclamation. The cost basis for these calculations are from contractor quotes. These quotes are presented in "Part III - Cost Basis".

(NRC Related Activity)

Appendix 1
ION EXCHANGE PLANT RECLAMATION COSTS
Cost Summary

ITEM	COSTS ($97)
1.1 Building	**40,116**
1.2 Tankage and Vessels	**39,913**
1.3 Piping	**13,224**
1.4 Pumps	**6,094**
1.5 Electrical	**9,470**
1.6 Foundations	**48,588**
1.7 Plant Site	**2,058**
1.8 Access Road	**1,054**
Total Cost	**160,517**

1.1 Building

Calculation Basis: 70 Ft. x 165 Ft. with 23 Ft. Eave
Floor Area = 11,550 Ft^2
Skin Area = 10,810 Ft^2

A. Washdown Building - 6 Days:
Wash 10,810 Ft^2 @ 1 Gal/Ft^2 = 10,818 Gal
Wash 10,810 Ft^2 @ 450 Ft^2/Man-Day = 24 Man-Days
= 6 Crew-Days

- Labor Crew = 1 - Foreman @ $21.58/Hr
  4 - Laborers @ $13.02/Hr
  $73.66/Hr x 48 Hr =$ 3,536
- Travel = $73.66/Hr x 6 Day x 1 Hr/Day =$ 442
- Eq. Rental = 4 - Pressure Washers @ $ 8.71/ Hr
  $ 34.84/Hr x 48 Hr =$ 1,672
- Materials = Soap @ $1.09/BBL
  10,810 Gal x BBL / 42 Gal x $1.09/BBL =$ 281
- Dispose of Fluid @ $0.11/BBL
  10,810 Gal x BBL / 42 Gal x $0.11/BBL =$ 28

Sub-total =$ 5,959

B. Dismantle and Load - 15 Days:

11,550 Ft^2 @ 100 Ft^2/Man-Day = 115.5 Man-Days
= 15.0 Crew-Days

- Labor Crew = 1 - Foreman @ $ 21.58/Hr
  2 - Welders @ $ 19.35/Hr
  2 - Operators @ $ 17.71/Hr
  4 - Laborers @ $ 13.02/Hr
  $147.78/Hr x 120 Hr =$ 17,734

- Travel = $147.78/Hr x 15 Days x 1 Hr/Day =$ 2,217

- Eq. Rental = 2 - 20 Ton Cranes @ $37.39/Hr
  2 - Welders/Torches @ $10.90/Hr
  $96.58/Hr x 120 Hr =$ 11,590

Sub-total =$ 31,541

C. Haul and Dispose - On-Site Land Fill:
Building = 235,000# = 5 Truck Loads** @ 47,000#

- Haul = 5 Trucks x 8 Hrs/Truck x $65.39/Hr = $ 2,616
- Dispose = Cost Included in Section 6.5

** 5 Trucks required to move building in 1988

Building Total =***$ 40,116***

1.2 Tankage and Vessels

Basis: See Table 1.1

A. Decontaminate - 0 Days: (Assume No Decontamination)

B. Remove and Load - 11 Days:

- Labor Crew = 1 - Foreman @ $21.58/Hr*
  1 - Operator @ $17.71/Hr
  2 - Laborers @ $13.02/Hr
  $65.33/Hr x 88 Hr =$ 5,749
- Travel = $65.33/Hr x 11 Days x 1 Hr/Day =$ 719
- Eq. Rental = 1 - 20 Ton Crane @ $37.39/Hr
  $37.39/Hr x 88 Hr =$ 3,290

* This foreman will also supervise1.2 C.

Sub-total =$ 9,758

C. Dismantle, Cut, or Crush - 11 Days:

Cut Steel @ 30 Ft.^{3}/Man-Day @ 631.4 Ft^3 = 21 Man-Day
Crush FRP @ 60 Ft.^{3}/Man-Day @ 240.5 Ft^3 = 4 Man-Day

- Labor Crew =1 - Foreman@ Foreman supervises both 1.2 (B) & (C)
  2 - Welders @ $19.35/Hr
  2 - Laborers @ $13.02/Hr
  $64.74/Hr x 88 Hr =$ 5,697
- Travel = $64.74/Hr x 11 Days x 1 Hr/Day =$ 712
- Eq. Rental = 1 - D8N Dozer @ $117.71/Hr for 4 Days
  $117.71/Hr x 32 Hr =$ 3,767
  2 - Welders/Torches @ $ 10.90/Hr
  $ 21.80/Hr x 88 Hr =$ 1,918

Sub-total =$ 12,094

D. Haul and Dispose - Licensed (NRC SUA - #1473) Site:

100% of Contaminated Service = 835.4 Ft.^{3} @ 198,380#
Total = 30.9 Cu.Yd. @ 198,380# = 5 Truck Loads @ 40,000#

- Haul = 5 Truck x 800 Mile x $3.27/Mile =$ 13,080
- Dispose = 198,380# = 99.1 tons
  @ $50/ton disposal cost =$ 4,955

E. Haul and Dispose - On-Site Land Fill:
100% of Non-Contaminated Service = 36.5 Ft^3 @ 2,320#
Total = 1.4 Cu.Yd. @ 2,230# = 0.05 Truck Loads @ 47,000#

- Haul = 0.05 Trucks x 8 Hrs/Truck x $65.39/Hr =$ 26
- Dispose = Cost Included in Section 6.5

Tankage and Vessel Total =***$39,913***

1.3 Piping

Basis: See Table 1.2

A. Remove, Cut or Crush and Load - 5 Days:
PVC & Poly - 2,800 Ft @ 140 Ft/Man-Day = 20 Man-Day
= 5 Crew-Day
Steel - 1,100 Ft @ 110 Ft/Man-Day = 10 Man-Day
= 5 Crew-Day

- Labor Crew = 1 - Foreman @ $ 21.58/Hr
2 - Welders @ $ 19.35/Hr
1 - Operator @ $ 17.71/Hr
4 - Laborers @ $ 13.02/Hr
$130.07/Hr x 40 Hr =$ 5,503
- Travel = $130.07/Hr x 5 Days x 1 Hr/Day =$ 650
- Eq. Rental = 1 - 20 Ton Crane @ $37.39/Hr
2 - Welders/Torches @ $10.90/Hr
$59.19/Hr x 40 Hr =$ 2,368

Sub-total =$ 8,521

B. Decontaminate - 0 Days: =$ 0

C. Haul and Dispose - Licensed (NRC SUA #1473) Site:
100% Piping = 886.7 Ft^3 @ 52,080#
Total = 32.8 Cu.Yd. @ 52,080# = 1.3 Truck Load @ 40,000#

- Haul = 1.3 Truck x 800 Mile x $3.27/Mile =$ 3,401
- Dispose = 52,080# = 26.04 tons
@ $50/ton disposal cost =$ 1,302

Piping Total =***$ 13,224***

1.4 Pumps

Basis: See Table 1.3

A. Removal and Loading - 6 Days:
21 Pumps @ 2 Pumps/Man-Day = 10.5 Man-Days
= 6.0 Crew-Days

- Labor Crew = 1 - Foreman @ $21.58/Hr
1 - Operator @ $17.71/Hr
2 - Laborers @ $13.02/Hr
$65.33/Hr x 48 Hrs =$ 3,136

- Travel = $65.33/Hr x 6 Days x 1 Hr/Day =$ 392

- Eq. Rental = 1 - 20 Ton Crane @ $37.39/Hr
$37.39/Hr x 48 Hrs =$ 1,795

Sub-total =$ 5,323

B. Haul and Dispose - Licensed (NRC SUA #1473) Site:
Contaminated Pumps = 77.9 Ft.^{3} @ 5,700#
Total = 2.9 Cu. Yd. @ 5,700# = 0.2 Truck Loads @ 40,000#

- Haul = 0.2 Truck x 800 Mile x $3.27/Mile =$ 523
- Dispose = 5,700# = 2.85 tons
@ $50/ton disposal cost =$ 143

C. Haul and Dispose - On-Site Land Fill:
Non-Contaminated Motors = 69.9 Ft^3 @ 8,445#
Non-Contaminated Pumps = 2 Ft^3 @ 100#
Total = 71.9 Ft.^{3} @ 8,545# = 0.2 Truck Loads @ 47,000#

- Haul = 0.2 Trucks x 8 Hrs/Truck x $65.39/Hr =$ 105
- Dispose = Cost Included in Section 6.5

Pump Total =***$ 6,094***

1.5 Electrical

A. Remove, Cut and Load - 5 Days:

- Labor Crew = 1 - Journeyman Elect. @ $ 34.88/Hr
  2 - Helpers @ $ 30.51/Hr
  1 - Welder @ $ 19.35/Hr
  1 - Operator @ $ 17.71/Hr
  $132.96/Hr x 40 Hr = $ 5,318

- Elec. Travel = $95.90/Hr x 5 Days x 2 Hr/Day = $ 959
  + $0.54/Mile x 5 Days x 120 Mile/Day = $ 324

- Travel = $37.06/Hr x 5 Days x 1 Hr/Day = $ 185

- Eq. Rental = 1 - 20 Ton Crane @ $37.39/Hr
  1 - Truck @ $12.26/Hr*
  1 - Welder/Torch @ $10.90/Hr
  $60.55/Hr x 40 Hr = $ 2,422

Sub-total = $ 9,208

B. Haul and Dispose - On-Site Land Fill:

MCC = 11.75 Ft. x 1.25 Ft. x 7.5 Ft. = 110.2 $Ft.^3$ @ 4,550#
Cable = 110.2 $Ft.^3$ x 0.5 = 55.1 $Ft.^3$ @ 18,400# (@ 40% Voids)
Total = 165.1 $Ft.^3$ @ 22,950#
= 6.1 Cu. Yd. @ 22,950# = 0.5 Truck Loads @ 47,000#

- Haul = 0.5 Trucks x 8 Hrs/Truck x $65.39/Hr = $ 262
- Dispose = Cost Included in Section 6.5

Electrical Total = ***$ 9,470***

1.6 Foundation

A. Decontaminate Slab - 3 Days:
11,550 Ft^2 @ 1,000 Ft^3/Man-Day = 11.6 Man-Days
= 3.0 Crew-Days

- Labor Crew = 1 - Foreman @ $21.58/Hr
  4 - Laborers @ $13.02/Hr
  $73.66/Hr x 24 Hr =$ 1,768
- Travel = $73.66/Hr x 3 Days x 1 Hr/Day =$ 221
- Eq. Rental = Hand Tools (Brooms, Squeegee) @ $10.90/Hr
  $10.90/Hr x 24 Hr =$ 262
- 10% HCl = 2 Gal/Ft^2 x 11,550 Ft^2
  = 23,100 Gal.
  Make-Up from 20° Be HCl Stock @ $0.55/Gal
  Require 288 Gal. Stock per 1,000 Gal. - 10%

23,100 gal x 0.288 x $0.55/Gal =$ 3,659

- Dispose of Fluid @ $0.11/BBL
  23,100 Gal x BBL / 42 Gal x $0.11/BBL =$ 61

Sub-total =$ 5,971

B. Break and Remove 25% of Slab - 10 Days:
11,550 Ft^2 x 0.25 = 2,888 Ft^2
2,888 Ft^2 @ 37.5 Ft^2/Hr = 77 Hrs

- Labor Crew = 1 - Operator @ $17.71/Hr
  17.71/Hr x 77 Hrs =$ 1,364
- Travel = $17.71/Hr x 10 Days x 1 Hr/Day =$ 177
- Eq. Rental = 1 - Pavement Breaker @ $31.33/Hr
  $31.33/Hr x 77 Hrs =$ 2,412
  1 - Cat 980C Loader @ $92.64/Hr
  $92.64/Hr x 40 Hrs =$ 3,706

Sub-total =$ 7,659

C. Haul and Dispose - Licensed (NRC SUA #1473) Site:

Concrete = $\frac{2{,}888\ Ft^2 \times 8\ In}{12\ In/Ft}$ = 1925 Ft^3 Set
= 377,365# @ 196# Ft^3
= 3,209 Ft^3 Loose (40% voids)

Total = 11.9 Cu.Yd. @ 377,365# = 9.4 Truck Loads @ 40,000#

- Haul = 9.4 Truck x 800 Miles x $3.27/Mile =$ 24,590
- Dispose = 377,365# = 188.7 tons @ $50/ton disposal cost =$ 9,435

D. Bury Area w/2 Ft Cover:
- Materials = 856 Cu.Yd. Cover @ $1.09/Cu.Yd. =$ 933

Foundation Total =***$ 48,588***

1.7 Plant Site

Basis: 200 Ft. x 300 Ft. = 60,000 $Ft.^2$ = 1.4 Acres

A. Rip and Contour:
- Basis: See Table 1.4
- Rip and Contour @ $166.68/Acre =$ 233

B. Topsoil Placement:
Replace 6 in. Topsoil = 60,000 $Ft.^2$ x 0.5 = 30,000 $Ft.^3$ = 1,111 Cu.Yd.
- Topsoil Placement @ $1.09/Cu.Yd. =$ 1,211

C. Revegetate:

• Grade and Contour Topsoil	@ $ 87.19/Acre x 1.4 Acre	=$ 122
• Seedbed Prep. (Disc. + Harrow)	@ $ 21.80/Acre x 1.4 Acre	=$ 31
• Mulch (Drill + Seed + Mow)	@ $ 49/Acre x 1.4 Acre	=$ 69
• Drill Seed and Fertilize (Drill + Seed + Fertilizer)	@ $163/Acre x 1.4 Acre	=$ 228
• Revegetation Contingency (All items excluding grading)	@ $233.80/Acre* x 0.7 Acre	=$ 164

*Assume only 50% of acreage requires reseeding

Sub-total =$ 614

Plant Site Total =***$ 2,058***

1.8 Access Road

Basis: Gravel Road = 21 Ft. x 1320 Ft. = 27,720 Ft.^{2} = 0.6 Acres

A. Rip and Contour:

- Basis: See Table 1.4
- Rip and Contour @ $166.68/Acre =$ 233

B. Topsoil Placement:

Replace 6 in. Topsoil = 27,720 Ft.^{2} x 0.5 = 13,860 Ft.^{3} = 513 Cu.Yd

- Topsoil Placement @ $1.09/Cu.Yd. =$ 559

C. Revegetate:

• Grade and Contour	@ $ 87.19/Acre x 0.6 Acre	=$ 52
• Seedbed Prep. (Disc. + Harrow)	@ $ 21.80/Acre x 0.6 Acre	=$ 13
• Mulch (Drill + Seed + Mow)	@ $ 49/Acre x 0.6 Acre	=$ 29
• Drill Seed and Fertilize (Drill + Seed + Fertilizer)	@ $163/Acre x 0.6 Acre	=$ 98
• Revegetation Contingency (All items excluding grading)	@ $233.80/Acre* x 0.3 Acre	=$ 70

Sub-total =$ 262

*Assume only 50% of acreage requires reseeding

Access Road =***$ 1,054***

TABLE 1.4
IX PLANT
SCARIFY (RIP) COMPACTED SURFACE

Equipment = Cat. 140G Motor Grader @ $65.39/Hr - Complete
Speed = 3.9 mph (2nd gear)
Width = 9 Ft/Pass

$$\text{Productivity} = 3.9 \frac{\text{Mile}}{\text{Hr}} \times 5280 \frac{\text{Ft}}{\text{Mile}} \times 9 \frac{\text{Ft}}{\text{Pass}} \times 0.83 \text{ Eff.}$$

$$= 153{,}822 \frac{\text{Ft}^2}{\text{Hr}}$$

$$= 3.53 \frac{\text{Acre}}{\text{Hr}}$$

$$\$/\text{Acre} = \frac{\$65.39}{\text{Hr}} \times \frac{\text{Hr}}{3.53 \text{ Acre}} = \frac{\$18.52}{\text{Acre}}$$

From Above - Ripping @ $166.68/Acre Allows for 9 Passes

APPENDIX 2
CENTRAL PROCESSING PLANT RECLAMATION COSTS

Cost Summary

ITEM	COSTS ($97)
2.1 Building	**57,548**
2.2 Tankage and Vessels	**60,246**
2.3 Piping	**10,846**
2.4 Pumps	**10,965**
2.5 Electrical	**19,682**
2.6 Foundations	**69,719**
Total Cost	**229,006**

2.1 Building

Basis: 100 Ft. x 165 Ft. with 30 Ft. Eave
Floor Area = 16,500 Ft^2
Skin Area = 15,900 Ft^2

A. Washdown Building - 9 days:

Wash 15,900 Ft^2 @ 1 Gal/Ft^2 = 15,900 Gal
Wash 15,900 Ft^2 @ 450 Ft^2/Man-Day = 35 Man-Days
= 9 Crew-Days

- Labor Crew = 1 - Foreman @ $21.58/Hr
  4 - Laborers @ $13.02/Hr
  $73.66/Hr x 72 Hr = $ 5,303

- Travel = $73.66/Hr x 9 Days x 1 Hr/Day = $ 663

- Eq. Rental = 4 - Pressure Washers @ $ 8.71/Hr
  $ 34.84/Hr x 80 Hr = $ 2,787

- Materials = Soap @ $1.09/BBL
  15,900 Gal x BBL / 42 Gal x $1.09/BBL = $ 413

- Dispose of Fluid @ $0.11/BBL
  15,900 Gal x BBL / 42 Gal x $0.11/BBL = $ 42

Sub-total = $ 9,208

B. Dismantle and Load - 21 Days:

Dismantle and Load @ 100 Ft^2/Man-Day
16,500 Ft^2 @ 100 Ft^2/Man-Day = 165 Man-Days = 168 Man-Days
= 21 Crew-Days

- Labor Crew = 1 - Foreman @ $ 21.58/Hr
  2 - Welders @ $ 19.35/Hr
  2 - Operators @$ 17.71/Hr
  4 - Laborers @$ 13.02/Hr
  $147.78/Hr x 168 Hr = $24,827

- Travel = $147.78 Hrs x 21 Days x 1 Hr/Day = $ 3,103

- Eq. Rental = 2 - 20 Ton Cranes @ $ 37.39/Hr
  2 - Welders/Torches @ $ 10.90/Hr
  $ 96.58/Hr x 168 Hr = $16,225

Sub-total = $44,155

C. Haul and Dispose - On-Site Land Fill:
Building = 376,000# = 8 Truck Loads* @ 47,000#

- Haul = 8 Trucks x 8 Hrs/Truck x $65.39/Hr = $ 4,185
- Dispose = See Appendix 6.5

Building Total = ***$ 57,548***

2.2 Tankage and Vessels

Basis: See Table 2.1

A. Decontaminate - 0 Days: = $ 0

B. Remove and Load - 19 Days:
- Labor Crew = 1 - Foreman @ $ 21.58/Hr
  1 - Operator @ $ 17.71/Hr
  2 - Laborers @ $ 13.02/Hr
  $ 65.33/Hr x 152 Hr = $ 9,930

- Travel = $65.33/Hr x 19 Days x 1 Hr/Day = $ 1,241

- Eq. Rental = 1 - 20 Ton Crane @ $ 37.39/Hr
  $ 37.39/Hr x 152 Hrs = $ 5,683

Sub-total = $ 16,854

C. Dismantle, Cut, or Crush - 19 Days:

Cut Steel @ 30 Ft^3/Man-Day @ 518.5 Ft^3 = 17 Man-Days
Crush FRP @ 60 Ft^3/Man-Day @ 111.4 Ft^3 = 19 Man-Days

- Labor Crew = 1 - Foreman @ $ Foreman Supervises both 2.2(A) & (B)
  1 - Welder @ $ 19.35/Hr
  2 - Laborers @ $ 13.02/Hr
  $ 45.39/Hr x 152 Hrs = $ 6,899

- Travel = $45.39/Hr x 19 Days x 1 Hr/Day = $ 862

- Eq. Rental = 1 - D8N Dozer @ $117.71/Hr
  1 - Welder/Torch @ $ 10.90/Hr
  $128.61/Hr x 152 Hrs = $ 19,549

Sub-total = $ 27,310

D. Haul and Dispose - Licensed (NRC SUA #1473) Site:
100% of Contaminated Service = 1236.7 $Ft.^3$ @ 172,420#
Total = 45.8 Cu.Yd. @ 172,420# = 4.3 Truckloads @ 40,000#

- Haul = 4.3 Trucks x 800 Mile x $3.27/Mile = $ 11,249
- Dispose = 172,420# = 86.2 tons
  @ $50/ton disposal cost = $ 4,310

E. Haul and Dispose - On-Site Land Fill:
100% of Non-Contaminated Service = 393.2 Ft^3 @ 45,010#
Total = 14.6 Cu.Yd. @ 45,010# = 1 Truckloads @ 47,000#

- Haul = 1 Truck x 8 Hrs/Truck x $65.39/Hr = $ 523

- Dispose = See Appendix 6.5

Tankage and Vessel Total = ***$ 60,246***

2.3 Piping

Basis: See Table 2.2

A. Remove, Cut or Crush and Load - 9 days:

PVC and Poly @ 140 Ft/Man-Day @ 5,000 Ft = 36 Man-Days
= 9 Crew-Days

- Labor Crew = 1 - Foreman @ $ 21.58/Hr
  1 - Operator @ $ 17.71/Hr
  4 - Laborers @ $ 13.02/Hr
  $ 91.37/Hr x 72 Hr = $ 6,579
- Travel = $91.37/Hr x 9 Days x 1 Hr/Day = $ 822
- Eq. Rental = 1 - 20 Ton Crane @ $ 37.39/Hr
  $ 37.39/Hr x 72 Hr = $ 2,692

Sub-total = $ 10,093

B. Decontaminate - 0 Days: = $ 0

C. Haul and Dispose - Licensed (NRC SUA #1473) Site:
100% Pipe = 244 Ft.^{3} @ 9,136#
Total = 9 Cu. Yd. @ 9,136# = 0.2 Truckloads @ 40,000#

- Haul = 0.2 Trucks x 800 Mile x $3.27/Mile = $ 523
- Dispose = 9,136# = 4.6 tons
  @ $50/ton disposal cost = $ 230

Piping Total = ***$ 10,846***

2.4 Pumps

Basis: See Table 2.3

A. Removal and Loading - 11 Days:

2 Pumps/Man-Day @ 43 Pumps = 21.5 Man-Days
= 11.0 Crew-Days

- Labor Crew = 1 - Foreman @ $21.58/Hr
  1 - Operator @ $17.71/Hr
  2 - Laborers @ $13.02/Hr
  $65.33/Hr x 88 Hr = $ 5,749
- Travel = $65.33/Hr x 11 Days x 1 Hr/Day = $ 719
- Eq. Rental = 1 - 20 Ton Crane @ $37.39/Hr
  $37.39/Hr x 88 Hr = $ 3,290

Sub-total = $ 9,758

B. Haul and Dispose - Licensed (NRC SUA #1473) Site:

100% Contaminated = 164.3 Ft.^{3} @ 10,612#

Total = 6.1 Cu. Yd. @ 10,612# = 0.3 Truck Load @ 40,000#

- Haul = 0.3 Truck x 800 Mile x $3.27/Mile = $ 785
- Dispose = 10,612# = 5.3 tons
  @ $50/ton disposal cost = $ 265

C. Haul and Dispose - On-Site Land Fill:

100% Non-Contaminated = 106.5 Ft.^{3} @ 10,723#

Total = 3.9 Cu. Yd. @ 10,723# = 0.3 Truck Load @ 47,000#

- Haul = 0.3 Truck x 8 Hrs/Truck x $65.39/Hr = $ 157
- Dispose = See Appendix 6.5

Pump Total = ***$ 10,965***

2.5 Electrical

A. Remove, Cut and Load - 10 Days:

- Labor Crew = 1 - Journeyman Elect. @ $ 34.88/Hr
  2 - Helpers @ $ 30.51/Hr
  1 - Welder @ $ 19.35/Hr
  1 - Operator @ $ 17.71/Hr
  $132.96/Hr x 80 Hr = $ 10,637
- Elec. Travel = $132.96/Hr x 10 Days x 2 Hr/Day = $ 2,659
  + $0.54/Mile x 10 Days x 120 Mile/Day = $ 648
- Other Travel = $37.06/Hr x 10 Days x 1 Hr/Day = $ 371
- Eq. Rental = 1 - 20 Ton Crane @ $ 37.39/Hr
  1 - Truck @ $ 12.26/Hr
  1 - Welder/Torch @ $ 10.90/Hr
  $ 60.55/Hr x 80 Hr = $ 4,844

Sub-total = $ 19,159

B. Haul and Dispose - On-Site Land Fill:

MCC#1 = 11.75 Ft. x 1.25 Ft. x 7.5 Ft. = 110.2 Ft.^{3} @ 4,550#

MCC#2 = 11.75 Ft. x 1.25 Ft. x 7.5 Ft. = 110.2 Ft.^{3} @ 4,550#

Cable = 220.4 Ft.^{3} x 0.5* = 110.2 Ft.^{3} @ 36,700#
(555#/Ft.^{3} @ 40% Void = 333#/Ft^2)

Total = 330.6 Ft.^{3} @ 45,800#
= 12.2 Cu. Yd. @ 45,800# = 1 Truck @ 47,000#

- Haul = 1 Truck x 8 Hrs/Truck x $65.39/Hr = $ 523
- Dispose = See Appendix 6.5

* Cable Volume = 1/2 MCC Volume

Electrical Total = ***$ 19,682***

2.6 Foundation

A. Decontaminate Slab - 5 Days:

16,500 Ft^2 @ 1000 Ft^2/Man-Day = 17 Man-Days
= 5 Crew-Days

- Labor Crew = 1 - Foreman @ $ 21.58/Hr
  4 - Laborers @ $ 13.02/Hr
  $ 73.66/Hr x 40 Hr = $ 2,646
- Travel = $73.66/Hr x 5 Days x 1 Hr/Day = $ 368
- Eq. Rental = Hand Tools @ $ 10.90/Hr
  (Broom, Squeegee) $ 10.90/Hr x 40 Hr = $ 436
- 10% HCl = 2 Gal/Ft^2 x 16,500 Ft^2
  = 33,000 Gal.

make-up from 20° Be HCl Stock @ $0.508/Gal
Require 288 Gal. Stock per 1,000 Gal. - 10%

33,000 x 0.288 x $0.55/Gal = $ 5,227

- Dispose of Fluid @ $0.11/BBL
  33,000 Gal x BBL / 42 Gal x $0.11/BBL = $ 86

Sub-total = $ 8,763

B. Break and Remove 25% of Slab - 14 Days:

16,500 Ft^2 x 0.25 = 4,125 Ft^2
4,125 Ft^2 @ 37.5 Ft^2/Hr = 110 Hrs

- Labor Crew = 1 - Operator @ $ 17.71/Hr
  $ 17.71/Hr x 110 Hrs = $ 1,948
- Travel = $17.71/Hr x 14 Days x 1 Hr/Day = $ 248
- Eq. Rental = 1 - Pavement Breaker @ $ 31.33/Hr
  $ 31.33/Hr x 110 Hrs = $ 3,446
  1- Cat 980C Loader @ $ 92.64/Hr
  $ 92.64/Hr x 56 Hrs = $ 5,188

Sub-total = $ 10,830

C. Haul and Dispose - Licensed (NRC SUA #1743) Site:

Concrete = 4,125 Ft^2 x $\frac{8\ In.}{12\ In/Ft}$ = 2,750 Ft^3 Set

= 539,000# @ 196#/Ft^3

= 4,583 Ft^3 Loose (40% Voids)

Total = 170 Cu.Yd. @ 539,000# = 13.5 Truckloads @ 40,000#

- Haul = 13.5 Truckloads x 800 Miles x $3.27/Mile = $ 35,316
- Dispose = 539,000# = 269.5 tons @ $50/ton disposal cost = $ 13,475

D. Bury Area with 2 Ft. Cover:

- Material = 1,225 Cu.Yd. Cover @ $1.09/Cu.Yd. = $ 1,335

Foundation Total = ***$69,719***

(NRC Related Activity)

APPENDIX 3
DRYER AREA RECLAMATION COSTS

Cost Summary

ITEM	COSTS ($97)
3.1 Building	**16,222**
3.2 Equipment	**14,739**
3.3 Foundations	**16,802**
Total Cost	**47,763**

3.1 Building

Basis: 100 Ft. x 35 Ft. with 30 Ft. Eave
Floor Area = 3,500 Ft^2
Skin Area = 8,100 Ft^2

A. Washdown Building - 0 Days = $ 0

B. Dismantle and Load - 5 Days:
3500 Ft^2 @ 100 Ft^2/Man-Day = 35 Man-Days
= 5 Crew-Days

- Labor Crew = 1 - Foreman @ $ 21.58/Hr
2 - Welders @ $ 19.35/Hr
2 - Operators @ $ 17.71/Hr
4 - Laborers @ $ 13.02/Hr
$147.78/Hr x 40 Hr = $ 5,911

- Travel = $147.78/Hr x 5 Days x 1 Hr/Day = $ 739

- Eq. Rental = 2 - 20 Ton Cranes @ $37.39/Hr
2 - Welder/Torch @ $10.90/Hr
$96.58/Hr x 40 Hr = $ 3,863

Sub-total = $ 10,513

C. Haul and Dispose - Licensed (NRC SUA - #1473) Site:
Buildings = 71,212#* = 1.8 Truck Loads @ 40,000#
- Haul = 1.8 Trucks x 800 Mile x $3.27/Mile = $ 4,709
- Dispose = 40,000# = 20 tons
@ $50/ton disposal cost = $ 1,000

*5 Trucks x 47,000#/Truck x $\frac{3500\ Ft^2}{11550\ Ft^2}$ = 71,212#

Building Total = ***$ 16,222***

3.2 Equipment

Basis: See Table 3.1

A. Remove and Load - 7 Days:

- Labor Crew = 1 - Foreman @ $21.58/Hr
  1 - Operator @ $17.71/Hr
  4 - Laborers @ $13.02/Hr
  91.37/Hr x 56 Hrs = $ 5,117
- Travel = $91.37/Hr x 7 Days x 1 Hr/Day = $ 640
- Eq. Rental = 1 - 20 Ton Crane @ $37.39/Hr
  $37.39/Hr x 56 Hrs = $ 2,094

Sub-total = $ 7,851

B. Dismantle and Cut - 7 Days:

Cut Steel @ 30 Ft^3/Man-Day @ 198.6 Ft^3 = 7 Man-Days

- Labor Crew = 1 - Foreman @ $ Foreman supervises 3.2(A) & (B)
  1 - Welders @ $19.35/Hr
  $19.35/Hr x 56 Hr = $ 1,084
- Travel = $19.35/Hr x 7 Days x 1 Hr/Day = $ 135
- Eq. Rental = 1 - Welder/Torch @ $10.90/Hr
  $10.90/Hr x 56 Hr = $ 610

Sub-total = $ 1,829

C. Haul and Dispose - Licensed (NRC SUA #1473) Site:

100% of Contaminated = 183.6 $Ft.^3$ @ 53,800#
Total = 6.8 Cu. Yd. @ 53,800# = 1.4 Truck Loads @ 40,000#

- Haul = 1.4 Truck x 800 Mile x $3.27/Mile = $ 3,662
- Dispose = 53,800# = 26.9 tons
  @ $50/ton disposal cost = $ 1,345

D. Haul and Dispose - Land Fill:

100% Non-Contaminated = 15 $Ft.^3$ @ 4,400#
Total = 0.6 Cu. Yd. @ 4,400# = 0.1 Truck Loads @ 47,000#

- Haul = 0.1 Truck x 8 Hrs/Truck x $65.39/Hr = $ 52
- Dispose = See Appendix 6.5

Equipment Total = ***$14,739***

3.3 Foundation

A. Decontaminate Slab - 2 Day:

3500 Ft^2 @ 1000 Ft^2/Man-Day Twice = 7 Man-Days
= 2 Crew-Days

- Labor Crew = 1 - Foreman @ $21.58/Hr
  4 - Laborers @ $13.02/Hr
  $73.66/Hr x 16 Hrs = $ 1,179
- Travel = $73.66/Hr x 2 Days x 1 Hr/Day = $ 147
- Eq. Rental = Hand Tools (Broom, Squeegee) @ $10.90/Hr
  $10.90/Hr x 16 Hrs = $ 174
- 10% HCl = 2 Gal/Ft^2 x 3500 Ft^2 x 2
  = 14,000 Gal.

Make-Up from 20° Be HCl Stock @ $0.55/Gal
Require 288 Gal. Stock per 1,000 Gal. - 10%

14,000 x 0.288 x $0.55/Gal = $ 2,218

- Dispose of Fluid @ $0.11/BBL
  14,000 Gal x BBL/42 Gal x $0.11/BBL = $ 37

Sub-Total = $ 3,755

B. Break and Remove 25% of Slab - 3 Day:

3500 Ft^2 x 0.25 = 875 Ft^2
875 Ft^2 @ 37.5 Ft^2/Hr = 23 Hrs

- Labor Crew = 1 - Operator @ $17.71/Hr
  $17.71/Hr x 23 Hrs = $ 407
- Travel = $17.71/Hr x 3 Days x 1Hr/Day = $ 53
- Eq. Rental = 1 - Pavement Breaker @ $31.33/Hr
  $31.33/Hr x 24 Hrs = $ 752

  1- Cat 980C Loader @ $92.64/Hr
  $92.64/Hr x 12 Hr = $ 1,112

Sub-total = $ 2,324

C. Haul and Dispose - Licensed (NRC SUA #1743) Site:

Concrete = 875 Ft^2 x 8 In = 583 Ft^3 Set

12 In/Ft = 114,268# @ 196#/Ft^3

= 972 Ft^3 Loose (40% Voids)

Total = 36 Cu.Yd. @ 114,268# = 2.9 Truckloads @ 40,000#

• Haul = 2.9 Truck x 800 Mile x $3.27/Mile	=	$ 7,586
• Dispose = 114,268# = 57.1 tons @ $50/ton disposal cost	=	$ 2,855

D. Bury Area with 2 Ft Cover:

• Materials = 259 Cu.Yd. Cover @ $1.09/Cu.Yd.	=	$ 282
Foundation Total	=	***$ 16,802***

(NRC & WDEQ/LQD Related Activity)

APPENDIX 4

EXISTING FACILITIES RECLAMATION COSTS

Cost Summary

ITEM	COSTS ($97)
4.1 Buildings	**95,635**
4.2 Structures	**14,067**
4.3 Pilot Plant Equipment	**21,266**
4.4 Foundation	**139,333**
4.5 Site Reclamation	**105,785**
4.6 O-Sand Pilot	**41,435**
4.7 Q-Sand Pilot	**N.A.**
4.8Mine Water Trt Ponds	**19,878**
Total Cost	**410,244**

4.1 Buildings

Basis: Floor Area = 33,248 Ft^2
Skin Area = 22,828 Ft^2 (13 Ft Eave)

1 @ 200 Ft. x 60 Ft. = 12,000 Ft^2 (Pilot ISL Building)
0 @ 70 Ft. x 48 Ft. - Demolished & Removed Sept. 1991
1 @ 70 Ft. x 68 Ft. = 4,760 Ft^2 (Existing Office Building)
1 @ 48 Ft. x 24 Ft. = 1,152 Ft^2 (Storage Building)
1 @ 24 Ft. x 24 Ft. = 576 Ft^2 (Water Treatment Plant)
1 @ 40 Ft x 120 Ft. = 4,826 Ft^2 (Shop Building)
1 @ Building = 9,934 Ft^2 (New Office Annex Building)

A. Washdown Building - 8 Days

22,828 Ft^2 @ 1 Gal/Ft^2 = 22,828 Gal
22,828 Ft^2 @ 450 Ft^2/Man = 51 Man-Days
= 13 Crew-Days

- Labor Crew = 1 - Foreman @ $ 21.58/Hr
  4 - Laborers @ $ 13.02/Hr
  $ 73.66/Hr x 104 Hr = $ 7,661
- Travel = $73.66/Hr x 13 Days x 1 Hr/Day = $ 958
- Eq. Rental = 4 - Pressure Washers @ $ 8.71/Hr
  $ 34.84/Hr x 104 Hr = $ 3,623
- Materials = Soap @ $1.09/BBL
  22,828 Gal x BBL / 42 Gal x $1.09/BBL = $ 592
- Dispose of Fluid @ $0.11/BBL

22,828 Gal x BBL x $0.11/BBL = $ 60
42 Gal

Sub-total = $ 12,894

B. Dismantle and Load - 24 Days:
33,248 Ft^2 @ 100 Ft^2/Man-Day = 332 Man-Days
= 42 Crew-Days

- Labor Crew = 1 - Foreman @ $ 21.58/Hr
2 - Welders @ $ 19.35/Hr
2 - Operators @ $ 17.71/Hr
4 - Laborers @ $ 13.02/Hr
$147.78/Hr x 336 Hrs = $ 49,654

- Travel = $147.78/Hr x 42 Days x 1 Hr/Day = $ 6,207

- Eq. Rental = 2 - 20 Ton Cranes @ $37.39/Hr
2- Welder/Torches @ $10.90/Hr
$96.58/Hr x 336 Hrs = $ 32,450

Sub-total = $ 88,311

C. Haul and Dispose - On-Site Land Fill:
Buildings = 676,800# = 14 Truck Loads* @ 47,000#

- Haul = 14 Trucks x 8 Hrs/Truck x $65.39/Hr = $ 7,324

- Dispose = See Appendix 6.5

* 5 Trucks x 18,488 $Ft.^2$ / 11,550 $Ft.^2$ = 14 Trucks

Buildings Total = ***$ 95,635***

4.2 Structures

A. Plug Shaft - Completed in 1994	=	$ 0
B. Plug Venthole		
• Backfill 335 ft. of hole (270 c.y. @ $1.09/yd)	=	$ 270
• Backhoe 16 hrs @ $27.25/hr	=	$ 436
• Steel plate and rebar	=	$ 300
• Cement - 10 c.y. @ $76/c.y. delivered	=	$ 760
• 40 man hours @ $13.02/hr	=	$ 521
• Dirt cover - 100 c.y. @ $1.09/c.y.	=	$ 109
Sub-total	=	$ 2,396

C. Mine Water Treatment Ponds

See Section 4.8

D. Evaporation Ponds

Total Area = 200 Ft. x 100 Ft. = 20,000 Ft.^{2} = 0.5 Acres

• Total = 0.5 Acres x $\frac{\$65,392^*}{5 \text{ Acres}}$	=	$ 6,539

* See Section 6 - part 6.2 for the cost on a 5 acre basis

E. Headframe Removal

• Dismantle - Completed in 1991	=	$ 0
• Haul & Dispose - Completed in 1993	=	$ 0

F. Fencing (includes delineation posts)

Facility Fence - 5900 ft
Wellfield #1 - 6600 ft
Wellfield #3 - 7500 ft
20000 ft

• Cost to remove fencing = $0.15/ft[1]	=	$ 3,000

[1] Cost per linear foot based on Third Party Cost Quote dated 6/11/99

G. Water Wells

- Water wells (2) are 5 inch diameter wells with depth of 750 feet.
- Cost Basis - $285/well ($7705 per 27 wells, see "Section 5.4 - Wells")

= $ 570

H. Fuel Area

- Size - 15 ft x 25 ft = 375 Ft^2.
  375 Ft^2 @ 37.5 Ft^2/Hr = 10 Hrs
- Labor Crew = 1 - Operators @ $ 17.71/Hr
  $ 17.71/Hr x 10 Hrs = $ 177
- Travel = $17.71/Hr x 2 Days x 1 Hr/Day = $ 35
- Eq. Rental = 1- Pavement Breaker @ $31.33/Hr
  $31.33/Hr x 10 hrs = $ 313

  1- Cat 980C Loader @ 92.64/Hr
  $96.58/Hr x 5 hr = $ 483

Sub-total = $ 1008

Structures Total = ***$ 14,067***

4.3 Pilot Plant Equipment

A. Tanks:

15 Tanks
- Total = 15 Tanks x $55,926* / 51 Tanks = $ 15,095

B. Piping:

1500 Ft. @ 6" Dia. or Less
- Total = 1500 Ft. x $10,616* / 5,000 Ft. = $ 3,185

C. Pumps:

12 Pumps
- Total = 12 Pumps x $10,700* / 43 Pumps = $ 2,986

* Reference Section 2 - parts 2.2, 2.3 & 2.4

Pilot Plant Total = ***$ 21,266***

4.4 Foundation

A. Decontaminate Slab - 5 Days:

33,248 Ft^2 @ 1000 Ft^2/Man-Day = 33.2 Man-Days
= 8.3 Crew-Days

- Labor Crew = 1 - Foreman @ $ 21.58/Hr
  4 - Laborers @ $ 13.02/Hr
  $ 73.66/Hr x 66.4 Hrs = $ 4,891
- Travel = $73.66/Hr x 9 Days x 1 Hr/Day = $ 663
- Eq. Rental = Hand Tools @ $10.90/Hr
  (Brooms, Squeegee) @ $10.90 /Hr x 66.4 Hrs = $ 724
- 10% HCl = 2 Gal/Ft^2 x 33,248 $Ft.^2$
  = 66,496 Gal.

Make-Up from 20° Be HCl Stock @ $0.55/Gal
Require 288 Gal. Stock per 1,000 Gal. - 10%

66,496 x 0.288 x $0.55/Gal = $ 10,532

- Dispose of Fluid @ $0.11/BBL
  66,496 Gal x BBL / 42 Gal x $0.11 BBL = $ 174

Sub-total = $ 16,984

B. Break and Remove 25% of Slab - 28 Days:

33,248 Ft^2 x 0.25 = 8,312 Ft^2
8,312 Ft^2 @ 37.5 Ft^2/Hr = 221 Hrs

- Labor Crew = 1 - Operator @ $17.71/Hr
  $17.71/Hr x 221 Hrs = $ 3,914
- Travel = $17.71/Hr x 28 Days x 1 Hr/Day = $ 496
- Eq. Rental = 1 - Pavement Breaker @ $31.33/Hr
  $31.33/Hr x 221 Hrs = $ 6,923

  1 - Cat 980C Loader @ $92.64/Hr
  $92.64/Hr x 111 Hrs = $ 10,283

Sub-total = $ 21,616

C. Haul and Dispose - Licensed (NRC SUA #1743) Site:

Concrete = 8,312 Ft^2 x 8 In. / 12 In/Ft = 5,541 Ft^3 Set

= 1,086,101# @ 196#/Ft^3

= 9,235 Ft^3 Loose(40% Voids)

Total = 342 Cu.Yd. @ 1,086,101# = 27.1 Truckloads @ 40,000#

• Haul = 27.1 Truckloads x 800 Miles x $3.27/Mile	=	$70,894
• Dispose = 1,086,101# = 543.1 tons @ $50/ton disposal cost	=	$27,155

D. Bury Area with 2 Ft Cover:

• Materials = 2,462 Cu. Yd. Cover @ $1.09/Cu. Yd.	=	$ 2,684
Foundation Total	=	***$139,333***

4.5 Site Reclamation

Basis: 59.53 Acres = 2,593,126 $Ft.^2$

A. Rip & Contour:

• Rip & Contour @ $166.68/Acre x 59.53 Acre	=	$ 9,922

B. Topsoil Placement:

Replace 8 In.* Topsoil = 1,728,750 $Ft.^3$ = 64,028 Cu.Yd.

• Topsoil @ $1.09/Cu. Yd.	=	$69,789

* 8 In. Topsoil Removed in Previous Years

C. Revegetate:

• Grade and Contour @ $87.19/Acre x 59.53 Acre	=	$ 5,190
• Seedbed Prep. (Disc. + Harrow) @ $ 21.80/Acre x 59.53 Acre	=	$ 1,298
• Mulch (Drill + Seed + Mow) @ $ 49/Acre x 59.53 Acre	=	$ 2,917
• Drill Seed and Fertilize (Drill + Seed + Fertilizer)@ $163/Acre x 59.53 Acre	=	$ 9,703
• Revegetation Contingency* @ $234/Acre x 29.77 Acre (All items excluding grading)	=	$ 6,966

* Assume only 50% of acreage requires reseeding

Sub-total	=	$ 26,074
Site Reclamation Total	=	***$105,785***

4.6 Q-Sand Pilot

A. Surface Reclamation:
Basis = 6 Patterns

• Total = 6 Patterns x $\frac{\$16,669^*}{10 \text{ Patterns}}$	=	$ 10,001

* Reference Section 5 - Summary Table Cost Per Pattern

B. Groundwater Restoration:
Basis = 6 Patterns

• Total = 6 Patterns x $\frac{\$5,239^*}{\text{Pattern}}$	=	$ 31,434

* Reference Appendix #7

Sub-Total	=	$ 41,435

4.7 Q-Sand Pilot

Basis - 6 Patterns

• Building - Removed in 1992	=	$ 0
• Plug & Abandon 10 Wells - Completed in 1992	=	$ 0
• Reclaim Surface = To Be Completed With WF1 Operations	=	$ 0
Sub-total	=	$ 0

4.8 Mine Water Treatment Ponds

A. Burial In-Place
- Settled solids to Pond 3 for Burial In-Place

D8N Dozer - 40 Hrs @ $117.71/Hr	=	$ 4,708
• Backfill and Contour Settling Ponds		
D8N Dozer - 120 Hrs @ $117.71/Hr	=	$14,125
Motor Grader - 16 Hrs @ $65.34/Hr	=	1,045
Sub-total	=	$19,878
Mine Water Treatment Total	=	***$19,878***

APPENDIX 5

UNIT HEADER SITE AND ASSOCIATED WELLFIELD RECLAMATION COSTS

Cost Summary

ITEM	Cost ($97) per 10 Patterns	Cost ($97) 374 Patterns 1999-2000
5.1 Buildings	**1,549**	**57,932**
5.2 Header Piping	**2,735**	**102,289**
5.3 Secondary Electrical	**2,633**	**98,474**
5.4 Wells-Total	**10,532**	**393,897**
5.5 Monitor Wells - Total	**1,450**	**54,230**
5.6 Site Reclamation	**1,019**	**37,111**
Total Cost	**19,918**	**743,933**

5.1 Building

Basis: 12 Ft. x 24 Ft. with 10 Ft. Eave
Floor Area = 288 Ft^2
Skin Area = 720 Ft^2

A. Washdown Building - 1 Day:

Wash 720 Ft^2 @ 1 Gal/Ft^2 = 720 Gal
Wash 720 Ft^2 @ 450 Ft^2/Man-Day = 1.6 Man-Days
= 0.8 Crew-Days

- Labor Crew = 1 - Foreman @ $ 21.58/Hr
2 - Laborers @ $ 13.02/Hr
$ 47.62/Hr x 8 Hr =$ 381

- Travel = $47.62/Hr x 1 Day x 1 Hr/Day =$ 48

- Eq. Rental = 2 - Pressure Washers @ $ 8.71/Hr
$ 17.42/Hr x 8 Hr =$ 139

- Materials = Soap @ $1.09/BBL
720 Gal x BBL / 42 Gal x $1.09/BBL =$ 19

- Dispose of Fluid @ $0.11/BBL
720 Gal x BBL / 42 Gal x $0.11/BBL =$ 2

Sub-total =$ 589

B. Dismantle and Load - 1 Day:

Dismantle and Load @ 100 Ft^2/Man-Day

288 Ft^2 @ 100 Ft^2/Man-Day = 2.9 Man-Day

= 1.0 Crew-Day

- Labor Crew = 1 - Foreman @ $ 21.58/Hr
  1 - Welders @ $ 19.35/Hr
  2 - Laborers @ $ 13.02/Hr
  $66.97/Hr x 8 Hr =$ 536
- Travel = $66.97/Hr x 1 Day x 1 Hr/Day =$ 67
- Eq. Rental = 1 - Backhoe @ $ 27.25/Hr
  1 - Welder/Torch @ $ 10.90/Hr
  $ 38.15/Hr x 8 Hr =$ 305

Sub-total =$ 908

C. Haul and Dispose - On-Site Land Fill:

Building = 4,700# = 0.1 Truck Loads* @ 47,000#

- Haul = 0.1 Truck x 8 Hrs/Truck x $65.39/Hr =$ 52
- Dispose = See Appendix 6.5

* 5 Truck x $\frac{288\ Ft.^2}{11,550\ Ft.^2}$ = 0.1 Trucks

Sub-total =$ 52

Building Total =***$ 1,549***

5.2 Header Piping

Basis: 2000 Ft. - 1¼" Piping Buried @6 Ft.
Trench = 6 Ft. x 2 Ft. = 45 Cu. Yd./100 Ft.
Excavation = 26 Cu. Yd./Hr (Case 580 Backhoe - 24 in. Bucket)

A. Open Trenches - 5 Days:

(2000 Ft.) x $\left(\frac{45\ Cu.\ Yd.}{100\ Ft.}\right)$ x $\left(\frac{\ Hr.\ }{26\ Cu.\ Yd.}\right)$ = 35 Hrs

- Eq. Rental = 1 - Backhoe @ $ 27.25/Hr
  $ 27.25/Hr x 40 Hr =$1,090

B. Remove, Cut and Load - 2.5 Days:
Trenches Opened at 400 Ft/Man-Day
Piping = 2000 Ft @ 400 Ft/Man-Day = 5 Man-Days
= 2.5 Crew-Days

- Labor Crew = 1 - Foreman @ $ 21.58/Hr
2 - Laborers @ $ 13.02/Hr
$ 47.62/Hr x 20 Hr =$ 952

- Travel = $47.62 x 3 Days x 1 Hr/Day =$ 143

- Eq. Rental = 2 - Chainsaws @ $2.40/Hr
$4.8/Hr x 20 Hrs =$ 96

Sub-total =$ 1,191

C. Backfill Trenches - 2 Day:
Backfill @ 2.5 Time Excavation Rate or
Backfill @ 26 $\frac{\text{Cu.Yd.}}{\text{Hr}}$ x 2.5 = 65 Cu.Yd./Hr
(2000 Ft) x (45 $\frac{\text{Cu.Yd.}}{100\text{ Ft}}$) x ($\frac{\text{Hr}}{65\text{ Cu.Yd.}}$) = 13.8 Hrs or 14 hours

- Eq. Rental = 1 - Backhoe@ $ 27.25/Hr
$ 27.25/Hr x 14 Hrs =$ 382

D. Haul and Dispose - Licensed (NRC SUA #1473) Site:
1 1/4" Poly Pipe = 43 #/100 Ft. = 2,000 Ft. x 0.43#/Ft. = 860#

Volume = $\frac{2{,}000\text{ Ft x (43 \#/100 Ft.)}}{62.4\ \frac{\#}{\text{Ft.}^3} \times 0.6}$ = 23 Ft.^{3}

Total = 0.9 Cu. Yd. @ 860# = 0.02 Truck Loads @ 40,000#

- Haul = 0.02 Trucks x 800 Mile x $3.27/Mile =$ 52
- Dispose = 860# = 0.4 tons
@ $50/ton disposal cost =$ 20

Header Piping Total =$2,735

5.3 Secondary Electrical

Basis: Remove 2,000 ft - #10 AWG, Power Cable
Remove Pole and Motor Starters

A. Remove Tray Cable - 1 Day:

- Labor Crew = 1 - Journeyman @ $ 34.88/Hr
  1 - Helper @ $ 30.51/Hr
  $ 65.39/Hr x 8 Hr =$ 523
- Travel = $65.39/Hr x 1 Day x 2 Hr/Day =$ 131
  + $0.54/Mile x 1 Day x 120 Mile/Day =$ 65
- Eq. Rental = 1 - Truck @ $12.26/Hr
  $12.26/Hr x 8 Hr =$ 98

Sub-total =$ 817

B. Remove Motor Starters - 1 Day:

- Labor Crew = 1 - Journeyman @ $ 34.88/Hr
  1 - Helper @ $ 30.51/Hr
  $ 65.39/Hr x 8 Hr =$ 523
- Travel = $65.39/Hr x 1 Day x 2 Hr/Day =$ 131
  + $0.54/Mile x 1 Day x 120 Mile/Day =$ 65
- Eq. Rental = 1 - Truck @ $12.26/Hr
  $12.26/Hr x 8 Hr =$ 98

Sub-total =$ 817

C. Disconnect Power Cable from Pole - 0.5 Days:

- Labor Crew = 1 - Journeyman @ $ 34.88/Hr
  1 - Helper @ $ 30.51/Hr
  $ 65.39/Hr x 4 Hr =$ 262
- Travel = $65.39/Hr x 0.5 Day x 2 Hr/Day =$ 65
  + $0.54/Mile x 0.5 Day x 120 Mile/Day =$ 32
- Eq. Rental = 1 - Bucket Truck @ $ 37.36/Hr
  1 - Truck @ $ 12.26/Hr
  $ 49.62/Hr x 4 Hr =$ 198

Sub-total =$ 557

D. Remove Pole - 0.5 Day:

- Labor Crew = 1 - Foreman @ $ 21.58/Hr
  1 - Operator @ $ 17.71/Hr
  1 - Laborer @ $ 13.02/Hr
  $ 52.31/Hr x 4 Hr =$ 209
- Travel = $52.31/Hr x 1 Day x 1 Hr/Day =$ 52
- Eq. Rental = 1 - 20 Ton Crane @ $ 37.39/Hr
  $ 37.39/Hr x 4 Hr =$ 150

Sub-total =$ 411

E. Haul and Dispose - On-Site Land Fill:

Cable = $\frac{3.14 \times (0.5)^2 \times 2,000}{4 \times 144 \times 0.6}$ = 4.5 Ft.^{3} @ 1499# (555#/Ft.^{3} @ 40% Void)

Motor Starter =
$10 \times \frac{(24in. \times 10in. \times 8in.)}{1728}$ = 11.1 Ft.^{3} @260# (@ 26# Each)

Pole = 1 Ft. Diam. x 35 Ft. = 27.5 Ft.^{3} @ 825# (@ 30#/Ft^3)

Total = 43.1 Ft.^{3} @ 2,585#
= 1.6 Cu. Yd. @ 2,585# = 0.06 Trucks @ 47,000#

- Haul = 0.06 Trucks x 8 Hr/Truck x $65.39/Hr = $ 31
- Dispose = See Appendix 6.5

Secondary Electrical Total = ***$ 2,633***

5.4 Wells

Basis: 27 Wells per 10 Patterns
5 in. Casing, 750 Ft. TD
Pumps and Tubing Set @ 550 Ft.

A. Pull Pumps and Tubing - 2 Days:

10 Pumps @ 5 Pumps/Crew-Day = 2 Days

- Eq. Rental = 1 - Pulling Unit w/2-Man Crew @ $32.70/Hr
  $32.70/Hr x 16 Hrs = $ 523

B. Plug and Abandon - 4.5 Days:

27 Wells @ 6 Wells/Crew-Day = 4.5 Days
10 - Sack Cement/Well
800# - 'Shur-Gel'/Well

- Labor Crew = 1 - Foreman @ $ 21.58/Hr
  1 - Operator @ $ 17.71/Hr
  2 - Laborers @ $ 13.02/Hr
  $ 65.33/Hr x 36 Hrs = $ 2,352

- Travel = $65.33 x 5 Days x 1 Hr/Day = $ 327

- Eq. Rental = 1 - Backhoe @ $ 27.25/Hr
  1 - 6000# Forklift @ $ 13.12/Hr*
  2 - Skid Tanks @ $ 2.40/Hr
  $ 45.17/Hr x 36 Hrs = $ 1,626

* $1927/Month @ 160 Hr/Month x 1.899 (CPI inflator) = $13.12/Hr

- Materials - 270 - Sacks Cement @ $ 5.45/each
  21,600 - # 'Shur Gel' @ $ 16.34/100#
  $ 5,001 = $ 5,001

Sub-total = $ 9,306

C. Haul and Dispose - Licensed (NRC SUA #1473) Site:

Pumps = 10 x 5 In. Dia. x 8 Ft. Long = 10.9 $Ft.^3$
@ 850# (@ 85# Each)

Tubing = 27 x $\frac{550 \text{ Ft x } 43\#/100 \text{ Ft.}}{62.4 \#/Ft.^3 \text{ x } 0.6}$ = 170.6 $Ft.^3$ @ 6386#

Total = 181.5 $Ft.^3$ @ 7,236#
= 6.7 Cu. Yd. @ 7,236# = 0.2 Trucks @ 40,000#

- Haul = 0.2 Truck x 800 Mile x $3.27/Mile = $ 523
- Dispose = 7,236# = 3.6 tons
  @ $50/ton disposal cost = $ 180

Wells Total = ***$10,532***

5.5 Monitor Wells

Basis: 3.21 Per 10 Patterns
5 in. Casing, 750 Ft. T.D.
Pumps and Tubing Set @ 550 Ft.

A. Pull Pumps and Tubing - 1 Day:
3.21 Pumps @ 5 Pumps/Crew-Day = 1 Day

- Eq. Rental = 1 - Pulling Unit w/2-Man Crew @ $ 32.70/Hr
  $ 32.70/Hr x 8 Hrs = $ 262

B. Plug and Abandon - 0.5 Days:
3.21 Wells @ 6 Wells/Crew-Day = 0.5 Crew-Days
10 Sacks Cement/Well
200# 'Shur-Gel'/Well

- Labor Crew = 1 - Foreman @ $ 21.58/Hr
  1 - Operator @ $ 19.35/Hr
  2 - Laborers @ $ 13.02/Hr
  $ 66.97/Hr x 4 Hrs = $ 268
- Travel = $66.97/Hr x 1 Day x 1 Hr/Day = $ 67
- Eq. Rental = 1 - Backhoe @ $ 27.25/Hr
  1 - 6000# Forklift @ $ 13.12/Hr
  2 - Skid Tanks @ $ 2.40/Hr
  $ 45.17/Hrs x 4 Hrs = $ 181
- Materials - 32 Sacks Cement @ $ 5.45/each
  2,568 - # 'Shur Gel' @ $ 16.34/100#
  $ 594 = $ 594

Sub-total = $ 1,110

C. Haul and Dispose - Licensed (NRC SUA #1473) Site:
Pumps = 3.21 @ 5 In. Dia. x 8 Ft. Long = 3.5 $Ft.^3$ @273#
(83# Each)

Tubing = 3.21 x $\frac{550 \text{ Ft x } 43\#/100 \text{ Ft.}}{62.4 \#/Ft.^3 \text{ x } 0.6}$ = 20.3 $Ft.^3$ @759#

Total = 23.8 $Ft.^3$ @ 1032#
= 0.8 Cu. Yd. @ 1032# = 0.03 Truck @ 40,000#

- Haul = 0.03 Truck x 800 Mile x $3.27/Mile = $ 78

Monitor Well Total = ***$ 1,450***

5.6 Site Reclamation

Basis: Revegetate 2.3 Acres (500 Ft. x 200 Ft.)
Replace 10 Cu.Yd. Topsoil (540 $Ft.^2$ x 6 In.) @ Building Pad

A. Topsoil Placement:

• 10 Cu.Yd. @ 1.09/Cu.Yd.		=	$ 11

B. Revegetate:

• Grade and Contour Topsoil	@ $ 87.19/Acre x 2.3 Acres	=	$ 201
• Seedbed Prep. (Disc. + Harrow)	@ $ 21.80/Acre x 2.3 Acres	=	$ 50
• Mulch (Drill + Seed + Mow)	@ $ 49/Acre x 2.3 Acres	=	$ 113
• Drill Seed and Fertilize (Drill + Seed + Fertilizer)	@ $163/Acre x 2.3 Acres	=	$ 375
• Revegetation Contingency* (All items excluding grading)	@ $234/Acre x 1.15 Acres	=	$ 269
Sub-total		=	$ 1,019

* Assume only 50% of acreage requires reseeding

Site Reclamation Total = *$1,030*

APPENDIX 6
ASSOCIATED STRUCTURES RECLAMATION COSTS

Cost Summary

ITEM	COSTS ($97)
6.1 Trunkline #1 (5000 ft)	**52,108**
6.2 Trunkline #2 (10000 ft)	**104,216**
6.3 Radium Settling Ponds	**70,077**
6.4 P/A Disposal Well	**77,735**
6.5 Sand Mining Area	**13,173**
6.6 Land Fill	**1,500**
Total Cost	**318,809**

6.1 Trunkline

Basis: 2 - 16 in. Trunklines Buried @6 Ft.

Length = 5,000 Ft.
Trench = 6 Ft. x 4 Ft. = 89 Cu. Yd./100 Ft
Excavation = 150 Cu. Yd./Hr (Cat. 225 1.25 Cu. Yd. Bucket)

A. Open Trench - 4 Days:

(5000 Ft.) x (89 Cu. Yd. / 100 Ft.) x (Hr. / 150 Cu. Yd.) = 30 Hrs - Round to 32 Hrs

- Eq. Rental = 1 - Cat. 225 Trackhoe @ $112.26/Hr
  $112.26/Hr x 32 Hr = $ 3,592

B. Remove, Cut and Load - 18 Days:

2 - 5000 Ft Trunklines @ 140 Ft/Man-Day = 71.4 Man-Day
= 18 Crew-Day

- Labor Crew = 1 - Foreman @ $21.58/Hr
  4 - Laborers @ $13.02/Hr
  $73.66/Hrs x 144 Hr = $ 10,607
- Travel = $73.66/Hr x 18 Days x 1 Hr/Day = $ 1,326

- Eq. Rental = 2 - Backhoe @ $27.25/Hr
  2 - Chainsaw @ $ 2.40/Hr
  $59.30/Hr x 144 Hr = $ 8,539

Sub-total = $ 20,472

C. Backfill Trench - 5 Days:

Backfill @ 65 Cu.Yd./Hr Per Backhoe or
Backfill @ 130 Cu.Yd./Hr with 2 Backhoes

(5000 Ft.) x (89 Cu. Yd.) (Hr.) = 34 Hrs
100 Ft. 130 Cu. Yd.

- Eq. Rental = 2 - Backhoes @ $ 27.25/Hr
  $ 54.50/Hr x 40 Hrs = $ 2,180

D. Decontaminate - 0 Days: = $ 0

E. Haul and Dispose - Licensed (NRC SUA #1473) Site:

100% of Pipe = 2 x 5,000 Ft. x 28.27#/Ft = 282,700#

$= \frac{282{,}700\#}{62.4\#/Ft.^3 \times 0.6} = 7551\ Ft.^3$

Total = 279.7 Cu. Yd. @ 282,700# = 7.1 Truckloads @ 40,000#

- Haul = 7.1 Trucks x 800 Mile x $3.27/Mile = $ 18,574
- Dispose = 282,700# = 141.4 tons
  @ $50/ton disposal cost = $ 7,070

F. Haul & Dispose - Land Fill: = $ 0

G. Surface Reclamation:

4 Ft. x 5000 Ft. = 20,000 Ft.^{2} = 0.5 Acres

- Grade and Contour @ $ 87.19/Acre x 0.5 Acre = $ 43
- Seedbed Prep.
  (Disc. + Harrow) @ $ 21.80/Acre x 0.5 Acre = $ 11
- Mulch (Drill + Seed + Mow) @ $ 49/Acre x 0.5 Acre = $ 25
- Drill Seed and Fertilize
  (Drill + Seed + Fertilizer)@ $163/Acre x 0.5 Acre = $ 82
- Revegetation Contingency* @ $234/Acre x 0.25 Acre = $ 59
  (All items excluding grading)

* Assume only 50% of acreage requires reseeding

Sub-total = $ 220

Trunkline Total = ***$52,108***

6.2 Trunkline #2

Cost for 5000 ft line is $52,108. Truckline #2 is 10,000 ft.
@ $52,108 x 2 = $104,216

6.3 Radium Settling Ponds

Basis: 2 Ponds
9 Ft. Deep Below Grade plus 3 Ft. Freeboard Above Grade
Bottom = 180 Ft. x 360 Ft. (Per Pond)
Top = 252 Ft. x 432 Ft. (Per Pond)
Liner = 106,000 Ft^2 x 30 MIL (Per Pond)
Solids = 200 $Ft.^3$/Yr (Both Ponds)

A. Remove Solids and Liner - 8 Days:
Liner = 2 Ponds x 106,000 $Ft.^2$ x 0.03 In/12 = 530 $Ft.^3$
= 33,072# @ 62.4#/Ft^3
= 883 Ft^3 @ 40% Voids

Solids = 200 ft3/yr = 200 $Ft.^3$/Yr Yr #1 - 1998
= 800 $Ft.^3$ In Yr #5 - 2002

Remove @ 55 Gal/Man-Hr or 60 Ft^3/Man-Day

Yr #5 = 1683 Ft^3 @ 60 Ft^3/Man-Day = 28 Man-Days
= 7 Crew-Days

- Labor Crew = 1 - Foreman @ $21.58/Hr
4 - Laborers @ $13.02/Hr
$73.66/Hr x 56 Hrs = $ 4,125

- Travel = $73.66/Hr x 7 Days x 1 Hr/Day = $ 516

- Eq. Rental = 2 - Backhoes @ $27.25/Hr
$54.50/Hr x 56 Hr = $ 3,052

Sub-total = $ 7,693

B. Backfill Ponds - 27 Days:

Volume @ Grade = 180 Ft x 360 Ft x 9 Ft = 583,200 Ft^3
+ 27 Ft x 180 Ft x 9 Ft = 43,740 Ft^3
+ 27 fT X 360 fT X 9 Ft = 87,480 Ft^3
714,420 Ft^3 (Per Pond)

Total Volume = 714,420 Ft^3/Pond x 2 Ponds = 1,428,840 Ft^3 = 52,920 Cu.Yd.

Backfill @ 250 Cu.Yd./Hr = 212 Hrs

- Eq. Rental = 1 - D8N Dozer @ $117.71/Hr
  1- Grader @ $ 65.39/Hr
  $183.10/Hr x 212 Hr = $ 38,817

C. Replace 6 In. Topsoil:

2 Ponds x 0.5 Ft. x 252 Ft. x 432 Ft. = 108,864 $Ft.^3$ = 4032 Cu. Yd.

- Topsoil = 4032 Cu. Yd x $1.09/Cu. Yd. = $ 4,395

D. Revegetate:

2 Ponds x 252 Ft. x 432 Ft. = 217,728 $Ft.^2$ = 5 Acres

- Grade and Contour @ $ 87.19/Acre x 5 Acre = $ 436
- Seedbed Prep.
  (Disc. + Harrow) @ $ 21.80/Acre x 5 Acre = $ 109
- Mulch (Drill + Seed + Mow) @ $ 49/Acre x 5 Acre = $ 245
- Drill Seed and Fertilize
  (Drill + Seed + Fertilizer)@ $163/Acre x 5 Acre = $ 817
- Revegetation Contingency* @ $234/Acre x 2.5 Acre = $ 585
  (All items excluding grading)

Assume only 50% of acreage requires reseeding

Sub-total = $ 2,192

E. Haul and Dispose - Licensed (NRC SUA #1473) Site:

Solids = 800 Ft.^{3} @ 154,400# (60% @ 280#/Ft.^{3} + 40% @ 62.4#/Ft.^{3} = 193#/Ft^3)

Liner = 883 Ft.^{3} @ 33,072# (62.4#/Ft.^{3} @ 40% Voids)

Total = 1683 Ft.^{3} @ 187,472#

62.3 Cu. Yd. @ 187,472# = 4.7 Truckloads @ 40,000#

• Haul = 4.7 Trucks x 800 Mile x $3.27/Mile	= $ 12,295
• Dispose = 187,472# = 93.7 tons @ $50/ton disposal cost	= $ 4,685
Radium Settling Pond Total	= ***$ 70,077***

6.4 Plugging and Abandoning A Deep Disposal Well

Oilfield Workover Unit, 6 Days @ $1,634.85/Day	= $ 9,809
Circulating Pump & Tank, 2 Days @ $545/Day	= $ 1,090
Power Swivel, 1 Day @ $436/Day	= $ 436
Water Hauling & Water, 3 Days @ $354/Day	= $ 1,062
Frac Tank Rental	= $ 109
Slickline Services, 2 Days @ $599/Day	= $ 1,198
2 - 7/8 Inch "R" Nipple	= $ 1,417
Mud Materials	= $ 545
2 - 7/8 Inch Tubing Rental, 8610' @ $0.54/Ft-Day	= $ 2,325
Rental Tubing Inspection, 278 Jnts @ $10.90/Jnt	= $ 3,030
Cement & Services, 3 Squeeze Jobs @ 4374 each	= $ 13,122
Squeeze Manifold, Retainer, Swivel, Setting Tool @ $1,820/Squeeze Job	= $ 5,460
Cement & Services, 2 Stabilizers & Surface Plugs	= $ 4,711
Welder, Dirtwork & Roustabouts	= $ 13,624
Trucking	= $ 2,725
Supervision, 8 Days @ $545/Day	= $ 4,360
Miscellaneous, Contingencies, & Sales Tax (10% Above)	= $ 6,502
Sub-Total	= $ 71,525
Year 1991 &1992 CPI Escalation	= $ 6,210
Sub-Total ($1997)	= $ 77,735
Plug and Abandoning Disposal Well	= ***$ 77,735***

6.5 Reclamation of Sand Mining Area

10 acres of disturbed area on sand outcrop

Grade and contour @ $ 87.19/acre x 10 Acre = $ 872

Replace 6 inch topsoil = 217,800 ft.^{3} = 8,067 Cu.Yd.
topsoil = $1.09/Cu.Yd. = $ 8,793

Seedbed Prep. (Disc. + Harrow) @ $ 21.80/acre x 10 Acre = $ 218

Mulch (Drill + Seed + Mow) @ $ 49/acre x 10 Acre = $ 490

Drill Seed and Fertilizer @ $163/acre x 10 Acre = $ 1,630

Revegetation Contingency*
(All items excluding grading) @ $234/acre x 5 Acre = $ 1,170

Assume only 50% of acreage requires reseeding

Sand Mining Area Total = ***$ 13,173***

6.6 Land Fill

Basis: Depth = 6 Ft. total with 4 Ft. active strg. plus 2 ft. cover.
Bottom = 30 Ft. x 70 Ft. = 2,100 Ft.^{2}
Top = 54 Ft. x 94 Ft. = 5,076 Ft.^{2}
Grade = 66 Ft. x 106 Ft. = 6,996 Ft.^{2}

4 Ft. Active Strg. Volume = 30 Ft. x 70 Ft. x 4 Ft. = 8,400 Ft.^{3}
+ 12 Ft. x 30 Ft. x 4 Ft = 1,440 Ft.^{3}
+ 12 Ft. x 70 Ft. x 4 Ft. = 3,360 Ft.^{3}
13,200 Ft.^{3}

2 Ft. Cover Volume = 54 Ft. x 94 Ft. x 2 Ft. = 10,152 Ft.^{3}
+ 6 Ft. x 54 Ft. x 2 Ft. = 648 F t.^{3}
+ 6 Ft. x 94 Ft. x 2 Ft. = 1,128 Ft.^{3}
11,928 Ft.^{3}

Total Volume = 13,200 Ft.^{3} + 11,928 Ft.^{3} = 25,120 Ft.^{3} = 931 Cu.Yd.

A. Open Pit - 1 Day:

Productivity = 167 Cu.Yd. / Hr (Cat. 627E Scraper)

(931 Cu. Yd.) x (Hr / 167 Cu.Yd.) = 5.6 Hrs round to 6 Hrs

- Eq. Rental = 1 - Cat. 627E Scraper @ $121/Hr
$121/Hr x 6 Hrs = $ 726

B. Backfill Non-Contaminated Material - 1 Day:

Basis: See Table 6.1
Yr. 5 Total Volume = 8448 Ft.^{3} = 312.9 Cu.Yd.

Backfill @ 65 Cu.Yd./Hr. = 4.8 Hrs. round to 5 Hrs

- Eq. Rental = 1 - Backhoe @$27.25/Hr
  $27.25/Hr x 8 Hrs = $ 218

C. Backfill to Grade - 2 Days:

Voids = 312.9 Cu.Yd. x 0.4 = 125 Cu.Yd.

Remainder of Active Strg. = 13,200 Ft.^{3} - 8,203 Ft.^{3}
= 5,103 Ft.^{3} = 189 Cu.Yd.

Cover = 11,928 Ft.^{3} = 442 Cu.Yd.
Total = 756 Cu.Yd.

Backfill @ 65 Cu.Yd./Hr = 11.6 Hrs round to 12 Hrs

- Eq. Rental = 1 - Backhoe @ $27.25/Hr
  $27.25/Hr x 12 Hrs = $ 327

D. Surface Reclamation:

Basis: 6996 Ft.^{2} = 0.2 Acre

Replace 6 in. Topsoil = 6996 Ft.^{2} x 0.5 Ft. = 3498 Ft^3 = 130 Cu.Yd.

- Topsoil Placement @ 1.09/Cu.Yd. = $ 142
- Grade and Contour @ $87.19/Acre x 0.2 Acre = $ 17
- Seedbed Prep. (Disc. + Harrow) @ $21.80/Acre x 0.2 Acre = $ 4
- Mulch (Drill + Seed + Mow) @ $49/Acre x 0.2 Acre = $ 10
- Drill Seed & Fertilize @ $163/Acre x 0.2 Acre = $ 33
- Revegetation Contingency* @ $234/Acre x 0.1 Acre
  (All items excluding grading) = $ 23

* Assume only 50% of acreage requires reseeding.

Sub-total = $ 229

Land Fill Total = ***$ 1,500***

TABLE 6.1
Non-Contaminated Disposal Volume

SOURCE	UNIT WEIGHT (#)	UNIT VOLUME ($Ft.^3$)	YR. #1 1998 ($Ft.^3$)	YR. #5 2003 ($Ft.^3$)
1. IX Plant:				
A. Building	235,000	801.6*	801.6	1,603.2
B. Tankage & Vessels	2,320	36.5	0	73.0
C. Piping	0	0	0	0
D. Pumps	8,545	71.9	0	43.8
E. Electrical	22,950	165.1	0	30.2
			801.6	2,150.2
2. Central Processing Plant:				
A. Building	376,000	1,282.6*	0	1,282.6
B. Tankage & Vessels	45,010	393.2	0	393.2
C. Piping	0	0	0	0
D. Pumps	10,723	106.5	0	106.5
E. Electrical	45,800	330.6	0	330.6
			0	2,112.9
3. Dryer Area:				
A. Building	0	0	0	0
B. Equipment	4,400	15.0	0	15.0
4. Existing Facilities:				
A. Building	676,800	2,308.6	2,308.6	2,308.6
B. Structures	0	0	0	0
C. Pilot Plant Equip.	16,230	145.3	145.3	145.3
			2,453.9	2,453.9
5. Header Site & Associated Wellfield:				
A. Building	4,700	16.0*	0	742.4
B. Header Piping	0	0	0	0
C. Secondary Elect.	2,585	43.1	0	1,999.8
D. Wells - Total	0	0	0	0
E. Mon. Wells - Total	0	0	0	0
			0	2,742.2
TOTAL			3,255.5	9,474.2

*Building Unit Volume = $\frac{\text{Unit Weight}}{62.4 \times 7.83 \times 0.6}$

(NRC & WDEQ/LQD Related Activity)

APPENDIX 7
GROUNDWATER RESTORATION COSTS

Cost Summary

ITEM	COSTS ($97)
7.1 Groundwater Restoration	**2,771,087**
Total Cost	**2,771,087**

7.1 Groundwater Restoration Costs

Basis: Table 7.1, Table 7.2 & Table 7.3 - Groundwater Restoration Basis

1999 SURETY DETAIL - PATTERNS TO BE RECLAIMED

Volume Estimate per Wellfield

Wellfield #1 (112 patterns)	$ 749,849
Wellfield #3 (144 patterns)	$ 890,703
Wellfield #4 (118 patterns)	$1,130,535
Total	$2,771,087

Basis of costs can be found on Tables 7.1, 7.2, and 7.3 attached to this page. The Affected Pore volume estimate is shown below and uses the Flare Factor of 1.68 which doubles RAMC's previous proposed flare factor. Please note, Rio Algom Mining Corp. does agree that the LQD flare factor of 2.94 is appropriate, and is currently modeling the hydrological and geochemical data to develop a more appropriate estimate for the Smith Ranch project. This will provide a more appropriate site-specific estimate. Although this flare factor results in a total bond estimate less that the currently posted bond, Rio Algom will not propose to reduce the current bonding until the groundwater restoration cost issue is resolved between LQD and Rio Algom.

Wellfield	Nominal Pattern Dimensions	Nominal Pattern Area (ft^2)	Number of Patterns	Average Open Interval (ft)	Effective Porosity	Flare Factor	Pattern Affected Pore Volume (gal/pattern)	Wellfield Affected Pore Volume (gallons)
1	100' x 100'	10000	112	15	0.27	1.68	508,939	57,001,190
3	100' x 100'	10000	144	20	0.27	1.68	678,586	97,716,326
4	100' x 100'	10000	118	18	0.27	1.68	610,727	72,065,791

(Page Left Intentionally Blank)

Table 7.1
SMITH RANCH PROJECT
Mining Unit Groundwater Restoration Costs
Wellfield #1

1 APV = 57,001,190

RESTORATION COST COMPONENT		Total Gallons Treated	Operating Flow Rate GPM	Total Cost	Number of Days
1. Wellfield Pumping Costs					
a) Groundwater Sweep (no reinjection) (3 APV)	($0.118/1,000 gal.)	171,003,571	1015	$20,178	117
b) Chemical Reductant Injection (95% reinjection) (1 APV)	($0.232/1,000 gal.)	57,001,190	1015	$13,224	39
c) RO/EDR Treatment (75% reinjection) (2 APV)	($0.201/1,000 gal.)	114,002,381	1000	$22,914	79
SUBTOTAL				$56,317	235
2. Chemical Treatment Power Costs					
a) Reverse Osmosis Unit	$1.33/gpm/day ($0.92/1,000 gal.)	114,002,381	1000	$104,882	
SUBTOTAL				$160,930	
3. Chemicals					
a) Waste Water Treatment (BaCl2, Resin Elut. Chem)			600	$41,636	235
BaCl2 @ $9.00/gpm/month, Elution					
@$400/elution, Waste Water @ 2 mg/L U3O8	Elution Costs (5.2 Elutions/year * $400/ Elution)			$1,340	
500 ft3 resin, 2 lb./ft3 loading,					
Annualized Waste Water Flow; 600 gpm					
1 elution every 69 days or 5.2 elutions per year					
b) Chemical Reductant (H2S or alternative)	$1.80/gpm/day ($1.25/1,000 gal.)	57,001,190	1015	$71,251	
c) RO Chemicals (H2SO4, Antiscalents, Oxygen Scavenger)	$0.57/gpm/day ($0.40/1,000 gal.)	114,002,381	1000	$45,601	
SUBTOTAL				$116,852	
4. Repairs and Maintenance					
a) Wellfield and Waste Water Treatment	$10,000/mo	7.7	months	$77,103	
b) RO and process equipment	$5,000/mo	7.7	months	$38,552	
SUBTOTAL				$115,655	
5. Labor					
Supervisor @ $20.00 per hour		7.7	months	$24,673	
4 Operators @ $13.00 per hour		7.7	months	$64,150	
2 Maintenance @ $13.00 per hour		7.7	months	$32,075	
SUBTOTAL				$120,898	
6. Contract Laboratory Analysis					
70 Monitor Wells (140 UCL samples per year @$100)		0.6		$8,995	
Stabilization Samples					
10 Wells	- 3 complete Assays @$350			10,500	
	- 9 abbreviated assays @ $250			22,500	
SUBTOTAL				$41,995	
7. Operating Expenses					
Supplies	@$3,000/mo	7.7		23,131	
Heating	@$5,000/mo	3.9		19,276	
Vehicle Fuel	@$1,000/mo	7.7		7,710	
Office Utilities	@$1,000/mo	7.7		7,710	
SUBTOTAL				$57,827	
TOTAL OPERATING COST TO RESTORE GROUNDWATER AT FULL PRODUCTION (Nominal Mine Unit)				$670,475	(1993$)
UNIT RESTORATION OPERATING COST			112 Patterns	$5,986	/Pattern
1993 -1997 inflation (CPI-U) = 160.6/143.6 =	11.84%			$79,374	
			Total	$749,849	(1997$)

Table 7.2

SMITH RANCH PROJECT

Mining Unit Groundwater Restoration Costs

Wellfield #3

1 APV = 97,716,326

RESTORATION COST COMPONENT		Total Gallons Treated	Operating Flow Rate GPM	Total Cost	Number of Days
1. Wellfield Pumping Costs					
a) Groundwater Sweep (no reinjection) (3 APV)	($0.118/1,000 gal.)	293,148,979	1015	$34,592	201
b) Chemical Reductant Injection (95% reinjection) (1 APV)	($0.232/1,000 gal.)	97,716,326	1015	$22,670	67
c) RO/EDR Treatment (75% reinjection) (2 APV)	($0.201/1,000 gal.)	195,432,653	1000	$39,282	136
SUBTOTAL				$96,544	403
2. Chemical Treatment Power Costs					
a) Reverse Osmosis Unit	$1.33/gpm/day ($0.92/1,000 gal.)	195,432,653	1000	$179,798	
SUBTOTAL				$160,930	
3. Chemicals					
a) Waste Water Treatment (BaCl2, Resin Elut. Chem)			600	$71,376	403
BaCl2 @ $9.00/gpm/month, Elution					
@$400/elution, Waste Water @ 2 mg/L U3O8	Elution Costs (5.2 Elutions/year * $400/ Elution)			$2,297	
500 ft3 resin, 2 lb./ft3 loading,					
Annualized Waste Water Flow; 600 gpm					
1 elution every 69 days or 5.2 elutions per year					
b) Chemical Reductant (H2S or alternative)	$1.80/gpm/day ($1.25/1,000 gal.)	97,716,326	1015	$122,145	
c) RO Chemicals (H2SO4, Antiscalents, Oxygen Scavenger)	$0.57/gpm/day ($0.40/1,000 gal.)	195,432,653	1000	$78,173	
SUBTOTAL				$200,318	
4. Repairs and Maintenance					
a) Wellfield and Waste Water Treatment	$10,000/mo	13.2	months	$132,177	
b) RO and process equipment	$5,000/mo	13.2	months	$66,089	
SUBTOTAL				$198,266	
5. Labor					
Supervisor @ $20.00 per hour		13.2	months	$42,297	
4 Operators @ $13.00 per hour		13.2	months	$109,971	
2 Maintenance @ $13.00 per hour		13.2	months	$54,986	
SUBTOTAL				$207,254	
6. Contract Laboratory Analysis					
70 Monitor Wells (140 UCL samples per year @$100)		1.1		$15,421	
Stabilization Samples					
10 Wells	- 3 complete Assays @$350			10,500	
	- 9 abbreviated assays @ $250			22,500	
SUBTOTAL				$48,421	
7. Operating Expenses					
Supplies	@$3,000/mo	13.2		39,653	
Heating	@$5,000/mo	6.6		33,044	
Vehicle Fuel	@$1,000/mo	13.2		13,218	
Office Utilities	@$1,000/mo	13.2		13,218	
SUBTOTAL				$99,133	
TOTAL OPERATING COST TO RESTORE GROUNDWATER AT FULL PRODUCTION (Nominal Mine Unit)				$1,010,865	(1993$)
UNIT RESTORATION OPERATING COST			144 Patterns	$7,020	/Pattern
1993 -1997 inflation (CPI-U) = 160.6/143.6	11.84%			$119,671	
			Total	$1,130,535	(1997$)

Table 7.3
SMITH RANCH PROJECT
Mining Unit Groundwater Restoration Costs
Wellfield #4

1 APV = 72,065,791

RESTORATION COST COMPONENT		Total Gallons Treated	Operating Flow Rat GPM	Total Cost	Number of Days
1. Wellfield Pumping Costs					
a) Groundwater Sweep (no reinjection) (3 APV)	($0.118/1,000 gal.)	216,197,372	1015	$25,511	148
b) Chemical Reductant Injection (95% reinjection) (1 APV)	($0.232/1,000 gal.)	72,065,791	1015	$16,719	49
c) RO/EDR Treatment (75% reinjection) (2 APV)	($0.201/1,000 gal.)	144,131,581	1000	$28,970	100
SUBTOTAL				$71,201	297
2. Chemical Treatment Power Costs					
a) Reverse Osmosis Unit	$1.33/gpm/day ($0.92/1,000 gal.)	144,131,581	1000	$132,601	
SUBTOTAL				$160,930	
3. Chemicals					
a) Waste Water Treatment (BaCl2, Resin Elut. Chem)			600	$52,640	297
BaCl2 @ $9.00/gpm/month, Elution					
@$400/elution, Waste Water @ 2 mg/L U3O8	Elution Costs (5.2 Elutions/year * $400/ Elution)			$1,694	
500 ft3 resin, 2 lb./ft3 loading,					
Annualized Waste Water Flow; 600 gpm					
1 elution every 69 days or 5.2 elutions per year					
b) Chemical Reductant (H2S or alternative)	$1.80/gpm/day ($1.25/1,000 gal.)	72,065,791	1015	$90,082	
c) RO Chemicals (H2SO4, Antiscalents, Oxygen Scavenger)	$0.57/gpm/day ($0.40/1,000 gal.)	144,131,581	1000	$57,653	
SUBTOTAL				$147,735	
4. Repairs and Maintenance					
a) Wellfield and Waste Water Treatment	$10,000/mo	9.7	months	$97,481	
b) RO and process equipment	$5,000/mo	9.7	months	$48,740	
SUBTOTAL				$146,221	
5. Labor					
Supervisor @ $20.00 per hour		9.7	months	$31,194	
4 Operators @ $13.00 per hour		9.7	months	$81,104	
2 Maintenance @ $13.00 per hour		9.7	months	$40,552	
SUBTOTAL				$152,850	
6. Contract Laboratory Analysis					
70 Monitor Wells (140 UCL samples per year @$100)		0.8		$11,373	
Stabilization Samples					
10 Wells	- 3 complete Assays @$350			10,500	
	- 9 abbreviated assays @ $250			22,500	
SUBTOTAL				$44,373	
7. Operating Expenses					
Supplies	@$3,000/mo	9.7		29,244	
Heating	@$5,000/mo	4.9		24,370	
Vehicle Fuel	@$1,000/mo	9.7		9,748	
Office Utilities	@$1,000/mo	9.7		9,748	
SUBTOTAL				$73,110	
TOTAL OPERATING COST TO RESTORE GROUNDWATER AT FULL PRODUCTION (Nominal Mine Unit)				$796,419	(1993$)
UNIT RESTORATION OPERATING COST			118 Patterns	$6,749	/Pattern
1993 -1997 inflation (CPI-U) = 160.6/143.6 =	11.84%			$94,284	
			Total	$890,703	(1997$)

(NRC Related Activity)

APPENDIX 8
HEALTH PYSICS COSTS

Cost Summary

ITEM	COSTS ($97)
8.1 Health Physics	**168,470**
Total Cost	**168,470**

Health Physics

Basis: Year #1 - 223 Days:
See Table 8.1

- Labor Crew = 1 - RSO @ $32.70/Hr
  0.5 - RST @ $21.80/Hr
  $43.60/Hr x 1784 Hr = $ 77,782

Basis: Year #5 - 483 Days
See Table 8.1

- Labor Crew = 1 - RSO @ $32.70/Hr
  0.5 - RST @ $22.80/Hr
  $43.60/Hr x 3864 Hr = $168,470

To provide consistency with Rio Algom Mining Corp.'s U.S. Nuclear Regulatory Commission (NRC) surety, Rio Algom has elected at this time to continue to use the five (5) forward bond amount utilized for NRC purposes.

(NRC & WDEQ/LQD Related Activity)

APPENDIX 9
WHOLE TRUCKING COSTS

Cost Summary

ITEM	COSTS ($97)
9.1 Contaminated Trucking	**523**
9.2 Uncontam. Trucking	**157**
Total Cost	**680**

Contaminated Trucking - Year #1

Basis: See Table 9.1

- Haul = 0.2 Trucks x 800 Miles x $3.27/Mile = $ 523

9.2 Non-Contaminated Trucking - Year #1

Basis: See Table 9.2

- Haul = 0.5 Trucks x 8 Hrs/Truck x $65.39/Hr = $ 157

9.3 Contaminated Trucking - Year #5

Basis: See Table 9.3

- Haul = 0.2 Trucks x 800 Miles x $3.27/Mile = $ 523

9.4 Non-contaminated Trucking - Year #5

Basis: See Table 9.4

- Haul = 0.3 Trucks x 8 Hrs/Truck x $65.39/Hr = $ 157

To provide consistency with Rio Algom Mining Corp.'s U.S. Nuclear Regulatory Commission (NRC) surety, Rio Algom has elected at this time to continue to use the five (5) forward bond amount utilized for NRC purposes.

(WDEQ/LQD Related Activity)

APPENDIX 10
DELINEATION DRILLING RECLAMATION COSTS

Cost Summary

ITEM	COSTS ($97)
10.1 Delineation Drilling	**396,808**
Total Cost	**396,808**

Delineation Drilling Costs

Basis:	Delineation Holes drilled in 1998-1999	1,313
	Delineation Holes to be drilled in 1999-2000	1,600
	Total Delineation Holes to be Bond	2,913

Per hole cost for reclamation of delineation is based on bonding estimate for exploration holes under DN 236. (see attached table)

Reclamation costs per hole = $136.22/hole

Cost for plugging and abandonment: 2913 holes x $136.22/hole

Delineation Drilling Costs = ***$396,808***

Table 10.1
Reclamation Cost Estimate for Delineation Holes

1999 Reclamation Bond Estimate				
Well Abandonment and Topsoil Replacement and Re-vegetation				
I.	Assumptions			
	A.	Drill Hole Abandonment		
		# of Drill holes		1
		Bentonite chips cost		$12.50
		Personnel - $/hr		$17.50
		Transportation - $/hr		$6.54
		Water truck - $/hr		$10.00
		Holes/day		5
		# of Days		0
		# of Hours		2
		Drill Hole Abandonment Cost		$80.58
	B.	Survey Crew Cost		
		Hours/hole		0.3
		$/hour		$75.00
		Subtotal		$22.50
		Survey Crew Cost		$22.50
II.	Equipment			
	A.	Abandonment Equipment		N/A
	ABANDONMENT COST			$103.08
Total Cost per Well or Drill Hole				$103.08
III.	Backfill & Topsoil Replacement			
	A.	Assumptions		
	1.	General		
		Affected Area/hole (ft2)		400
		Affected area/hole (acres)		0.01
		Pit area/pit (ft2)		120
		Backfill depth		9
		Modified Pit Volume		800
		Number of wells and drill holes		1
		Topsoil Replacement Depth (ft)		0.33
		Pit Topsoil Volume (yd3)		1.47
		yd3 backfill		29.63
		total yd3 backfill		29.63
		Total yd3 topsoil		1.47
		Total affected area (acres)		0.01
	2.	Equipment with operator		
		Productivity backhoe w/trailer (yd3/hr)		32.39
		$/hour		$33.24
		Total replacement costs		$31.92
IV.	Reseeding			
	1.	Equipment		
		Drill Seeder w/trailer ($/acre)		$100.00
		Subtotal Equipment Cost		$0.92
	2.	Seed		
		$/acre		$33.00
		Subtotal Seed Cost		$0.30
	Subtotal Re-Seeding Cost			$1.22
V.	Mulching & Crimping			
	1.	Equipment		N/A
		Subtotal Equipment Cost		$0.00
	2.	Mulch		N/A
	Subtotal Mulching & Crimping Cost			$0.00
Subtotal Reseeding Cost/hole				$1.22
TOTAL				$136.22

APPENDIX 11 - SURETY BOND SUMMARY

This section contains the cost basis that was used in the bond calculations provided within Appendices 1-10. The basis for the bond calculations are from contractor bids to perform the work with the costs then adjusted to constant 1997 dollars as requested by WDEQ/LQD. Provided in the summary table below are the initial bids in the dollars of their day and the adjustment to 1997 dollars. The individual contractor bids follow the summary table.

BID RATES FOR LABOR AND EQUIPMENT

ITEM	HOURLY BID RATE-YEAR ($/HR)	ADJUSTED 1997 DOLLARS ($/HR)
Foreman	19.80 (1993)	21.58
Certified Welder	17.75 (1993)	19.35
Operator	16.25 (1993)	17.71
Laborer	11.95 (1993)	13.02
Journeyman Electrician	32.00 (1993)	34.88
Apprentice Electrician	28.00 (1993)	30.51
20 Ton Crane (**)	34.31 (1993)	37.39
6000# Forklift (**)	12.04 (1993)	13.12
Welding/Torch (**)	10.00 (1993)	10.90
D8N Dozer (*)	108.00 (1993)	117.71
140G Blade (*)	60.00 (1993)	65.34
Pavement Breaker, Fuel/Maint	28.75 (1993)	31.33
980C Loader (*)	85.00 (1993)	92.64
235 Trackhoe (*)	103.00 (1993)	112.25
627 Scraper (*)	111.00 (1993)	120.98
Pulling Unit (*)	30.00 (1993)	32.70
Backhoe (*)	25.00 (1993)	27.25
2000 PSI Spray Washer	8.00 (1993)	8.71
Chainsaw (**)	2.20 (1993)	2.40

Note - (*) includes operator, fuel, and maintenance. Others include fuel and maintenance unless shown otherwise.. (**) bid obtained by telephone. Adjustment to 1997 dollars were made using GNP-IPD inflation rate of 8.99% [1st quarter 1993 (101.8) through 1st quarter 1997 (110.95)].

Estimate of Byproduct Material Disposal Costs

Currently, License Condition 9.5 of Source Material License SUA –1548, authorizes Rio Algom to dispose of byproduct material from the Smith Ranch Facility at the Quivira Mining Company tailings pile, New Mexico. Quivira Mining Corporation is a wholly owned subsidiary of Rio Algom Mining Corp.

In the 1998 Surety Review, NRC has requested that RAMC consider the disposal costs in the surety estimates. To provide an estimate for byproduct material disposal costs, RAMC will include a cost of $50/ton of material. This cost estimate is based on QMC's contract with the Grace Estate, Source Material license SUA-1480, to accept their byproduct material. This cost includes labor, equipment, analysis, and allow for a profit. The estimate is to receive material at QMC's site and place the material into the disposal cells. The basis of this cost is to provide funding to place the byproduct material from Smith Ranch into the tailings pile as designated by the license.

The estimated disposal costs are listed below, and the breakdown of the tasks are based on the reclamation activities described in Section 6.0 of the amended March 31, 1988 License Application.

Item	Qty of Waste (lbs) Section 6.0	Qty of Waste (tons)	Disposal Cost (SUA-1473) (1998 dollars)
Ion Exchange Plants			
Tankage and Vessels	396,760	198.38	9,919
Piping	104,160	52.08	2,604
Pumps	11,400	5.7	285
Foundations	754,730	377.37	18,868
Sub Total			31,676
Central Processing Plant			
Tankage and Vessels	172,420	86.21	4,311
Piping	9,136	4.57	229
Pumps	10,612	5.31	266
Foundation	539,000	269.5	13,475
Sub Total			18,281
Dryer Area			
Building	71,212	35.61	1,781
Equipment	53,800	26.90	1,345
Foundations	114,268	57.13	2,857
Sub Total			5,983
Existing Facilities			
Foundations	1,086,101	543.1	27,155

Sub Total			27,155
Item	Qty of Waste (lbs) Section 6.0	Qty of Waste (tons)	Disposal Cost (SUA-1473) (1998 dollars)
Unit Header Sites & Wellfields			
Header Piping	75,852	37.9	1,895
Wells – Total	109,015	54.5	2,725
Monitor Wells – Total	91,022	45.51	2,276
Sub Total			6,896
Associated Structures			
#1 Trunkline (5,000 ft. ea.)	282,700	141.4	7,070
#2 Trunkline (10,000 ft. ea.)	565,400	282.7	14,135
Radium Settling Ponds	187,472	93.74	4,687
Sub Total			25,892
Total Disposal Costs			115,883

CHAPTER 7

ENVIRONMENTAL EFFECTS

The objective of the mining and environmental monitoring program is to conduct a mining operation that is viable and environmentally responsible. The environmental monitoring programs used to ensure that potential sources of pollution are controlled and monitored are presented in Chapter 5.

This Chapter discusses and describes the degree of unavoidable environmental change, the short-term and long-term impacts due to the operation and discusses potential impacts of possible accidents associated with the project.

7.1 Site Preparation and Surface Impacts

Impacts from site preparation and construction will be limited to the local soils and vegetation. The recovery plant will be located within the Bill Smith Mine site, therefore, its construction will not result in new surface disturbance. Implementation of the solution mining project will extend the operating life of the site and defer final reclamation. During this period, livestock grazing will continue to be excluded from the approximately 40-acre Bill Smith Mine site.

Drilling wells and installation of pipelines will result in temporary disturbance to the soils and vegetation in those areas; however, as demonstrated by the pilot programs, the impact is minimal. Topsoil will be bladed to one side, then re-spread over the area and seeded as soon as construction is complete. Vegetation in these areas is normally re-established within two years of disturbance. Implementation of the project will result in livestock being excluded from some of the

wellfield areas, however, this will vary with the grazing level and the rancher's desires. In the Q-Sand pilot, the one acre production area was fenced to exclude livestock. However, in the 1.8 acre O-Sand pilot the area excluded from grazing is only about 0.2 acres. The area to be excluded from grazing due to pipelines and the wellfields is expected to average less than 100 acres over the life of the project.

Surface disturbances associated with the evaporation ponds and access roads will be for the life of these activities as the topsoil will be removed from this area and stockpiled prior to construction. As these facilities are no longer needed for the operation, the areas will be re-contoured, top-soiled and re-seeded. The primary impact of these activities will be the exclusion of livestock and wildlife from the evaporation pond areas for the life of the ponds. At start-up it is expected that grazing will be excluded from approximately 30 acres, with the total area increasing to as much as 150 acres over the life of the project. After the project is complete, all areas will be reclaimed and the pre-mining use restored, therefore, there will be no long-term surface impact from the operation.

There will be no subsidence as a result of the operation. The proposed in-situ leach process quantitatively removes uranium minerals from the surfaces of the host formation along with trace quantities of other elements similarly deposited on the host sandstone and clays. The demonstrated nature of this process is that the physical structure of the host matrix is unaffected. For this reason, subsidence does not result from in-situ leaching, nor does in-situ leaching of uranium alter the potential for subsidence.

Because there is no potential for subsidence as a result of the in-situ mining process, no subsidence mitigation or control plan has been included with this application.

7.2 Air and Water Impacts

No significant or measurable impacts to air or surface water quality are anticipated as a result of the operation.

7.2.1 Potential Impact to Ephemeral Drainages

Within the permit area, the main drainages collect surface precipitation and snowmelt in a roughly northwest to southeast direction along Sage Creek. All flow within the permit is ephemeral with no intermittent or perennial streams or flows. The volume of flow from these ephemeral drainages is seasonal and directly related to local climatic conditions. The climate is semi-arid with an overall precipitation averaging 12 inches per year. Snow accumulations are generally light and overall contribute little to the total annual precipitation. Most of the precipitation comes in the form of local rain-bearing thunderstorms.

Mining activities may sometimes come in contact with ephemeral drainages as a result of roads or due to wellfield operations. The travel roads include two track and/or established roadways. To the extent possible, existing travel roads will be utilized when travelling within the permit area. In instances where ephemeral drainages may be impacted by mining operations, whether by road or wellfield operations, the appropriate protection measures will be afforded to minimize impact to the drainage including prevention of erosion.

The primary surface disturbances associated with in-situ leaching occur with well drilling, pipeline installations, road and wellfield construction. These disturbances however, involve relatively small areas and/or have a very short-term impact. An effort will be made to keep short-term disturbances caused by these operations to a minimum. Activities associated with drilling include construction of drill pits and preparation of drill sites. Once a drill site has been selected, the appropriate topsoil protection methodology (Chapter 6 of this permit) will be employed. Erosion protection measures which may be taken, based on the site specific requirements, include the placement of hay bales, sedimentation breaks, placement of water contour bars, grading and contouring both before and/or after drilling operations to minimize erosion.

Road construction will be kept to a minimum by utilizing existing roads when possible. When designing and constructing new roads, weather, elevation contours, land rights, and drainages will be considered. When constructing new roads, efforts will be to cross ephemeral drainages or channels at right angles to enhance erosion protection measures. However, given that each specific site is different, it may not always be feasible or warranted to construct roads or crossings at right angles or along elevation contours. In such cases, appropriate erosional measures will be considered, examined, and utilized to minimize erosion.

During the construction of wellfields, many activities are on-going including drilling, casing of wells, well development, pipeline construction, header house construction, lateral pipeline placement and access road construction. These activities may have a short term or temporary effect on erosion.

To reduce the potential impact of these activities, erosion protection measures may be employed based on site specific conditions. These measures may include; the placement of hay bales, sedimentation breaks, placement of water contour bars, installing culverts, grading and contouring to help minimize erosion.

In steep grade areas, in addition to the previously noted erosion protection measures, the disturbed areas will be re-seeded as soon as possible after construction is completed. This seeding will commence at the appropriate time for optimum growth, whether the next spring or fall planting, and weather permitting.

In areas where wells may be constructed in drainage areas, impacts will be minimized through the use of necessary erosion protection structures including but not limited to; placement of hay bales; construction of water contour bars; installing culverts; flow diversion structures; grading and contouring; application of rip rap; and designated traffic routes. Traffic within the drainage bottoms will be limited to work activities necessary to construct and service wells. Wells that are constructed in significant drainages where runoff has a likely potential to impact the wellhead will have added wellhead protection. This protection will vary depending on the drainage and its potential for runoff. Protection measures may include barriers surrounding the wellhead, protective steel casing, cement blocks or other means to protect the wellhead from damage that may be caused by runoff.

7.2.2 Potential Impacts to Surface Waters

The potential impacts to surface waters as a result of operations at the Smith Ranch are considered to be minimal and temporary. There is, however, the potential for impacts to occur during wellfield construction and reclamation activities. During leaching, restoration, and after reclamation, the surface will be vegetated and contoured to minimize temporary effects to surface water quality.

The physical presence of the surface facilities including wellfields and associated structures, access and haul roads, satellite IX buildings, office buildings, pipelines, central processing plant and other structures associated with the solution mining and processing of uranium ore are not expected to significantly change peak surface water flows because of the relatively flat topography of the drainages at the sites, the low regional precipitation, the absorptive capacity of the soils, and the small area of disturbance relative to the large drainage are within and adjacent to the permit area. In areas where these structures may affect surface water drainage patterns, diversion ditches and culverts or be used to prevent excessive erosion and control runoff. In areas where runoff is concentrated, energy dissipaters may be used to slow the flow of runoff to minimize erosion and sediment loading in the runoff.

During wellfield construction and reclamation, the potential loss of vegetation to those activities may cause increased opportunities for erosion and potential movements of sediments into drainages. Where possible, contouring will be used to minimize the potential effects of erosion. Upon completion of construction and reclamation, and as soon as feasible considering growing seasons, re-vegetation work will be

started using either cover crops or a native seed mix to stabilize the soil and minimize erosion due to runoff.

7.2.3 Potential Impacts to Groundwater

Over the long-term, the groundwater concentration, of some parameters, in the ore zone may slightly vary compared with the initial condition; however, any changes will be minimal and will not alter the potential use category of these waters as defined by the Wyoming Department of Environmental Quality. The most significant water impact will be the withdrawal and beneficial use of about 20,000 acre feet of groundwater over the life of the project; approximately the same volume as was produced from the Bill Smith Mine between 1974 and 1982. Most of the water removed will be returned to the environment after treatment and discharge or used for irrigation, etc. The remaining water removed from the formation will be evaporated or disposed through authorized deep well injection with only small amounts leaving the site as wet product and/or waste.

7.2.4 Potential Impacts to Air

The potential impacts to air quality as a result of solution mining and processing of uranium are considered to be minimal and temporary. During wellfield and plant construction, the principal emissions to air would be suspended particulates and gaseous pollutants from vehicle and drill rig exhausts, dust from vehicular traffic on unpaved roads, and dust from disturbed and unprotected soils. During the life of the project, drill rigs and associated mobile equipment will be used during wellfield construction. Diesel powered drill rigs and water trucks associated with wellfield delineation and development, act as non-stationary sources of air pollutants. The drilling

activities will proceed through the various wellfields with each drill hole location requiring one to four days of work. Most other equipment associated with wellfield development and construction will experience intermittent use, and its impact on air quality will be negligible. Other mobile vehicles will either be gasoline or diesel powered on-road cars and trucks typically equipped with required emission control devices.

Dust emissions from wind erosion will be minimized by promptly reclaiming disturbed soil and establishing vegetative cover to wellfields and soil stockpiles.

Air quality impacts related to operations will largely be limited to airborne effluents generated from processing. Air pollution consisting of dust suspended and exhaust emissions by vehicle traffic associated with routine wellfield maintenance will be minimal.

Dissolved radon gas, generated by its dissolution from processing solutions, may escape to the atmosphere and potentially adversely impact air quality in the wellfields and near processing buildings. Radon can be vented to the atmosphere from the wellfields at each wellhead or from the process equipment in the IX facility or the processing plant. Rio Algom is using pressurized downflow IX columns, and therefore radon releases would occur only when individual IX columns are disconnected from the circuit and opened to remove the resin for elution. Additionally, the yellowcake dryers could potentially release airborne particulate emissions, including natural uranium and radon daughters, to the environment. Rio Algom has modeled the radiological effects of these emissions upon the local population using the MILDOS-AREA computer code developed

by NRC. A more detailed discussion of this model can be found in Section 7.3.

7.3 Radiological Impacts

Exposure pathways to radiological materials in solution mining operations are considerably different from pathways associated with other uranium mining and milling methods. The environmental advantages of the solution mining method and the processing of uranium for this project are two-fold. First, the majority of the radioactive daughter products remains underground and is not removed with the uranium. Second, the use of modern vacuum dryers equipped with wet scrubbers to produce yellowcake reduces the potential radiological air particulate releases typically associated with conventional uranium milling facilities to insignificant levels (FEIS, NUREG-1508, 1997).

7.3.1 Exposure Pathways

There will be no routine particulate emissions from the facility. Liquids released from the facility will be treated on site to reduce radiation/ concentration levels of uranium and radium to levels acceptable for release to unrestricted areas as specified in 10 CFR 20 Appendix B Table II (1992). The only avenue, which is considered a potentially significant radiological exposure pathway for the proposed project, is the release of gaseous radon-222 to the atmosphere.

The effects of radon gas release from wellfields, satellites, main production facility, and ponds during production and restoration were modeled with the use of MILDOS-Area, a dispersion model approved by NRC for estimating potential radiological impacts caused by air emissions. The 1997

version of the model allows comparison of specific receptor site air concentrations with the ALCs given in 10 CFR 20.

7.3.2Background Radiation Exposures to the Population

The major population areas within 50 miles of the recovery plant site are the towns of Glenrock with a population of approximately 2,000 (17 miles SSW), Douglas with a population of approximately 5,000 (23 miles SE), and Casper with a population of approximately 52,000 (36 miles WSW). A regional population within 50 miles of the plant site is approximately 59,000 persons.

In the FEIS for the Teton ISL Project (NUREG-0925, Section 4.5.7), the NRC staff stated the primary sources of radiological exposure to the population in the vicinity of the Teton project were naturally occurring cosmic and terrestrial radiation (174 mRem/yr), naturally occurring radon-222 (up to 625 mRem/yr), and diagnostic medical procedures (75 mRem/yr. Since the Teton ISL project is only some 10 miles from the Smith Ranch Central Processing Facilities, it can be assumed that natural background radiological exposure will be similar in nature at Smith Ranch.

7.3.3 Annual Population Doses from the Project

Annual population doses computed by MILDOS for the period of maximum mine emissions of radon-222 indicated a dose of 0.3 person-Rem/yr from mine activities to persons living within 50 miles of the site.

7.3.4 Dose to Individuals

A series of nearby receptors were assessed in the MILDOS model runs. These receptors included nearby dwellings and

ranches, towns as far distant as Casper, and a series of hypothetical receptors placed around the perimeter of the project on the permit boundary. These last receptors included locations downwind of the satellites and the main processing facility.

The highest radon working level at a permit boundary receptor with access to an unrestricted area was 7.99E-05 WL compared to an ALC of 1.10E-03 WL.

Dose to Effective was predicted to be 2.24 mRem/yr at this receptor (downwind of the main processing facility). Dose to Bronchi at two unrestricted area boundary receptors were more that 25 mRem/yr but within the error of the model. These two locations will be monitored for dosage during the period of maximum mine activity

7.3.5Radiological Impacts on Biota Other than Man

Spill prevention and clean-up standard operating procedures, restrictive fencing, and equipment design will restrict contact between native biota and the radioactive materials accumulated during mining. Some small mammals, insects, and birds will have occasional contact with materials containing small amounts of radioactivity. No significant impact is expected from this contact.

The primary radioactive emission from the project will be airborne radon-222. Since the levels will be closely monitored within the restricted area for worker safety, it is reasonable to assume that wildlife mobility and limited access will lead to lower exposures than those experienced by workers. In unrestricted areas, radiological impacts on biota other than man should be at least as low as the impacts predicted for man.

7.4 Endangered Species Impact

There are no known endangered species or endangered species habitat within the project area; therefore, there will be no impact to endangered species from the proposed project.

7.4.1 Wildlife Impact

The species observed on the permit area are common throughout eastern Wyoming and many other areas of the Rocky Mountain region. Many individuals of the small animal species such as the small burrowing mammals, snakes, lizards, and arthropods that now live in areas that will be disturbed by the proposed project will be destroyed when the vegetation is removed. The total area disturbed during the project life will approximate 500 acres. Since a relatively small number of reptiles inhabit the disturbed permit area, the impact on these animals will be relatively minor. Vegetation removal will also have a relatively minor effect on insects and other arthropods because of their ability to quickly re-establish populations on reclaimed area. However, the loss of arthropods will decrease the amount of food available to insectivorous animals, including many species of birds. More small mammals (mice, rats, and ground squirrels) will be lost as a result of vegetation removal than any other group of vertebrates. The number of animals lost in any area will be generally proportional to the number of acres disturbed. The short average life cycle of small mammals means that the loss in potential biomass accumulates during each year of project operation and rebounds proportionally once project areas are revegetated and released. It is estimated that as much as 8.4 to 120 lbs./yr. of rodent biomass may be lost throughout the life of the recovery plant and associated facilities. A total of 84. to 1200 lbs./yr. of rodent biomass

may be lost as a result of wellfield installation and operation. Construction and operation of the additional satellite facilities may result in a loss of 4.2 to 60 lb./yr. of rodent biomass. While this will not significantly affect the long-term maintenance of small mammal populations in the area, it will reduce the amount of food available to predatory animals such as raptors, coyotes, and badgers. Whittaker (1970) states that the efficiency of food utilization by primary carnivores may be as high as 15 percent. If this figure is used as a rough estimate, then planned project operations may result in the loss of a maximum of 14 to 198 lbs./yr. of carnivore biomass. Construction of the future additional facilities could result in a loss of 1 to 9 lbs./yr. of carnivore biomass.

Highly mobile species, such as the larger mammals (pronghorn antelope and mule deer) and most birds, will be able to escape the disturbed area. However, the movement of those animals into adjacent undisturbed habitat may result in increased competition for food, shelter, territory, mates, and other necessities. This may result in the loss of some of these animals.

In terms of economic value and public interest, the most important wildlife species that utilizes the permit area is probably the pronghorn antelope. It is estimated that the density of antelope in this region is five to seven animals per square mile and that they remain in the area throughout the year. Consequently, the loss of 40 acres of vegetation due to the recovery plant and associated facilities may result in a reduction in antelope carrying capacity on the permit area by less than one (1) animal, while mining activities on an average of 40 acres/year may reduce antelope carry capacity by the same

amount. Operation of the additional satellite facilities (an average of 80 acres/year) could reduce antelope carrying capacity by one (1) animal.

The increased number of people in the permit area could have an additional impact on antelope and other wildlife populations, since some animals are likely to be killed by increased vehicular traffic. These additional wildlife losses are not expected to result in any long-term decrease in any wildlife populations, including antelope, since the number lost each year is expected to be a very small percentage of the total population.

Other than actual removal of vegetation and the potential of accidents resulting from activity in the area, project activities are not expected to significantly affect the antelope population. These animals do not appear to be disturbed by mining and processing activities similar to those proposed for this project. For example, at the Highland ISL Uranium Project adjacent to the Rio Algom permit area, antelope are commonly observed near active mining areas without any noticeable concern. No reduction in the pronghorn population has been observed in the vicinity of that facility since it was originally constructed by Exxon in the early 1970's.

Construction and operation of the proposed project should not have a significant effect on raptors utilizing the permit area due to the small percentage of prey that would be lost as a result of vegetation removal.

Wildlife species will re-invade disturbed areas after they are reclaimed. The time required for re-invasion is a function of the habitat requirements of each species. Herbivores capable

of feeding on grasses and weedy plant species (e.g., deer mouse, thirteen-lined ground squirrel, mourning dove, and horned lark) would be the first animals to establish themselves on re-vegetated areas. Those animals also nest on the ground and prefer open habitats. Predaceous arthropods, such as ground beetles and assassin bugs, and insectivorous animals, such as the grasshopper mouse, meadowlark, loggerhead shrike, and horned lizard, would also be expected to be early invaders of re-vegetated areas. Several other species of animals (such as sage grouse) that are heavily dependent on sagebrush and other shrubs for food, cover, and/or nesting could take several years to successfully re-invade reclaimed areas because of the time required for shrubs to become re-established.

Although it is likely that noise has some effect on certain species of wildlife, the EPA states that a thorough literature search "revealed an almost complete lack of information concerning the effects of noise on wildlife" (EPA, 1972). Specific effects of mining noise on the wildlife in the permit area cannot be determined; however, from experience at similar mine sites, it is likely that most species will quickly become accustomed to noise from operating machinery. For example, at the Highland ISL Uranium Project, the deer and pronghorn antelope are commonly observed within active mining and drilling areas and they display no noticeable concern. Although this does not prove that noise created by mining has no effect on wildlife, it tends to indicate that effects, if any, are minor.

Impacts to wetlands and surface water sources available to wildlife are expected to be minimal during the life of the project. At this time, no disturbances to any wetlands or water sources are planned. If, in the future, a change in the mine

plan should involve an impact to a wetlands area or water source, appropriate agencies will be contacted for development of a mitigation plan. All proposed drainage crossings will comply with appropriate regulations.

7.5 Mineral Resource Impacts

The only mineral known to be present in economically recoverable quantities in the project area is uranium. Oil and gas exploration has been conducted and is expected to continue in the general area. However, exploration and production drilling for oil and gas within the permit area is aimed at pay sands at subsurface depths of 8,000 feet or more. To date, such drilling has been unsuccessful. Extensive drilling and evaluation has shown that economic coal beds and coal bed methane prospects are not underlying the Smith Ranch Facility Permit Area. This activity will not be affected by the solution Mining program; therefore, no impact to other minerals is anticipated.

7.6 Socioeconomic Impacts

Implementation of the project will provide jobs for about 60 company employees and 15 to 20 contract employees. The general population of Converse County declined approximately 20 percent between 1980 and 1984 and the overall economy remains depressed; therefore, the impact of the project, although limited, will be beneficial to the local communities. No adverse impact is anticipated as current housing, schools and other support facilities are more than adequate to accommodate the projected employment.

7.7 Environmental Impact of Potential Accidents

7.7.1 Tank Failure

Under normal operating conditions the process fluids are contained in the process vessels and piping circuits within the plant. Alarms and automatic controls are used to monitor and keep levels within prescribed limits. In the unlikely event of a failure of process vessel or tank in the process building, the fluid would be contained within the building, collected in sumps and pumped to other tanks or to a lined evaporation pond. The area would then be washed down with the water contained in a similar manner eliminating any environmental impact from the failure.

Failure of a tank outside the process building could result in the spill of leach solution to a retention or containment system. The liquids would then be pumped to another tank or lined pond. The environmental impact of such an accident could result in some soils being contaminated requiring controlled disposal. All areas affected by such a failure or leak would be surveyed and any contaminated soils or material requiring controlled disposal would be removed and disposed of in accordance with NRC and/or State requirements. The affected area would then be reclaimed as specified in Chapter 6, therefore, there would be no long-term impact from such an accident.

7.7.2 Pipeline Failure

The rupture of a pipeline between the main process facility and the wellfield could result in a loss of either pregnant or barren solutions to the surface. To minimize the volume of fluid that could be lost, the pipeline systems will be equipped with high pressure and low pressure shutdown systems and

flowmeters. The systems will also be equipped with alarms so the operator will be alerted immediately if a major malfunction occurs. If the volume and/or concentration of the solutions released in such an accident did constitute an environmental concern, the area would be surveyed and the contaminated soils would be removed and disposed of according to NRC and/or State regulations. The pipelines will normally be buried approximately five feet below the surface and will be of a corrosion free high density polyethylene material, therefore, the probability of such a failure after the pipelines have been tested and placed in service is considered small.

A worst case scenario for a pipeline would involve a major pipeline rupture going unchecked for an hour at full operating capacity. This event could potentially release 240,000 gallons of barren or pregnant lixiviant to the adjacent environment. Such an event would involve a complete pipeline rupture, and a failure by operators to detect the rupture in a timely manner. The NRC staff in their review of Hydro Resources Inc. Final Environmental Impact Statement for the Crownpoint Uranium Solution Mining Project, (NUREG-1508, 1997),indicate that the industry experience has been that major pipeline ruptures are not complete breaks in the line, but are more likely smaller openings in the pipes such as cracks, punctures and other types of partial line breaks. Monitoring systems typically enable operators to detect a leak, determine its cause, and shut down the appropriate pumps in less than 15 minutes. According to the NRC Staff in the Crownpoint EIS, actual experience for pipeline ruptures often represents less than 25% of the volume of lixiviant within the pipeline is spilled in the worst-case scenario, and in actuality, most leaks and spills occur through minor cracks or disconnection on smaller pipes.

7.7.3 Fires and Explosions

The fire and explosion hazard of the uranium recovery plant will be minimal as the plant will not use flammable liquids in the recovery process. Natural gas used for building heat or accumulation of gaseous oxygen would be the primary source for a potential fire or explosion. In the uranium recovery plant the uranium will be in solution, adsorbed on ion exchange resin, wet yellowcake slurry, or as a dried yellowcake powder contained in a sealed drum or the vacuum dryer. An explosion, therefore, would not appreciably disperse the uranium to the environment. Spilled liquids or slurries would be confined to the building sump or to the runoff control system. The sealed drums and vacuum dryer would contain the dried yellowcake powder, and any potential releases would be contained within the dryer building.

7.7.4 Tornadoes

The Smith Ranch Facility is located in Converse County Wyoming, in which 30 tornadoes touch downs were recorded in a period from 1950 through 1995. Of those, 14 tornadoes were classified as F0 with wind speeds of 40-72 miles per hour and described as a gale tornado. F1 tornadoes described as moderate with wind speeds of 73-112 miles per hour accounted for 14 tornadoes. Finally, 2 were classified as F2 with wind speeds of 113-157 miles per hour and described as significant tornadoes. (Tornado Project, State Data from the Storm Prediction Service - Wyoming, 1999). The F scales for the tornadoes is based on the Fujita Scale that is commonly used to measure the relative strength of a tornado based on the destruction.

The probability of occurrence of a tornado in the area in which the project is located is about 3×10^{-4} per year (NUREG

0706 - Section 7.1.3.1). The area is categorized as region 3 in relative tornado intensity. For this category, the wind speed of the "design" tornado is 240 mph, of which 190 mph is rotational and 50 mph is translational. None of the plant structures are designed to withstand a tornado of this intensity.

The nature of the operation is such that little more could be done to secure the facility with advance warning than without it. The yellowcake product has the highest specific activity of any material processed at the site; however, since the material would be a wet slurry or as a contained dry powder, the potential environmental effects would be minimal. The strongest tornado recorded in Converse county is an F2. Based on the Fujita scale, the type of damage that can be expected from an F2 tornado is roof damage, unsecured mobile homes pushed off foundations, and light structures severely damaged or destroyed. At the Smith Ranch Facility, all of the dried yellowcake is contained and stored in sealed 55 gallon drums or in the vacuum dryer within an engineered metal building. Because of the density of the material, it is not reasonable to expect the container to become mobile due solely to the winds of the tornado. However, if a portion of the building superstructure were to collapse where the dried yellowcake is stored, there is a possibility that a portion of the drums could be crushed and potentially release yellowcake.

In the Generic Environmental Statement for Uranium Milling, (NUREG-0706, NRC, 1980), NRC staff assumed 25,100 lbs. of dry yellowcake, the equivalent of 26 55-gallon drums, were picked up by a tornado. From the model study, NRC staff concluded the maximum radiation exposure due to the accident would occur at a

distance of 2.5 miles from the facility, and the 50 year dose commitment to the lungs of an individual was estimated to be $8.3x10^{-7}$ rem. For the model site, the 50 year dose commitment to an individual of the public at the fenceline, 1,600 feet from the facility, and at the nearest residence, 6,500 feet from the facility, would be estimated to be $2.2x10^{-7}$ rem and $4.8x10^{-7}$ rem, respectively.

7.7.5 Well Casing Failure

A casing failure in an injection well would have the potential for the most significant environmental impact because the leach fluid is being injected under pressure. It is possible that this type failure could occur and continue for several days before being detected by the monitoring system. If such a failure did occur, the defective well would be either repaired or plugged and abandoned. If contamination of another aquifer was indicated, wells would be drilled and completed in the contaminated aquifer then produced until concentrations of leach solution constituents were reduced to acceptable levels. With proper casing, cementing and testing procedures, the probability of such a failure is very low. No casing failures have occurred in the two pilot programs where a total of 21 injection wells that have been operated over a period of several years.

To minimize the risk of a casing failure significantly impacting the environment, should one occur, monitor wells will be completed in the aquifers above and below the ore zone. The fluid levels and quality of the water in the adjacent aquifers will be routinely monitored during mining to check for fluid movement into these aquifers. In addition, casing integrity tests will be performed on all injection wells prior to using

the wells for injection and after any work that involves entering a fiberglass or PVC cased well with a cutting tool, such as a drill bit or underreamer.

Failure of a production well casing would normally not cause an excursion because the production wells operate at pressures lower than the aquifer pressures.

7.7.6 Leakage Through Old Exploration Holes

Movement of leach solution between aquifers through old exploration holes in the project area is very unlikely. The drill holes were left full of bentonite abandonment mud when they were abandoned and the mud is an effective seal against fluid interchange between the various aquifer units penetrated by the drilling. The rapid swelling and bridging of the isolating shales between the sandstone aquifer units provides additional well bore sealing.

However, to ensure there is no communication between aquifers, monitor wells completed in aquifers above and below the ore zone will be checked routinely for changes in aquifer pressure and water composition. In addition, pump tests will be conducted prior to start-up of a mining unit to demonstrate no significant communication between the aquifers exists. Should leakage between aquifers through old drill holes be indicated during the tests, the old holes would be re-entered and plugged. If contamination of another aquifer was indicated, wells would be drilled and completed in the contaminated aquifer, samples, and if needed, produced to reduce the concentration of any leach solution fluids to acceptable levels.

7.7.7 Transportation Accidents

Materials transportation to and from the processing sites can be classified into four categories: 1.) shipments of dried yellowcake product from the central processing plant to an offsite licensed facility, 2.) shipments of resin to the central processing plant from the Satellite IX Facilities, 3.) Shipments of yellowcake slurry from offsite licensees to the central processing plant for drying, and 4.) shipments of process chemicals from suppliers to the processing facilities.

7.7.7.1 Shipments of Dried Yellowcake offsite

Yellowcake produced by the Smith Ranch Facility, and its shipment for further processing, would not differ significantly from yellowcake produced at a conventional mill. The NRC has evaluated transportation accidents associated with yellowcake shipments from uranium mills and published the results in a generic Environmental Statement, (NUREG-0706, NRC, 1980). The following analysis is based upon that earlier study.

The dried yellowcake is generally packed in 55-gallon, 18-guage steel drums holding an average of 950 lbs. and classified by the Department of Transportation as Type A packaging (49 CFR Parts 171-189 and 10 CFR part 71). The yellowcake is shipped by truck approximately 1,200 miles to a conversion plant, which processes the yellowcake in the first step of manufacturing reactor fuel. An average truck shipment contains approximately 45 to 52 drums, or up to an average net weight of 42,000-lbs yellowcake. Using an average annual production rate of 2 million lbs. U_3O_8 or 2.4 million lbs. yellowcake, approximately 57 such shipments would be required annually. By increasing the annual production rate to 3 million lbs. U_3O_8 or 3.6 million lbs. yellowcake, approximately 86 such shipments would be required annually.

Based on published accident statistics, the average probability of a truck is 2.1×10^{-6}/mi (from NUREG-0706). Truck accident statistics include three categories of events: collisions, non-collisions, and other events. Collisions are between the transport vehicle and any other objects, whether moving vehicles or fixed objects. Non-collisions are accidents involving only the one vehicle, such as when it leaves the road and rolls over. Other events include personal injuries suffered on the vehicle, persons falling from or being thrown against the standing vehicle, cases of stolen vehicles, and fires occurring on a standing vehicle. The likelihood that a transport vehicle being involved in an accident of any type during a one-year period is 14 percent.

A generalized accident-risk evaluation was performed by NRC (NUREG-0706) that classified accidents into eight categories, depending upon the combined stresses of impact, puncture, crush and fire. On the basis of this classification scheme, conditional accident probability was developed for eight severity levels. (see Table 7.1) The NRC utilized two release models for this analysis. Model I is hypothetical, assuming complete loss of drum contents, and Model II is based on actual tests, assuming a partial loss of drum contents. The quantity estimated to be released in the event of a truck accident was 17,000 lbs. for Model I and 1,200 lbs. for Model II, (NUREG 0706, NRC, 1980). Most of the yellowcake released from the container would directly be deposited on the ground in the immediate vicinity of the accident. Some fraction of the released material would be dispersed to the atmosphere. The NRC used the following expression to estimate material dispersion (NUREG-0706, 1977).

$$F = 0.001 + 4.6 \times 10^{-4} (1 - e^{-0.15ut}) u^{1.78}$$

where: F = the fractional airborne release
u = the wind speed at 50ft in m/s
t = the duration of release (hours)

The first term represents the initial "puff" immediately airborne when the container falls in an accident. Using an assumed wind speed of 10 mph (5m/s) and a release time of 24 hours, the environmental release fraction would be 9×10^{-3}. Since the conversion facility is located in Illinois, a population density of 160 persons/mi^2 was used for the eastern U.S. In NUREG-0706, the NRC found that the 50 year dose commitment to the lungs would be about 2 man-Sv (200 man-rem) and 0.14 man-Sv (14 man-rem) for Models I and II respectively. The integrated dose estimate would be lower for more sparsely populated areas.

An accident involving vehicles transporting the yellowcake product could result in some yellowcake being spilled. In the unlikely event of such an accident, all yellowcake and contaminated soils would be removed and processed through a mill or disposed of in a licensed facility. All disturbed areas would then be reclaimed in accordance with all applicable State and NRC regulations.

The risk of an accident involving a yellowcake spill will be kept to a minimum by use of Department of Transportation approved containers and exclusive use shipments. To further reduce the environmental impact should an accident occur, a "Transportation Accident Response Guide" for the facility has been prepared and copies of the special instruction will be included with every yellowcake shipment. A copy of the current Transportation Accident Response Guide, which will be updated as needed, is included in Appendix G.

Commercial yellowcake shipments are required to meet the fuel needs of the licensed power generation facilities and all risks associated with the transportation of yellowcake cannot be eliminated. However, the potential environmental impacts of an accident involving the shipment of yellowcake can be kept to a minimum by having proper procedures in place to ensure that the yellowcake is contained and the spill area is secure from unauthorized personnel.

7.7.7.2 Shipments of Resin

The operation of satellite IX facilities requires that the resin used for IX operations be transferred from the satellite facility to the central processing plant. The resin holds the recovered uranium. While attached to the resin, the uranium will remain fixed until stripped using a strong brine solution. When the resin is transferred, it is moved using barren process water. This process water has uranium concentrations consistent with barren lixiviant (1-3 mg/l U_3O_8). The resin is transported in specially designed 700 ft^3 aluminum tanks. The tanker trucks typically haul 500 ft^3 of loaded resin and associated process water. Such tanker trucks would withstand the impact of most collisions.

In the event of an accident that could rupture the tank, a portion of the resin and water would spill on the ground. Uranium loaded resin is slightly denser than water and settles to the bottom of the tank, and any water decants to the top. Should the tanker truck overturn and rupture, the water would carry some of the resin away from the tank while the majority would stay in the tank or within the immediate proximity of the tank. The risk of environmental impact is slight with respect to uranium loaded resin beads. The beads will retain the uranium,

The risk of an accident involving a yellowcake slurry spill will be kept to a minimum by use of Department of Transportation approved containers and exclusive use shipments. To further reduce the environmental impact should an accident occur, a "Transportation Accident Response Guide" for the facility has been prepared and copies of the special instruction will be included with every yellowcake slurry shipment. A copy of the current Transportation Accident Response Guide, which will be updated as needed, is included in Appendix G.

7.7.7.4 Shipment of Chemicals

Accidents involving truck shipments of process chemicals to the project site could result in a local environmental impact. Any spills would be removed and the area would be cleaned and reclaimed. Shipments of the chemicals used in solution mining in truck load quantities are common to many industries and present no abnormal risk. These chemicals include sodium carbonate, carbon dioxide, oxygen, sulfuric acid, hydrogen peroxide, and sodium chloride (salt). Since most of the material would be recovered or could be removed no significant long-term environmental impact would result from a shipping accident involving these materials.

The exception to the above chemicals is anhydrous ammonia, which is used at the facility in the precipitation circuit. If involved in an accident, the presence of anhydrous ammonia could result in a significant environmental impact. It is delivered bulk shipments of 7,500 gallons using a tanker truck. Approximately 12 to 14 shipments are made annually, and the supplier is assumed to be 150 miles away. From the Generic Environmental Impact Statement for Uranium Mills, (NUREG-0706,

NRC, 1980), an accident rate of 4.8×10^{-7}/mile is used for determining risk of a traffic accident.

7.7.8 Evaporation Pond Failure

The evaporation ponds will be constructed with leak detection systems and these systems will be monitored daily. If a liner leak were detected, the fluid would be pumped to another pond and the liner repaired as needed. The pond area will be surveyed and reclaimed as part of the final reclamation eliminating any significant long-term impact.

An evaporation pond embankment failure would be the most severe type of evaporation pond failure. To minimize the risk of an embankment failure, the ponds will be inspected daily to ensure there is no significant deterioration of the embankments. Should a failure occur, all impacted areas would be surveyed, cleaned up as needed, and reclaimed.

Table 7.1

Fractional Probabilities of Occurrence and Corresponding Package Release Fractions for Each of the Release Models for Low Specific Activity (LSA) and Type A Containers Involved in Truck Accidents (NUREG-0170, NRC, 1977)

Accident Severity Category	Fractional Occurrence of Accident	Release Fractions	
		Model I	Model II
I	0.55	0.0	0.0
II	0.36	1.0	0.01
III	0.07	1.0	0.1
IV	0.016	1.0	1.0
V	0.0028	1.0	1.0
VI	0.0011	1.0	1.0
VII	8.5×10^{-5}	1.0	1.0
VIII	1.5×10^{-5}	1.0	1.0

CHAPTER 8
ALTERNATIVES TO THE PROPOSED ACTION

The solution mining method is proposed over other mining methods for recovery of uranium from these deposits because in-situ mining is the most economical and environmentally sound method presently available for mining these reserves. This conclusion is based on the Company's experience in uranium mining in the South Powder River Basin area which includes open pit mining, underground mining, and the solution mining pilot projects.

8.1 Alternate Mining Methods

Underground and open pit mining represent the two currently available alternatives to solution mining for the uranium deposits in the project area.

The Company has conducted uranium mining by both open pit and underground methods in the area and has concluded that these methods are not economically viable methods for producing the reserves in these deposits at this time.

From an environmental perspective, open pit mining or underground mining and the associated mill involve higher risks to employees, the public, and the environment. Radiological exposure to the personnel in these processes is increased not only from the mining process but also from milling and the resultant mill tailings. Moreover, the personnel injury rate is traditionally much higher in open pit and underground mines than has been the experience in our solution mining operations.

Both open pit and underground mining methods would require substantial de-watering to depress the potentiometric surface of the local aquifers to provide access to the ore. The groundwater would contain naturally high levels of Ra-226 that would have to be removed prior to discharge resulting in additional radioactive solids that would have to be disposed of. For conventional mining, a mill tailings pond that could contain 5 to 10 million tons of solid tailings waste from the uranium mill would also be required.

In a comparison of the overall impacts of in-situ leaching of uranium compared with conventional mining, an NRC evaluation [NUREG-0925 (1983) Para. 2.3.5] concluded that environmental and socioeconomic advantages of in-situ leaching include the following:

(1) Significantly less surface area is disturbed than in surface mining, and the degree of disruption is much less.

(2) No mill tailings are produced, and the volume of solid wastes is reduced significantly. The gross quantity of solid wastes produced by in-situ leaching is generally less than 1% of that produced by conventional milling methods [more than 948 kg (2090 lb) of tailings usually result from processing each metric ton (2200 lb) of ore].

(3) Because no ore and overburden stockpiles, or tailings pile(s), are created and the crushing and grinding ore-processing operations are not needed, the air pollution problems caused by windblown dusts from these sources are eliminated.

(4) The tailings produced by conventional mills contain essentially all of the radium-226 originally present in the ore. By comparison, less than 5% of the radium in an ore body is brought to the surface when in-situ leaching methods are used. Consequently, operating personnel are not exposed to the radionuclides present in and emanating from the ore and tailings, and the potential for radiation exposure is significantly less than that associated with conventional mining and milling.

(5) By removing the solid wastes from the site to a licensed waste disposal site and otherwise restricting them from contaminating the surface and subsurface environment, the entire mine site can be returned to unrestricted use within a relatively short time.

(6) Solution mining results in significantly less water consumption than conventional mining and milling.

(7) Socioeconomic advantages of in-situ leaching include:

- ability to mine a lower grade ore,
- a minimum of capital investment,
- less risk to the miner,
- shorter lead time before production begins, and
- lower manpower requirements.

(8) The primary disadvantage of in-situ leaching of uranium is the potential for groundwater contamination. This, however, does not imply that conventional uranium mining necessarily has an

advantage in regard to groundwater pollution. On the contrary, in-situ leaching will have a less severe impact on groundwater quality than does conventional mining.

8.2 Alternative Sites for the Recovery Plant

No alternative site for the recovery plant was considered since most of the facilities and support systems are already in place from past uranium operations. Additions to the existing facilities will be required; however, no new surface disturbances will be needed for the recovery plant.

8.3 Alternative Energy Sources

A discussion of alternative energy sources available to the USA has been prepared by US NRC in prior solution mining licensing actions band a summary of the subject is included in Chapter 2.2 of NUREG-0925 (US NRC, 1983) prepared for the Teton Uranium ISL Project (Docket 40-8781).

8.4 Alternate Leach Solutions

The sodium carbonate/carbon dioxide leach solution was selected for the proposed project because of favorable performance in the pilot programs with no significant adverse environmental impact. Alternate leach solutions include ammonium carbonate solutions and acidic leach solutions. These solutions have been used in solution mining programs; however, operators have experienced difficulty in restoring and stabilizing the aquifer, therefore these solutions were excluded from consideration.

8.5 Groundwater Restoration Alternatives

The proposed combination of groundwater sweep and EDR/RO clean water reinjection was selected because of the proven success in the pilot program. Alternatives include natural restoration and the use of groundwater sweep only. Natural restoration was excluded from consideration because of the time considerations and uncertainties with this technique.

Restoration using groundwater sweep only is a cost effective proven restoration technique and could be applied for this project. it was not selected as the sole restoration method for this project because a potential adverse impact on the

ability to properly control the leach solutions in other active mining units within the same aquifer.

8.6 Liquid Waste Disposal Alternatives

High TDS liquid wastes will be stored in lined ponds and evaporated. An alternate disposal method is deep well disposal. Deep well disposal was evaluated and considered potentially feasible for limited volumes of water. Initially all high TDS liquid wastes will be pumped to lined evaporation ponds; however, operating experience with deep disposal wells by other operators will be monitored and the deep well disposal alternative will be re-evaluated after the project is placed in operation.

CHAPTER 9
MANAGEMENT ORGANIZATION AND ADMINISTRATIVE PROCEDURES

9.0 Environment, Health, and Safety Management

Rio Algom Mining Corp. will maintain a performance-based approach to the management of the environment, health and safety program, including radiation safety. The Environment, Health and Safety Systems Management Program encompasses licensing, compliance, environmental monitoring, industrial hygiene, and health physics programs under one umbrella, and it includes involvement by the individual worker to the senior management of Rio Algom Mining Corp. This program will allow Rio Algom to operate efficiently and maintain an effective environment, health and safety program.

9.1 Environment, Health and Safety Management Organization

Figure 9-5 is a partial organization chart for Rio Algom Mining Corp. with respect to the operation of the Smith Ranch Facility, and represents the management levels that play a key part in the Environmental, Health and Safety Systems management and may serve a functional part of the Safety and Environmental Review Panel described under Section 9.1.2. The dashed line of reporting signifies a dual reporting function. This organization allows environmental, health, and safety, including radiation safety, matters to be considered at any management level.

Rio Algom Mining Corp. maintains a dual reporting pathway for all members of the facility Environmental, Health and Safety Systems Management (EHS). This dual reporting pathway allows the facility EHS Management the conduct day-to-day operations and ensures that there is sufficient corporate oversight with respect to regulatory compliance, protection of the environment, and radiation and worker safety.

9.2 Environment, Health and Safety Management Qualifications

9.2.1 President, Rio Algom Mining Corp.

The President of Rio Algom Mining Corp. will have the ultimate responsibility for all operations of Rio Algom Mining Corp., including the Smith Ranch Facility and its off-site development activities.

9.2.2Executive Vice President, Rio Algom Mining Corp.

The Executive Vice President is responsible for the safe operations of the Rio Algom Mining Corp., including the Smith Ranch Facility and its off-site development activities. The Executive Vice President reports directly to the President of Rio Algom Mining Corp.

9.2.3 Manager, Radiation Safety, Regulatory Compliance and Licensing, Rio Algom Mining Corp.

The Manager, Radiation Safety, Regulatory Compliance and Licensing will have the ultimate responsibility and authority for the radiation safety, environmental compliance, and Quality Assurance program at the Smith Ranch Facility, in addition to off-site project development activities. The Manager, Radiation Safety, Regulatory Compliance and Licensing will provide corporate audit input to the Supervisor, Environmental and Regulatory Affairs, and Radiation Safety Officer (RSO) to ensure that all radiation safety, environmental compliance, and permitting/licensing programs will be conducted in a responsible manner, and in compliance with all applicable regulations, and permit/license conditions. Then Manager, Radiation Safety, Regulatory Compliance and Licensing may be a member of the ALARA audit team, and may be a member of the Safety and Environmental Review Panel (SERP). The Manager, Radiation Safety, Regulatory Compliance and Licensing will report directly to the Executive Vice President of Rio Algom Mining Corp..

Rio Algom Mining Corp. will require the Manager, Radiation Safety, Regulatory Compliance and Licensing to have either a Bachelors degree in an engineering or science field from an accredited college or university, or an equivalent level of work experience. Additionally, a minimum of five years of experience in senior engineering management and operations functions will be required as well as the ability to meet the requirements of Regulatory Guide 8.31 for the position of RSO.

9.2.4 General Manager, Smith Ranch Facility

The General Manager for the Smith Ranch Facility will be directly responsible for all operations, including, implementing industrial and radiation safety, and

environmental protection programs. This includes all operating procedures, radiation safety programs, industrial safety programs, environmental and groundwater monitoring programs, associated quality assurance programs, and routine and non-routine maintenance activities. The General Manager will also be responsible for compliance with all regulatory license conditions, and regulations, and reporting requirements. The General Manager will have the responsibility, and authority, to terminate immediately any activity that is determined to be a threat to employees, public health, or the environment. The General Manager will chair the ALARA ("As Low As Reasonably Achievable") committee, will be a member of the ALARA audit team, and a member of the Safety and Environmental Review Panel (SERP). The General Manager for the Smith Ranch Facility will report directly to the Executive Vice President of Rio Algom Mining Corp.

Rio Algom Mining Corp. will require the General Manager to have a Bachelor's degree in engineering or science from an accredited college or university, or equivalent work experience, and a minimum of five years supervisory experience. Work experience will include industrial process/production experience, and industrial process/production management.

9.2.5 Radiation Safety Officer, Smith Ranch Facility

The RSO is responsible for the daily supervision of the environmental protection and radiation safety programs for the Smith Ranch Facility. The RSO may also fill the position of Supervisor, Environmental and Regulatory Affairs and Safety Engineer, simultaneously if deemed necessary by the Corporate Management. The RSO is the designated Site QA/QC Coordinator. The RSO will be a member of the ALARA Committee and report directly to the Facility General Manager on all matters regarding environmental protection and radiation and worker safety. In addition, the RSO has a responsibility to report to the Manager, Radiation Safety, Regulatory Compliance and Licensing on all matters regarding environmental protection and radiation and worker safety.

The RSO has responsibility for the daily supervision of all radiation and safety protection procedures, equipment and controls, including emergency procedures. Responsibilities will include developing and implementing all radiation

safety and environmental programs, ensuring that all records will be correctly maintained, and assisting the General Manager in ensuring compliance with NRC regulations and license conditions. The RSO will conduct routine training programs for the supervisors and employees with regard to the proper application of radiation protection, emergency response, and environmental control programs. The RSO will inspect the facilities to verify compliance with all applicable radiological health and safety requirements and the QA/QC program. Additionally, the RSO will annually review all operating procedures to ensure that radiation exposures will be maintained ALARA. The RSO is authorized to terminate immediately any activity that may be a threat to the employees, public health, or the environment. RSO will be a member of the Safety and Environmental Review Panel (SERP).

The Radiation Safety Officer (RSO) shall have a bachelor's degree in the physical sciences, industrial hygiene, or engineering from an accredited college or university, and meet the qualifications outlined in Regulatory Guide 8.31. Individuals who have other types of degrees may be acceptable provided they have the necessary relevant experience.

The RSO should have a minimum of one year of work experience relevant to the chemical process operations and be familiar with pertinent health physics regulations, programs, and their implementation. It is also the responsibility of the RSO for the development, implementation, and supervision of all these pertinent programs. The RSO shall advise management on the state of the health physics program at the facility.

As the facility RSO, this individual shall have specialized classroom training pertinent to health physics and attend a subsequent refresher training every two (2) years consisting of seminars or course work. The RSO shall coordinate implementation of the health physics programs with other departments within the facility to ensure compliance with regulations. The position is responsible for ensuring that all health physics samples and records are complete, accurate, and properly filed and stored.

9.2.6 Supervisor, Environmental and Regulatory Affairs, Smith Ranch Facility

The Supervisor, Environmental and Regulatory Affairs reports directly to General Manager, and is responsible for the development, administration and enforcement of all environmental programs for the Smith Ranch Facility. The Supervisor, Environmental and Regulatory Affairs will also interface with the corporate Manager, Radiation Safety, Regulatory Compliance and Licensing to ensure that the environmental programs are conducted consistent with the applicable regulations. The Supervisor, Environmental and Regulatory Affairs will be responsible for routinely auditing all operational and monitoring procedures and the QA/QC programs, will be a member of the ALARA ("As Low As Reasonably Achievable") committee, and will be a member of the ALARA audit team. The Supervisor, Environmental and Regulatory Affairs is authorized to terminate immediately any activity that may be a threat to the employees, public health, or the environment.

The Supervisor, Environmental and Regulatory Affairs will assist in the development, review, and approval of sampling and analysis procedures used at the Smith Ranch Facility, and aid in the technical evaluation of laboratory data, as required.

Rio Algom Mining Corp. will require the Supervisor, Environmental and Regulatory Affairs to have a bachelor's degree in the physical or biological sciences, mathematics, or engineering from an accredited college or university. Additionally, the position will require at least three years of work experience in the mining industry.

9.2.7Operations Managers, Smith Ranch Facility

The Operations Managers include the Manager - Plant Operations, Manager - Wellfield Operations, Chief Geologist, and the Supervisor, Administration. The Operations Managers are be responsible for the site's operational and maintenance activities and procedures. The Operations Managers will implement, and annually review, a training program for operation and maintenance personnel. The Operations Managers will report to the General Manager of the Smith Ranch Facility. Development and review of procedures involving radiological safety concerns will be coordinated with the radiation staff.

9.2.8Safety Engineer, Smith Ranch Facility

The Safety Engineer is responsible for the overall Industrial Hygiene Program at the Smith Ranch Facility and is primarily responsible for ensuring that compliance is met with Mine Safety and Health Administration and State Mine Safety regulations. The Safety Engineer reports directly to General Manager, and is responsible for the development, administration and enforcement of all industrial hygiene programs for the Smith Ranch Facility. The Safety Engineer will also interface with the corporate Manager, Radiation Safety, Regulatory Compliance and Licensing to ensure that the industrial hygiene programs are conducted consistent with the applicable regulations. The Safety Engineer will make routine safety inspections of all operations at the facility and report those findings. The Safety Engineer is authorized to terminate immediately any activity that may be a threat to the employees, public health, or the environment. One person with another position may simultaneously perform the position of Safety Engineer.

Safety Engineer should have two (2) years of college in the physical sciences, engineering, or health fields. Two years of applied occupational safety experience may be substituted for each one (1) year of college. In any event, a minimum of a high school diploma or equivalent is required. This position should be familiar with the industrial hygiene programs established at the Smith Ranch Facility.

9.2.9 Radiation Safety Technician, Smith Ranch Facility

The Radiation Safety Technician (RST) should have two (2) years of college in either the physical sciences, engineering, or health fields. Two years of applied health physics and occupational safety experience may be substituted for each one (1) year of college. In any event, a minimum of a high school diploma or equivalent is required. This position should be familiar with the health physics and environmental programs established at the Smith Ranch Facility. The incumbent shall assure that all samples and records are properly logged, filed, and stored. It is also the responsibility of this position to maintain and properly calibrate and service all equipment needed for measurements to comply with Federal/state regulations and company policies.

It is also the responsibility of this position to inform and update the RSO on daily performance of duties as well as completing and submitting the required reports and survey data. The RST reports directly to the RSO.

data. The RST reports directly and shall have access to the RSO at all times.

9.2.10 Environmental Technician, Smith Ranch Facility

The Environmental Technician should have two (2) years of college in the physical sciences, engineering, or health fields. Two years of environmental science experience may be substituted for each one (1) year of college. In any event, a minimum of a high school diploma or equivalent is required. This position should be familiar with the environmental programs established at the Smith Ranch Facility. The incumbent shall assure that all samples and records are properly logged, filed, and stored. It is also the responsibility of this position to maintain and properly calibrate and service all equipment needed for measurements to comply with Federal/state regulations and company policies.

It is also the responsibility of this position to inform and update the RSO on daily performance of duties as well as completing and submitting the required reports and survey data. The Environmental Technician reports directly to the RSO.

9.3 ALARA Policy

The purpose of the ALARA (As Low As Reasonably Achievable) Policy is to keep exposures to all radioactive nuclides and other hazardous material as low as possible and to as few personnel as possible, taking into account the state of technology and the economics of improvements in relation to benefits to the public health and safety, and other societal and socioeconomic considerations, and in relation to the utilization of atomic energy in the public interest.

In order for an ALARA Policy to correctly function, all individuals including management, supervisors, health physics staff, and workers, must take part and each share in the responsibility to keep all exposures as low as reasonably achievable. This policy addresses this need and describes the responsibilities of each.

9.3.1 Management Responsibilities

Consistent with Regulatory Guide 8.31, the licensee management will be responsible for the development, implementation, and enforcing the applicable rules,

policies, and procedures as directed by regulatory agencies and company policies. These shall include the following:

1. The development of a strong commitment to and continuing support of the implementation and operations of the ALARA program;

2. Annual audit program which reviews radiation monitoring results, procedural, and operational methods;

3. A continuing evaluation of the health physics program including adequate staffing and support;

4. Proper training and discussions which address the ALARA program and its function to all facility employees and, when appropriate, to contractors and visitors.

9.3.2 Radiation Safety Officer Responsibility

The RSO shall be charged with ensuring technical adequacy, proper radiation protection, and the overall surveillance and maintenance of the ALARA program. The RSO shall be assigned the following:

1. The responsibility for the development and administration of the ALARA program;

2. Sufficient authority to enforce regulations and administrative policies that affect any aspect of the radiological safety program;

3. To review and approve plans for new equipment, process changes or operating procedures to ensure that the plans do not adversely affect the protection program against uranium and its daughters;

4. Maintain equipment and surveillance programs to adequately monitor the ALARA program to assure its implementation;

5. To perform an annual audit with management to determine the effectiveness of the program and make any appropriate recommendations or changes as may be dictated by the ALARA philosophy;

6. Review annually all existing operating procedures involving or potentially involving any handling, processing, or storing of radioactive materials to

ensure the procedures are ALARA and do not violate any newly established or instituted radiation protection practices;

7. Conduct daily inspections (or designee) of pertinent facility areas to observe that general control practices, cleanliness, and housekeeping practices are in line with the ALARA principle.

9.3.3 Supervisors Responsibility

Supervisors shall be the front line for implementing the ALARA program. Each shall be trained and instructed in the general radiation safety practices and procedures. Their responsibilities include:

1. Adequate training to implement the general philosophy behind the ALARA program;

2. Provide direction and guidance to subordinates in ways to adhere to the ALARA program;

3. Enforcement of rules and policies as directed by regulatory agencies and company officials;

4. Seek additional help from management and the RSO should radiological problems be deemed by the supervisor to be outside their sphere of training;

9.2.4 Worker Responsibility

Because success of both the radiation protection and ALARA programs are contingent upon the cooperation and adherence to those policies by the workers themselves, the facility employees must be responsible for certain aspects of the program in order for the program to accomplish its goal of keeping exposures as low as possible. Worker responsibilities include:

1. Adhere to all rules, notices, and operating procedures as established by management and the RSO;

2. Make valid suggestions which might improve the ALARA program;

3. Reporting promptly, to immediate supervisor, any malfunction of equipment or violation of procedures

which could result in an unacceptable increase radiological hazard;

4. Proper use and fit testing of any respirator;

5. Proper use and returning of any bioassay sample kit at its required time.

9.4 Management Control Program

9.4.1 Performance Based License Condition

License condition 9.xx of source material license SUA-1548 is considered to be the Performance based license condition. Under that license condition, Rio Algom Mining Corp. may, without prior U.S. Nuclear Regulatory Commission approval, 1.) make changes to the facility or process, as presented in the application, 2.) make changes in the procedures presented in the application, and 3.) conduct tests or experiments not presented in the application. These changes are subjected to the following conditions:

1. The change, test or experiment does not conflict with any requirement specifically stated in the source material license (excluding the license condition referencing the license application or reclamation plan), or impair Rio Algom's ability to meet all applicable NRC regulations.
2. There is no degradation in the essential safety or environmental commitments in the license application, or provided in the approved reclamation plan.
3. The change, test or experiment is consistent with the conclusions of actions analyzed and selected in the facilities Environmental Assessment (EA) or supplemental Environmental Assessments.

Rio Algom shall file an application for a license amendment to the license if the above listed conditions are not met. Determination of compliance concerning the above listed conditions, shall be made by a "Safety and Environmental Review Panel (SERP)." The SERP shall consist of a minimum of three individuals. One member of the SERP shall have expertise in management and shall be responsible for managerial and financial approval changes; one member shall have expertise in operations and/or construction and shall have expertise in implementation of any changes; and one member shall be the radiation safety officer (RSO) or equivalent. Other members of the SERP may be utilized as appropriate, to address technical aspects of the change, experiment or test, in several areas, such as health physics, groundwater hydrology, surface water hydrology, specific earth sciences, and others. Temporary members, or permanent members other than the three identified above, may be consultants.

Rio Algom shall maintain records of any changes made pursuant to this condition. These records shall include written safety and environmental evaluations, made by the SERP, that provide the basis for the determination that the change is in compliance with the requirements conditions liste above. Rio Algom shall furnish, in an annual report to NRC, a description of such changes, tests, or experiments, including a summary of the safety and environmental evaluation of each. In addition, Rio Algom shall annually submit changed pages to its license application to reflect changes made under this condition.

9.4.2Safety and Environmental Review Panel

9.4.2.1 Task Description of the Safety and Environmental Review Panel

1. The SERP is responsible for reviewing the following: Proposed changes in the facility or process, as presented in the license application. Proposed changes in the procedures presented in the license application. Proposed changes in the conducting of tests and experiments not presented in the license application.

2. From that review, the SERP shall determine if the following three criteria are met:

   a) The change, test, or experiment does not conflict with any requirement specifically stated in this license (excluding the license condition referencing the License Application or Reclamation Plan), or impair the licensee's ability to meet all applicable NRC regulations.
   b) There is no degradation in the essential safety or environmental commitments in the license application, or provided by the approved reclamation plan.
   c) The change, test, or experiment is consistent with the conclusions of actions analyzed and selected in the facility's Environmental Assessment (EA) or supplemental Environmental Assessments.

3. If the SERP concludes the change, test, or experiment fails to meet all three of the criteria listed in item 2, an application for an amendment to the Source Material License shall be made to the U.S. Nuclear Regulatory Commission.

9.4.2.2 Organization of the Safety and Environmental Review Panel

The composition of the SERP shall be as follows:

Number of Participants: No less than 3 persons. It may consist of more participants.

Required Participants:

Radiation Safety Officer
(as defined in License Condition 9.14)

A member of Facility Management
(e.g. Facility General Manager)

A member of Operations Management
(e.g. Plant Manager, Wellfield Manager, and etc.)

Other members of the SERP may be utilized as appropriate to address technical aspects of 9.4.2.1 and 9.4.2.2 shown above in several areas of expertise such as health physics, groundwater hydrology, surface water hydrology, specific earth sciences, and other areas. Temporary or permanent members other than the three above may be consultants

9.4.2.3 Safety and Environmental Review Panel Responsibilities

This procedure will be used for the evaluation of all major changes to the facility operations as described in Section 9.4.2.1 of this chapter. The changes may be derived from operational and/or economic considerations, and can include changes dictated by regulatory requirements including Federal and State agencies outside of the NRC organization. The following reviews shall be carried out by the SERP. The SERP may delegate any portion of these responsibilities to a committee of two or more members of the SERP. This committee will report their findings to the full SERP for a determination of compliance with Section 9.4.1 of this chapter.

1. Operations / Technical Review

a. Review operating criteria and critical equipment and determine the following:

i. Does the proposed change impact the operations as described in the license application?

ii. Does the proposed change significantly change the processes used at the facility as described in the license application?

b. Review the Standard Operating Procedures, (SOP), for the proposed change and determine the impact on current SOP's. Make the necessary updates to the current SOP's or develop new ones.

c. If applicable, review the emergency response plan and determine it compatibility with the current ERP.

2. Environmental / Health Physics / Safety Review

a. Review the proposed change to determine if any changes in monitoring and record keeping are required to ensure compliance with existing programs.

b. Review the proposed changes and determine the need for additional training.

c. Review key personnel training records and determine training needs as required by the proposed change.

3. Compliance Review

a. Review the proposed change and determine whether it will conflict with Corporate and Facility Policies regarding training, safety, and responsibility concerns.

b. Review the proposed change and determine compliance with the Facility Source Material License.

c. Review the proposed change and determine compliance with U.S. Nuclear Regulatory Commission regulations and other Federal and State regulations.

Upon completion of this review, the SERP will determine if the proposed change meets the three criteria listed in

meet those criteria, then the SERP may implement the change and provide a record of that change as described in Section 9.4.3 of this chapter, (see below). If the proposed change does not meet those criteria, then the change will not be implemented until approval through a license amendment application is received from the U.S. Nuclear Regulatory Commission.

9.4.3 Record Keeping and Reporting

Records shall be kept of all changes made following the Performance Based License Condition as described in Section 9.4.1. These records shall include written safety and environmental evaluations, performed by the SERP, that provide the basis for the determination that the change is in compliance with the requirements referred to in section 9.4.2.1. These records shall be maintained by the RSO and a copy provided to the Facility General Manager, members of the SERP, and the Manager, Radiation Safety, Regulatory Compliance and Licensing.

An Annual Report will be submitted to the U.S. Nuclear Regulatory Commission providing a description of changes, tests, or experiments made pursuant to the SERP approval process including a summary of the safety and environmental evaluation of each. Additionally, all pages that reflect a change made to the license application under the Performance Based License Condition shall be submitted to the NRC annually. Each replacement page shall include both a change indicator for the area of change, (e.g., Bold marking vertically in the margin adjacent to the portion actually change), and a page change identification, (date of change or change number or both).

9.5 Employee Training

All permanent site employees will attend a training program conducted by the RSO or another qualified individual on the basic principles of radiation safety, health hazards of exposure to uranium, personal hygiene practices for uranium facilities, radiation safety procedures, and responses to emergencies or accidents involving radioactive materials. A written examination will be given at the completion of the training and the instructor will review all questions with incorrect answers with the employees. Each worker must achieve a predetermined passing score before being allowed to work in a controlled or restricted area of the recovery plant. The written examination for these employees shall be maintained on file.

All permanent facility workers will also receive an annual refresher training course including a review of any new radiation safety regulations, site safety experience and radiation exposure trends. Radiation safety problems or subjects will also be offered for discussion at least six times per year in the general safety meetings. Safety meeting subjects and attendance records will be maintained on file at the site. Specialized instruction on the radiation health and safety aspects of jobs involving higher than normal exposure risks will be provided by the RSO, RST and/or Supervisor.

Each worker who may be required to use respiratory protective equipment shall receive training in the use of the specific equipment to be used. No person shall use respiratory equipment until they are specifically trained in the use of the equipment.

9.6 Standard Operating Procedures

Standard written operating procedures shall be established for all operational activities involving radioactive materials that are handled, processed, stored, or transported by employees. The procedures shall enumerate pertinent radiation safety procedures to be followed. Written procedures shall also be established for in-plant and environmental monitoring, bioassay analysis, and instrument calibration for activities involving radiation safety. A copy of the written procedure shall be kept in the area where it is used. All procedures involving radiation safety shall be reviewed and approved in writing by the RSO or another individual with similar qualifications prior to being implemented. The RSO shall review and approve the operating procedures annually.

For work where the potential for significant exposure to radioactive material exists, and which has no standard operating procedure, is designated as nonroutine and a Radiation Work Permits (RWP) will be prepared. The RWP will describe the scope of the work, precautions necessary to maintain radiation exposures to ALARA, and any supplemental radiological monitoring and sampling to be conducted during the work. The RWP shall be reviewed and approved in writing by the RSO, RST, or a designated supervisor in the absence of the RST, prior to initiation of the work.

Any changes to the Health Physics manual developed for this uranium recovery facility will be reviewed and approved by the RSO prior to being implemented. Written standard operating procedures for both operational and non-operational activities involving radioactive materials will be prepared and be reviewed and approved by the RSO and the RST prior to their implementation.

Standard written operating procedures shall be established for all routine operational and non-operational activities that do not involve radioactive materials. These procedures will enumerate pertinent safety procedures to be followed. A copy of the written procedure shall be kept in the area where it is used. These procedures that do not involve radiation safety shall be reviewed and approved by the Safety Engineer, RSO, or another individual with similar qualifications prior to being implemented. The Safety Engineer shall review and approve all of the non-rad standard operating procedures annually.

9.7 Personnel TLD Monitors

External personnel dosimeters, either thermoluminescent dosimeters (TLD) or film type dosimeters will be worn by all employees who work in or routinely enter the recovery plant controlled area (Figure 9-1).

9.8 Bioassay Program

A urinalysis program consistent with the program outlined in Regulatory Guide 8.22 "Bioassay of Uranium Mills" has been implemented and will be maintained at the site. The program includes a baseline urinalysis for all permanent employees prior to their initial assignment at the facility and monthly urinalyses for those employees who routinely work in the recovery plant controlled area.

The bioassay results shall be carefully reviewed and appropriate actions will be taken if the results exceed predefined levels, and are determined to be correct. If there is doubt as to the correctness of a bioassay result, an investigation will be initiated which may include a conference with the affected employee and or his/her immediate supervisors.

The following table describes the actions and levels which will be taken on those samples deem legitimate.

TABLE 9-1 - CORRECTIVE ACTIONS BASED ON URINARY URANIUM RESULTS

Urinary Uranium Concentrations	Interpretation	Actions
Less than 15 mg/l	Uranium confinement and air sampling programs are indicated to be adequate	None. Continue to review further bioassay results.
15 to 35 mg/l	Uranium Confinement and air sampling may not provide an adequate margin of safety.	1) Confirm results (repeat urinalysis). 2) Identify the cause of elevated urinary uranium and initiate additional control measures if result confirmed. 3) Determine why air samples were not representative and did not warn of excessive concentrations of airborne uranium. Make corrections. 4) Determine whether other workers could have been exposed and perform bioassay measurements for them. 5) Consider work assignment limitations until the worker's urinary uranium concentration falls below 15 mg/l. 6) Improve engineered protection or respiratory protection program as investigation indicates.
Greater than 35 mg/l	Uranium confinement and perhaps air sampling programs are not acceptable	1) Take the actions given above. 2) Continue operations only if it is virtually certain that no other worker will exceed a urinary concentration of 35 mg/l. 3) Normal work assignments are applied until confirming sample is greater than 35 mg/l, immediate work restrictions would be applied.
Confirmed to be greater than 35 mg/l for two consecutive specimens, confirmed to be greater than 130 mg/l for any single specimen, or air sampling indication of more than a	Worker may have exceeded regulatory limit on intake.	1) Take actions given above. 2) Have urine specimen tested for albuminuria. 3) If any sample greater than 130 mg/l, immediate work restrictions would be applied until confirmation samples are less than 130 mg/l.

quarterly limit of
intake.

9.9 Exposure Calculations

Calculations of internal exposure to radon daughters and natural uranium shall be made for those employees who routinely work in the recovery plant based on a Time Weighted Average (TWA) incorporating both occupancy times and average airborne working levels or activity concentrations. If occupancy times are established as an average for any category of workers, an annual time study shall be conducted for that category of worker to determine the basis for the average occupancy periods used.

If any worker reaches or exceeds 25 percent of the maximum permissible exposure limits as specified in 10 CFR 20 based upon a calculated TWA for the week or the calendar quarter, dependent on the solubility of the material, the RST shall initiate an investigation of the employee's work record and exposure history to identify the source of the exposure. Necessary corrective measures shall be taken to ensure reduction of future exposures to as low as is reasonably achievable. Records shall be maintained of these investigations.

9.10 Protective Equipment & Procedures

All process and maintenance workers who work in yellowcake areas or work on equipment contaminated with yellowcake will be provided and required to wear protective clothing including coveralls, boots or shoe covers. Workers who package yellowcake for transport shall also be provided gloves. Before leaving the change area, all process workers involved in the precipitation or packaging for transport of yellowcake, shall, at a minimum, monitor their hands and feet using a calibrated alpha survey instrument. In addition, spot surveys shall be performed for alpha contamination at least quarterly on all workers leaving the recovery plant area. The monitoring results shall be documented and maintained on file.

At the recovery plant, eating shall only be allowed in administrative offices and designated lunch areas that are separated from the process areas. Eating or smoking in the plant controlled areas is prohibited and violators are subject to disciplinary action.

9.11 Facility Radiation Surveys

The radiological monitoring programs include alpha, gamma, air sampling programs. Alpha contamination surveys of the eating and change areas will be conducted weekly and surveys of the facility laboratory and offices will be conducted monthly.

If the alpha contamination levels exceed those listed in Table 9-2 (Table from "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct or Source Materials" dated September 1984), the area shall be decontaminated. The source of the contamination shall be determined, control measures shall be initiated, and the results shall be documented.

Surveys for natural uranium and radon daughters shall be performed monthly in the recovery plant areas as shown on Figure 9-2, "Radon Progeny and Airborne Uranium Survey Locations". If radon daughters concentrations 0.08 working level (WL), sampling shall be increased to weekly until four (4) consecutive weekly samples are below 0.08 WL. Figure 9-4 shows the radon progeny sampling locations for the Satellite IX Facilities. Since there is no yellowcake handled in these areas, in either a wet or dry form, sampling for airborne uranium is not required.

Gamma radiation surveys shall be conducted quarterly in the recovery plant at the locations shown on Figure 9-3, "Gamma Radiation Survey Locations" and at the evaporation pond. A continuous passive radon detector, located at the downwind recovery plant site boundary, shall continue to be analyzed quarterly. Figure 9-4 shows the gamma radiation survey locations for the Satellite IX Facilities,

All equipment, materials, and/or packages will be surveyed for radiation contamination prior to release from the restricted area in accordance with U.S. NRC "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct or Source Materials" dated September 1984.

9.12 Management Audit and Inspection Programs

Regular auditing of the radiation protection and environmental programs will be carried out in accordance with Rio Algom Mining Corp. procedures. An audit team

consisting of members familiar with the radiation protection program and operations at the facility, will perform auditing. This audit team may include operations managers from the facility and/or other persons from outside the facility management that are experienced in the operational aspects of the facility radiation protection program. The RSO and/or RST will accompany the audit team. These audits will be conducted at least annually. Copies of the audit reports will be sent to corporate management, as well as to the local management, for corrective action and recommendations on ways to further reduce personnel exposures to uranium and its daughters as appropriate. Additionally, audit reports on the health physics programs will also be sent to the NRC if required.

During commercial production, the RSO, RST, or a trained designee shall perform and document a daily walk-through inspection of all operating areas. The inspection's purpose is to ensure that all radiation protection and monitoring requirements are being followed.

Table 9-2
ACCEPTABLE SURFACE CONTAMINATION LEVELS

Nuclides [a]	Average [b c e]	Maximum [b d e]	Removable [b e f]
U-nat, U-235, U-238, and associated decay products	5,000 dpm / 100 cm^2	15,000 dpm / 100 cm^2	1,000 dpm / 100 cm^2
Transuranics, Ra-226, Ra-228, Th-230, Th-118, Pa-231, ac-237, I-125, I-129	100 dpm / 100 cm^2	300 dpm / 100 cm^2	20 dpm / 100 cm^2
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	1,000 dpm / 100 cm^2	3,000 dpm / 100 cm^2	200 dpm / 100 cm^2
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above	5,000 dpm / 100 cm^2	15,000 dpm / 100 cm^2	1,000 dpm / 100 cm^2

[a] Where surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for alpha and beta-gamma-emitting nuclides should apply independently.

[b] As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

[c] Measurements of average contaminant should not be averaged over more than 1 square meter. For objects of less surface are, the average should be derived for each such object.

[d] The maximum contamination level applies to an area of not more than 100 cm^2.

[e] The average and maximum radiation levels associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 mrad/hr at 1 cm and 1.0 mrad/hr at 1 cm respectively, measured through not more than 7 milligrams per square centimeter of total absorber.

[f] The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with a dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally and the entire surface should be wiped.

Figure 9-1
Recovery Plant Site

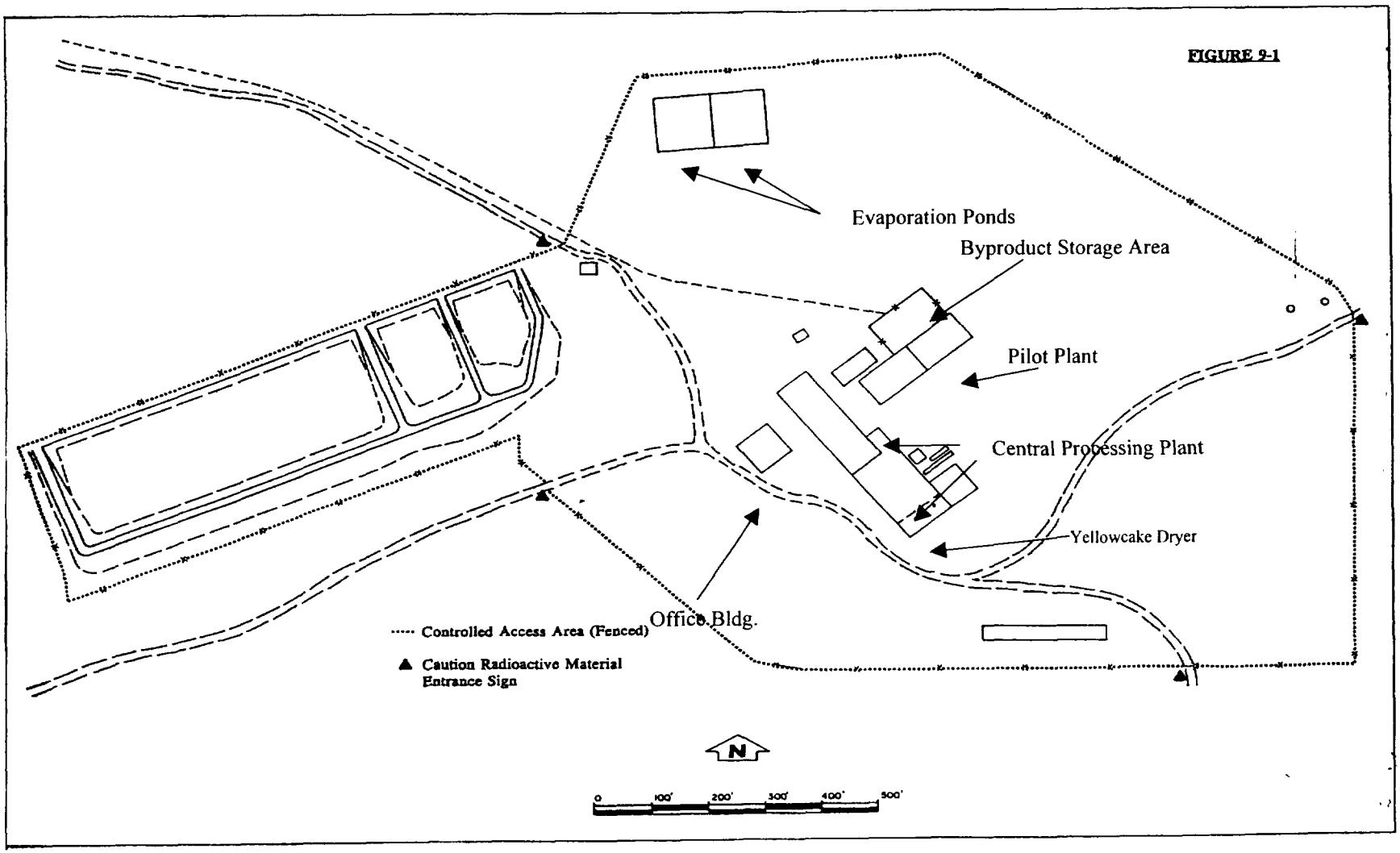


Figure 9-2
Pilot Plant Gamma Radiation Survey Locations

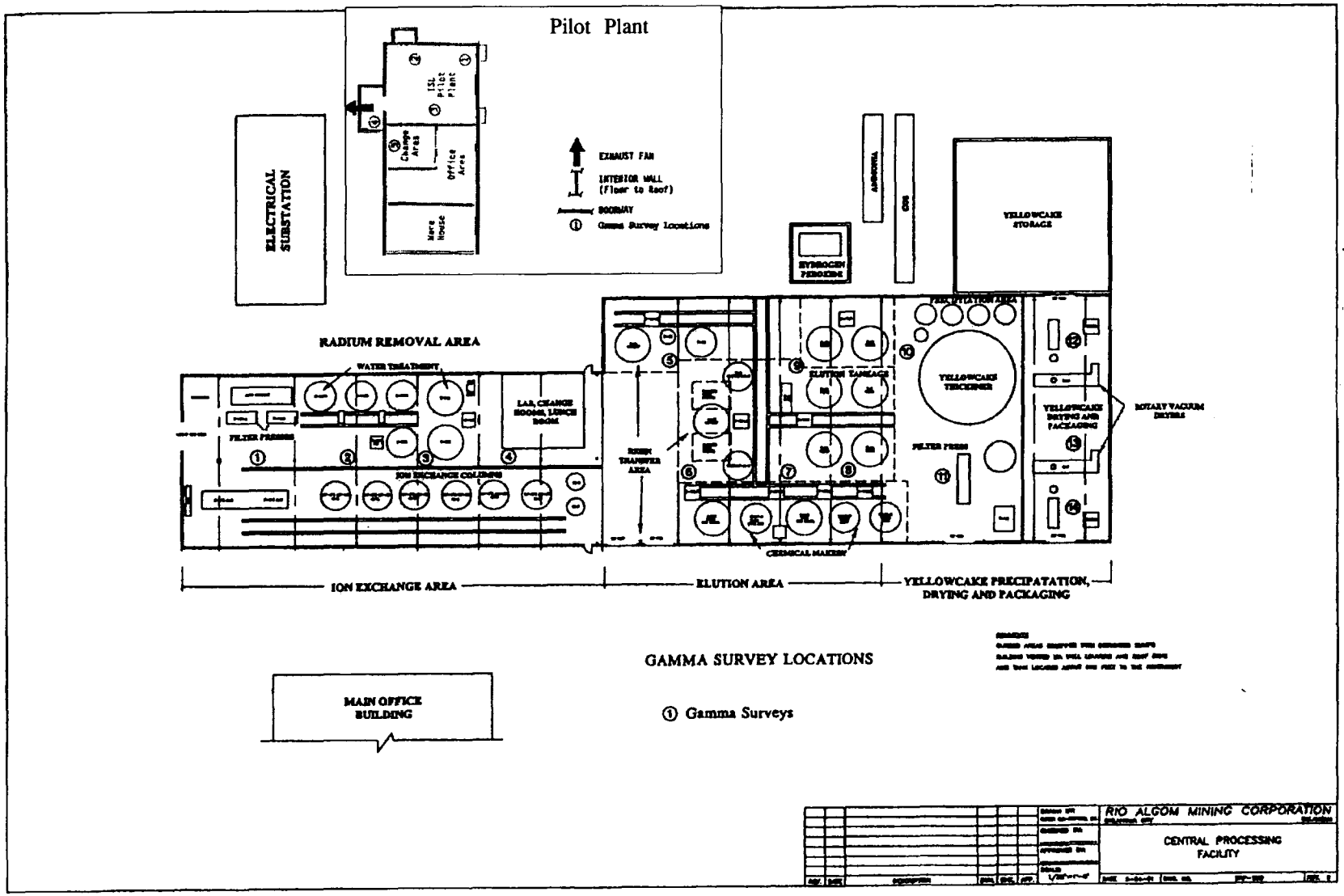


Figure 9-3
Airborne Yellowcake and Radon Progeny Sampling Locations

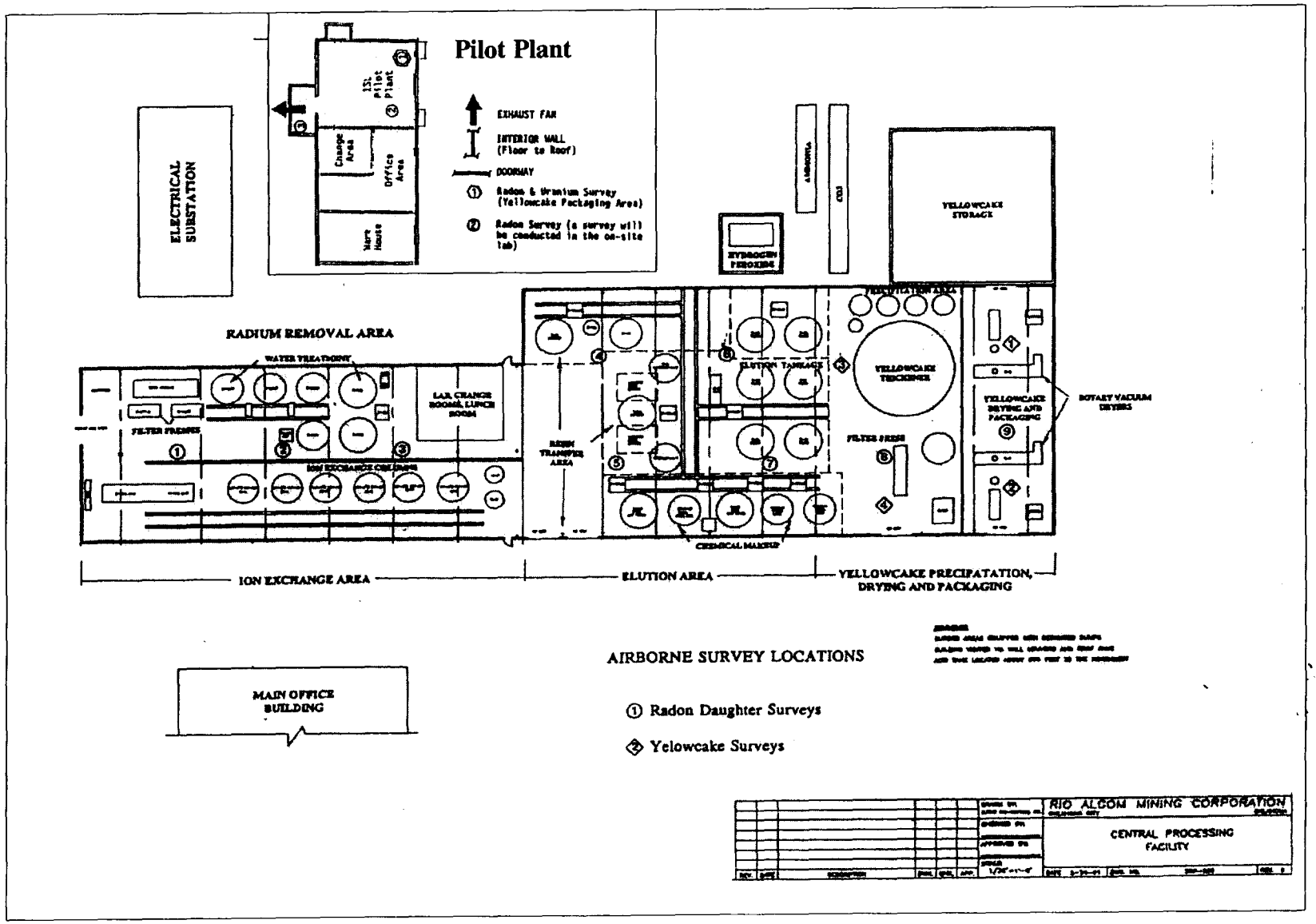


Figure 9-4
Satellite IX Plant Gamma Radiation and Radon Progeny Sampling Locations

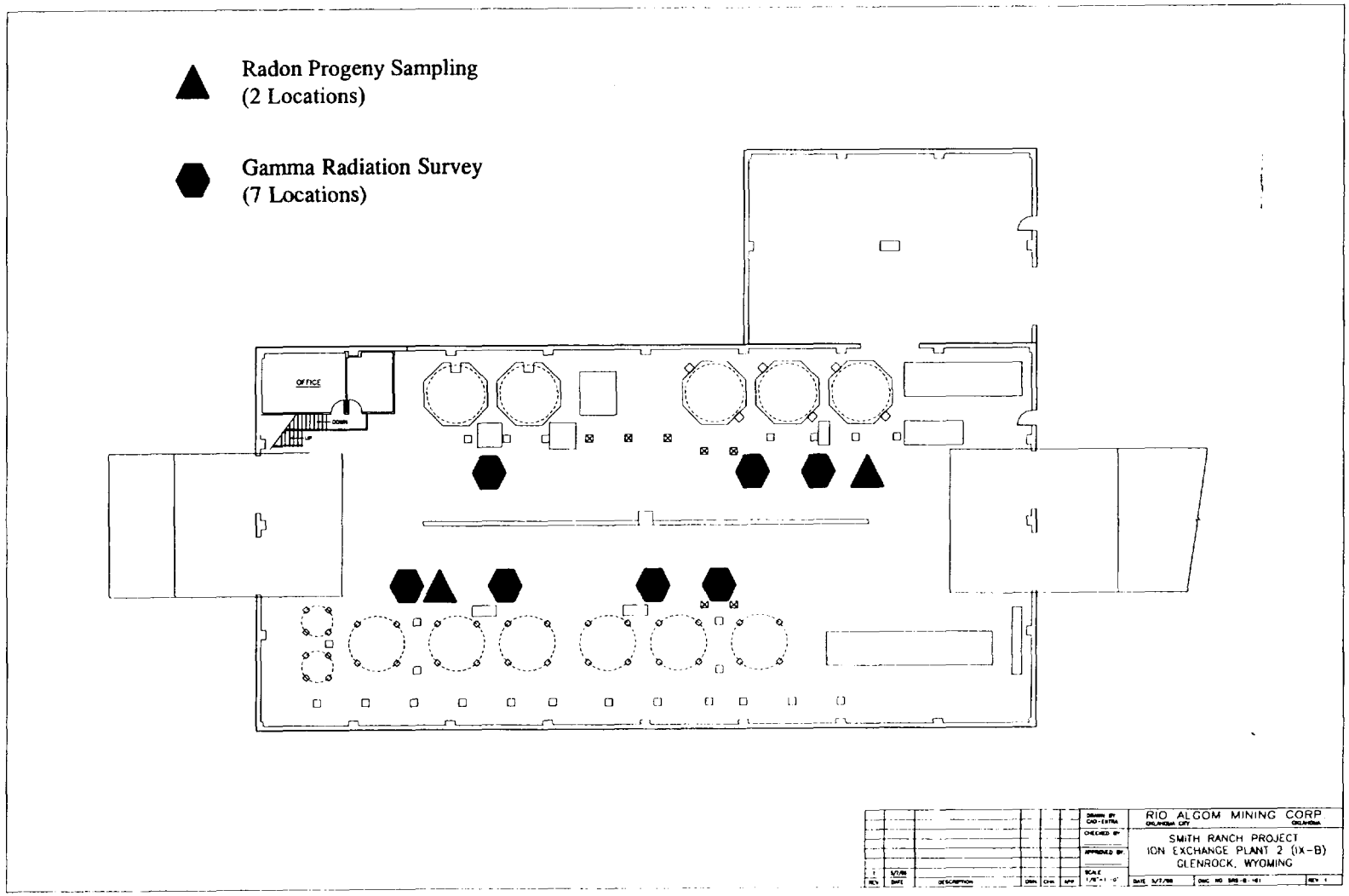
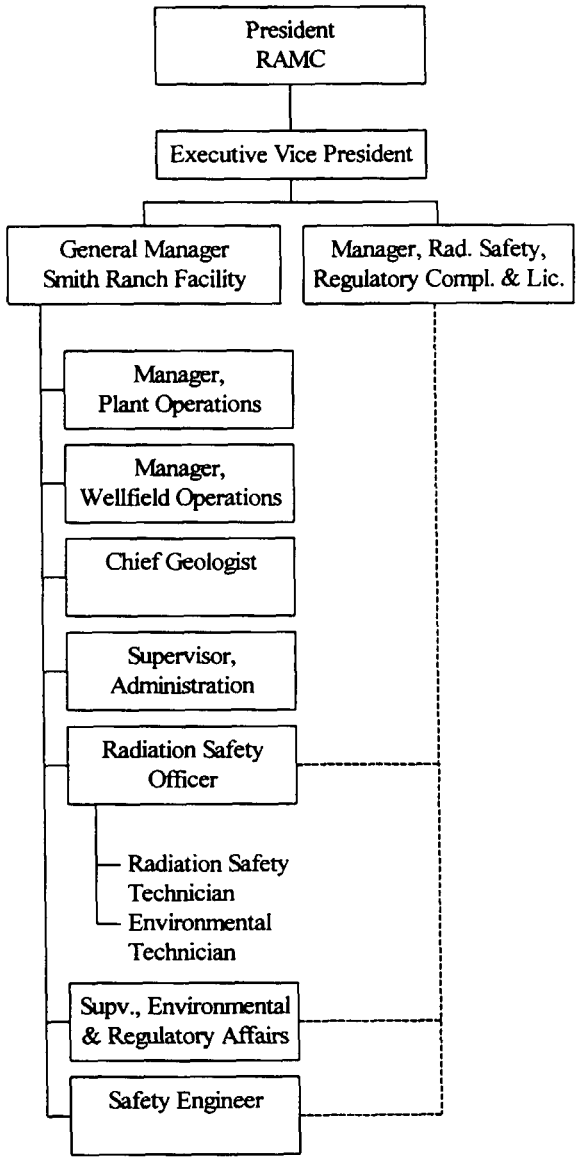


Figure 9-5
Organization and Reporting
Environmental, Health and Safety Management



CHAPTER 10
BENEFIT-COST SUMMARY

10.1 General

The general need for uranium is for replacement of the uranium consumed in the operation of nuclear power reactors. In reactor-licensing evaluations the benefits of the energy produced are weighted against related environmental costs, including a prorated share of the environmental costs of the uranium fuel cycle. The incremental impacts of typical mining and milling operation required for the fuel cycle are justified in terms of the benefits of energy generation to the society in general . However, the specific site-related benefits and costs of an individual fuel-cycle facility must be reasonable as compared to that typical operation.

10.2 Quantifiable Economic Impacts

Monetary benefits will accrue to the local community from the presence of the project, from employees living in the community, local expenditures of operating funds and the state and local taxes paid by the project. Against these monetary benefits are potential monetary costs to the communities involved, such as those for new or expanded schools and other community services. For this project however, the local communities currently have a surplus of such facilities and the only new costs for these facilities will be the additional operational costs. it is not possible to arrive at a numerical balance between the benefits and costs for any one community, or for the project, because of uncertainties in the market place and the ability of a community to alter the benefits and costs. For example, the community can use its various taxing powers to change tax rates, however the effect of such a change could be either offset or compounded by changes in price the operator receives for the end product.

10.3 Environmental Cost

The benefit-cost comparison for a fuel-cycle facility such as the proposed project also involves comparing the benefits to the United States and to the society in general of an ensured U_3O_8 supply for generating electrical energy against local environmental costs for which there may be no directly related compensation. For the proposed project, there are basically only three of these environmental costs:

groundwater impact, radiological impact, and disturbance of the land. The radiological impacts of the project during operation are small, and during reclamation the remaining solid radioactive wastes will be disposed of off-site; therefore, there will be no long-term impact. The disturbance of the land is also a small environmental impact. All of the disturbed land will be reclaimed after the project is decommissioned and will become available for the pre-mining uses. Restoration of an aquifer contaminated by a solution mining project has been demonstrated in the solution mining pilot program and bonding will be provided to ensure funds for restoration of the commercial solution mining project eliminating any significant long-term impact to the groundwater.

10.4 Summary

In considering the energy value of the U_3O_8 produced, the economic benefit to the local communities, the minimal radiological impacts, minimal disturbance of land, and mitigable nature of all other impacts, it is believed that the overall benefit-cost balance for the project is favorable, and that granting a license for this solution mining project is an appropriate regulatory action.

APPENDIX A

NAMES AND LAST KNOWN ADDRESSES OF OWNERS OF THE SURFACE RIGHTS ON LANDS WITHIN THE PERMIT AREA

SOUTH POWDER RIVER BASIN

CONVERSE COUNTY, WYOMING

APPENDIX A

NAMES AND LAST KNOWN ADDRESSES OF OWNERS OF THE SURFACE RIGHTS ON LANDS WITHIN THE PERMIT AREA

SOUTH POWDER RIVER BASIN

CONVERSE COUNTY, WYOMING

SURFACE LANDOWNER'S CONSENT
SMITH RANCH PROJECT
CONVERSE COUNTY, WYOMING
WYOMING DEQ-LQD TFN 2 6/99

I, MARVIN D. FREEMAN, CERTIFY that Quivira Mining Company, a subsidiary of Rio Algom Mining Corp., holds surface rights on certain lands within the proposed Smith Ranch Project uranium solution mining permit area including the following lands:

Section 13-T36N-R74W - SE1/4
Section 14-T36N-R74W - S1/2
Section 23-T36N-R74W - All except S1/2 SW1/4
Section 24-T36N-R74W - W1/2
Section 25-R36N-R74W - Patented claims in W1/2
Section 26-T36N-R74W - All patented claims
Section 27-T36N-R74W - Patented claims in E1/2
Section 35-T36N-R74W - All
Section 2-T35N-R74W - N1/2 N1/2

I have examined the mining plan and the reclamation plan prepared by Rio Algom Mining Corp. in compliance with the Wyoming Environmental Quality Act of 1973 as amended, and do hereby approve said plans and give consent to enter and carry out said mining and reclamation programs on said lands as proposed therein.

Dated this 12th day of July, 1990.

Owner or Representative

Witness:

Janet E. Teague

Janet L Woodard

TRANSFER OF PROPOSED PERMIT AREA FROM PERMIT 304C TO NEW PERMIT

The permit area as proposed in this application is totally within and is identical to that portion of the Permit Area in Sequoyah Fuels Coproration's Mining Permit 304C south of an east-west line drawn along the southern edge of the North half of Sections 13 and 14, Township 36N, Range 74W. Sequoyah Fuels Corporation hereby requests on approval of this application all of the current 304C permit area south of the above referenced line be deleted from Mining Permit 304C. All reclamation obligations associated with this area of Permit 304C would also be transferred to the new permit.

Since the proposed permit area lies totally within the authorized Permit 304C area and does not involve any new surface area, Sequoyah Fuels hereby requests DEQ accept this reference to Permit 304C in lieu of additional surface owner consent forms, as Sequoyah Fuels' rights have already been documented through Permit 304C.

APPENDIX "A"
THE NAMES AND LAST KNOWN ADDRESSES OF OWNERS OF THE SURFACE RIGHTS ON LANDS WITHIN THE PERMIT AREA

T35N, R74W	Interest Located in Sections
Smith Land Company 207 North 4th Street Douglas, Wyoming 82633	3, 4, 8, 9, 10, 11, 17, 18, 21
Smith Sheep Company 207 North 4th Street Douglas, Wyoming 82633	2, 5, 10, 11
Florence P. Coates, et al Glenrock, Wyoming 82637	17, 18, 19
State of Wyoming Commissioner of Public Lands 122 West 25th Street Cheyenne, Wyoming 82003	3, 4, 16
Quivira Mining Company c/o Rio Algom Mining Corp. 6305 Waterford Blvd., Suite 325 Oklahoma City, OK 73118-1119	2
United States Government Bureau of Land Management Platte River Resource Area P.O. Box 2420 Mills, Wyoming 82644	2
T35N, R75W	
Pacific Power & Light 2840 East Yellowstone Highway Casper, Wyoming 82601	13, 24
T36N, R73W	
Duck Creek Ranches Box 146 Douglas, Wyoming 82633	20
Vollman Ranches, Inc. P.O. Box 13 Douglas, Wyoming 82633	19, 20, 29, 30, 31
T36N, R74W	
Duck Creek Ranches P.O. Box 146 Douglas, Wyoming 82633	13

APPENDIX "A" (Con'd)

T36N, R74W	Interest Located in Sections
Linda Kay Birkner 3245 Rio Drive Apartment 610 Falls Church, Virginia 22401	25
State of Wyoming Commissioner of Public Lands 122 West 25th Street Cheyenne, Wyoming 82003	36
United States Government Bureau of Land Management Platte River Resource Area P.O. Box 2420 Mills, Wyoming 82644	22, 25, 26, 27, 33, 34, 35
Smith Sheep Company 207 North 4th Street Douglas, Wyoming 82633	22, 23, 24, 27, 33
Smith Land Company 207 North 4th Street Douglas, Wyoming 82633	33, 34
Quivira Mining Company c/o Rio Algom Mining Corp. 6305 Waterford Blvd., Suite 325 Oklahoma City, OK 73118-1119	13, 14, 23, 24, 25, 26, 27, 35

OTHER PARTIES WHO HAVE A VALID
LEGAL ESTATE WITHIN THE PERMIT BOUNDARY

Mountain States Telephone and Telegraph Company
155 North Beech
Casper, Wyoming 82601

Pacific Power and Light Company (Power Lines)
2840 East Yellowstone Highway
Casper, Wyoming 82601

MGTC, Inc. (Natural Gas Lines)
120 North Center
Casper, Wyoming 82601

Converse County Commissioners (County Road)
Douglas, Wyoming 82633

NAMES AND LAST KNOWN ADDRESSES OF OWNERS OF MINERAL LEASES OR INTERESTS WITHIN PERMIT AREA TO WHICH SEQUOYAH FUELS DOES NOT CONTROL MINERAL MINING RIGHTS

	Interest Located in Sections
T36N, R73W	
Power Resources, Inc. 800 Werner Court, Suite 230 Casper, Wyoming 82601	19, 20, 29, 30
T36N, R74W	
W. C. Salisbury 1004 Beaumont Drive Casper, Wyoming 82601	25

NAMES AND LAST KNOWN ADDRESSES OF OWNERS OF OIL & GAS INTERESTS WITHIN THE PERMIT AREA

	Interest Located in Sections
T35N, R74W	
Apache Corporation 1660 Lincoln St., Suite 2016 Denver, Colorado 80264	5, 8, 9, 16, 17, 18, 19
APCOT-FINADEL Joint Venture P. O. Box 2159 Dallas, Texas 75221	4
Conoco, Inc. P. O. Drawer 1267 Ponca City, Oklahoma 74603	5, 6, 9, 17, 18
DEPCO, Inc. 1000 Petroleum Bldg. 110 - 16th Street Denver, Colorado 80202	2, 5, 10, 11
Grynberg, Stephen M. Grynberg, Miriam Z. 5000 South Quebec, Suite 500 Denver, Colorado 80237	8

	Interest Located in Sections
T35N, R74W (Cont'd)	
Haynie, Robert L. 544 Metro Bank Building 17th & Glenorm Denver, Colorado 80202	16
I.C. Gas Amcana, Inc. 320 South Boston, Suite 1900 Tulsa, Oklahoma 74103	2, 9, 10, 11, 21
I.G.C. Petroleum Co. 2700 - 140 Fourth Ave., S.W. Calgary, Alberta, Canada T2P353	2, 9, 10, 11, 21
Kerr McGee Corporation P. O. Box 25861 Oklahoma City, Oklahoma 73125	3
Meridian Oil Company 1000 M Bond Plaza P. O. Box 99005 El Paso, Texas 79999	17
Moncrief, W. A., Sr. Moncrief Building Ninth & Commerce Fort Worth, Texas 76102	5, 8, 9, 16, 17, 18, 19
NICOR Exploration Co. 1667 Cole Bldg. Golden, Colorado 80401	2, 5, 10, 11
Petromark Resources Company 7170 S. Braden, Suite 200 Tulsa, Oklahoma 74136	2, 9, 10, 11, 21
Reading & Bates Petroleum Co. 3200 Mid-Continent Tower Tulsa, Oklahoma 74103	2, 9, 10, 11, 21
Samedan Oil Corporation 1616 Glenarm Place, Suite 2550 Denver, Colorado 80202	3
Southport Exploration Co. Box 21648 Oklahoma City, Oklahoma 74121	10

	Interest Located in Sections
T35N, R74W (Cont'd)	
Shell Western E&P, Inc. Box 831 Houston, Texas 77001	3, 4, 6, 17
TXO Production Corp. Fidelity Union Tower Dallas, Texas 75201	4
Woods Petroleum Co. ATTN: J. Barry Suite 700, 1 Lakeview Energy Center 3817 N. W. Expressway Oklahoma City, OK 73112	5, 8, 9, 16, 17, 18, 19
Yates, S. P. 207 South Fourth Street Artesia, New Mexico 88210	10
T35N, R75W	
Apache Corporation 1660 Lincoln St., Suite 2016 Denver, Colorado 80264	13, 24
Woods Petroleum Co. Attn: J. Barry Suite 700, 1 Lakeview Energy Center 3817 N. W. Expressway Oklahoma City, Oklahoma 73112	13, 24
T36N, R73W	
Phillips Petroleum Co. 8055 E. Tufts Ave. Pkwy. Denver, Colorado 80237	29, 31
Shell Western E&P, Inc. Box 831 Houston, Texas 77001	19, 20
T-Bar-S Oil, Inc. 820 Division St. Billings, Montana 59101	19, 20, 29, 30

	Interest Located in Sections
T36N, R74W	
Andermon/Smith & Co. 1776 Lincoln St., Suite 500 Denver, Colorado 80203	14
Apache Corporation 1660 Lincoln St., Suite 2016 Denver, Colorado 80264	33, 34, 35
APCOT-FINADEL Joint Venture P. O. Box 2159 Dallas, Texas 75221	25
Armstrong Petroleum Corp. Box 1546 Newport Beach, California 92663	33, 34, 35
Barlow-Horn, Inc. 139 W. Second Street Casper, Wyoming 82601	33, 34, 35
Carl Underwood Oil & Gas P. O. Box 3040 Casper, Wyoming 82602	22
Charney, Joan 555 - 17th Street, Suite 1000 Denver, Colorado 80202-3910	22
Cimarron Corp. 1120 One Energy Square Dallas, Texas 75206	33, 34, 35
Corbin J. Robertson Box 3331 Houston, Texas 77210	25
Diamond Shamrock Expl. Co. Box 631 Amarillo, Texas 79173	22, 25
Ellbagen, John P. Box 1928 Casper, Wyoming 82602	23
First Energy Corp. 16701 Greenspoint Rock Dr., Suite 200 Houston, Texas 77060	25

	Interest Located in Sections
T36N, R74W (Cont'd)	
Getty Oil Company Box 66729 Houston, Texas 77006	25
Hook, J. D. 5644 Vineyard Road Oregon, Wisconsin 53575	35
Kerr McGee Corporation P. O. Box 25861 Oklahoma City, Oklahoma 73125	22, 27
Killian, B. K. 2240 Belmont Blvd. Casper, Wyoming 82001	23
Louisana Land & Expl. Co. Suite 2100/Great West Life Tower 1675 Broadway Denver, Colorado 80202	25, 36
Mobil Oil Corporation Box 5444 Denver, Colorado 80217	22
Moncrief, W. A., Sr. Moncrief Building Ninth & Commerce Fort Worth, Texas 76102	33, 34, 35
Newall Land & Farming Company Box 5500 Valencia, California 91355	33, 34, 35
Northern Natural Gas Co. 720 S. Colorado Blvd., Suite 620 Denver, Colorado 80222	23
Oklahoma Oil Company 4849 Greeneville Avenue Dallas, Texas 75206	33, 34, 35
Samedan Oil Corporation Suite 1280 633 - 17th Street Denver, Colorado 80202	22, 27
Santa Fe Energy Operating Partners, L.P. 1616 South Voss Road Houston, Texas 77057	25

	Interest Located in Sections
T36N, R74W (Cont'd)	
Sawyer, Joseph Addison 650 Grand Avenue Los Angeles, California 90017	35
Shell Western E&P, Inc. Box 831 Houston, Texas 77001	14, 22, 23, 24, 26, 33, 34, 35
Sohio Petroleum Co. Box 4587 Houston, Texas 77210	25
Superior Oil Company P. O. Box 1521 Houston, Texas 77251	13
TXO Production Corp. Fidelity Union Tower Dallas, Texas 75201	25
Texaco Producing, Inc. P. O. Box 3000 Tulsa, Oklahoma 74102	22
Woods Petroleum Company Attn: J. Barry Suite 700, 1 Lakeview Energy Center 3817 N. W. Expressway Oklahoma City, OK 73112	33, 34, 35

APPENDIX "A" (Cont'd)

LAND DESCRIPTION

Location Converse County, Wyoming	Surface Owner	Mineral Owner	Mineral Claim/Lease
T36N, R73W			
Sec. 19: SW¼; W½ SE¼; NE¼ SE¼; SE¼ NE¼	Vollman Ranches, Inc. P. O. Box 13 Douglas, Wyoming 82633	Domsalla Heirs (See Attached Table)	Lease
Sec. 20: E½ NW¼; S½ SW¼ NW¼	Duck Creek Ranches P. O. Box 146 Douglas, Wyoming 82633	USA Bureau of Land Mgt. P.O. Box 2420 Mills, Wyoming 82644	Claim
Sec. 20: SW¼	Vollman Ranches, Inc.	Domsalla Heirs	Lease
Sec. 29: NW¼	Vollman Ranches, Inc.	Domsalla Heirs	Lease
Sec. 29: S½	Vollman Ranches, Inc.	USA	Claim
Sec. 30: E½; NW¼; N½ SW¼; SE¼ SW¼	Vollman Ranches, Inc.	Domsalla Heirs	Lease
Sec. 31: NW¼	Vollman Ranches, Inc.	USA	Claim
T35N,R74W			
Sec. 2: N½ N½	USA (Quivira Mining Company Land Patent)	Quivira Mining Company c/o Rio Algom Mining Corp. 6305 Waterford Blvd., Suite 325 Oklahoma City, OK 73118 -1119	Patented Claim

APPENDIX "A" (Cont'd)

Location Converse County, Wyoming	Surface Owner	Mineral Owner	Mineral Claim/Lease
T35N, R74W (Cont'd)			
Sec. 2: S½ SE¼; S½ N½; W½ SW¼	Smith Sheep Company 207 North 4th Street Douglas, Wyo. 82633	Smith Mineral Trust c/o Converse County Bank Douglas, Wyo. 82633	1/4 Lease
		William J. Smith 207 North 4th Street Douglas, Wyo. 82633	1/4
		J. B. Sullivan & Wyo. Nat'l Bank of Casper Co-Trustees	1/2
Sec. 3: N½	State of Wyoming Comm. of Public Lands 122 West 25th Street Cheyenne, Wyoming 82003	State of Wyoming Comm. of Public Lands 122 West 25th Street Cheyenne, Wyoming 82003	Lease
Sec. 3: S½	Smith Land Company 207 North 4th Street Douglas, Wyoming 82633	USA	Claim
Sec 4: NE¼	State of Wyoming	State of Wyoming	Lease
Sec. 4: SE¼	Smith Land Company	USA	Claim
Sec. 4: W½	Smith Land Company	Smith Mineral Trust	Lease
Sec. 5: All	Smith Sheep Company	USA	Claim

APPENDIX "A" (Cont'd)

Location Converse County, Wyoming	Surface Owner	Mineral Owner	Mineral Claim/Lease
T35N, R74W (Cont'd)			
Sec. 8: SW¼, SW¼; E½; N½ NW¼	Smith Land Company	USA	Claim
Sec. 8: S½ NW¼; N½ SW¼; SE¼ SW¼	Smith Land Company	Smith Mineral Trust	Lease
Sec. 9: W½	Smith Land Company	USA	Claim
Sec. 9: E½	Smith Land Company	Smith Mineral Trust	Lease
Sec. 10: S½ SE¼	Smith Land Company	Smith Mineral Trust	Lease
Sec. 10: N½; N½ S½; S½ SW¼	Smith Land Company	USA	Claim
Sec. 11: W½ SW¼; SW¼ NW¼	Smith Land Company	Smith Mineral Trust	Lease
Sec. 11: N½ N½; SE¼ NW¼; E½ Sw¼; SE¼ NE¼; NE¼ SE¼	Smith Sheep Company	Smith Mineral Trust William J. Smith J. B. Sullivan & Wyo. Nat'l Bank of Casper Co-Trustees	1/4 Lease 1/4 Lease 1/2 Lease
Sec. 16: All	State of Wyoming	State of Wyoming	Lease

APPENDIX "A" (Cont'd)

Location Converse County, Wyoming	Surface Owner	Mineral Owner	Mineral Claim/Lease
T35N, R74W (Cont'd)			
Sec. 17: N½; N½ SE¼	Smith Land Company	USA	Claim
Sec. 17: SW¼; S½ SE¼	F. P. Coates, et al	USA	Claim
Sec. 18: N½; NW¼ SW¼; NW¼ SE¼	Smith Land Company	USA	Claim
Sec. 18: S½ S½; NE¼ SW¼; NE¼ SE¼	F. P. Coates, et al Glenrock, Wyo. 82637	USA	Claim
Sec. 19: W½ NW¼; W½ E½ NW¼	F. P. Coates, et al	USA	Claim
Sec. 21: N½	Smith Land Company	Smith Mineral Trust	Lease
T36N, R74W			
Sec. 13: SE¼	Duck Creek Ranches	Walter J. Reynolds P. O. Box 146 Douglas, Wyoming 82633	Lease
Sec. 13: SW¼	Quivira Mining Company	Walter J. Reynolds	Lease
Sec. 14: S½	Quivira Mining Company	USA	Claim
Sec. 22: W½	Smith Sheep Company	USA	Claim

APPENDIX "A" (Cont'd)

Location Converse County, Wyoming	Surface Owner	Mineral Owner	Mineral Claim/Lease
T36N, R74W (Cont'd)			
Sec. 22: E½	USA Bureau of Land Mgt. P.O. Box 2420 Mills, Wyoming 82644	USA	Claim
Sec. 23: N½; SW¼; N½ SE¼	Quivira Mining Company	Smith Mineral Trust William J. Smith J. B. Sullivan & Wyo. Nat'l Bank of Casper Co-Trustees Lawrence D. Young 40 Rodeo Trailer Ct. Rt. 2, Kearney, Neb.	1/8 Lease 1/8 Lease 1/4 Lease 1/2 Lease
Sec. 23: S½ SE¼	Smith Sheep Company	USA	Claim
Sec. 24: W½	Quivira Mining Company	USA	Claim
Sec. 24: E½	Smith Sheep Company	Smith Mineral Trust J. B. Sullivan & Wyo. Nat'l Bank of Casper	1/2 Lease 1/2 Lease
Sec. 25: NW¼, Part SW¼	USA	USA	Claim
Sec. 25: Part SW¼	USA	Quivira Mining Company	Patented Claim

APPENDIX "A" (Cont'd)

Location Converse County, Wyoming	Surface Owner	Mineral Owner	Mineral Claim/Lease
T36N, R74W (Cont'd)			
Sec. 25: E½	Linda Kay Birkner 3245 Rio Drive Apt. 610 Falls Church, Va. 22041	Linda Kay Birkner 3245 Rio Drive Apt. 610 Falls Church, Va. 22041	1/2 Lease
		W. C. Salisbury 1004 Beaumont Drive Casper, Wyo. 82601	1/4 Lease
		Quivira Mining Company	1/4 Lease
Sec. 26: S½; Part N½	USA	Quivira Mining Company	Patented claim
Sec. 26: Part N½	USA	USA	Claim
Sec. 27: W½ E½; NE¼ SE¼; NE¼ NE¼; W½ SE¼ NE¼; W½ E½ SE¼ NE¼	USA	USA	Claim
Sec. 27: W½	Smith Sheep Company	USA	Claim
Sec. 27: E½ E½ SE¼ NE¼; SE¼ SE¼	USA	Quivira Mining Company	Patented Claim
Sec. 33: N½	USA	USA	Claim

APPENDIX "A" (Cont'd)

Location Converse County, Wyoming	Surface Owner	Mineral Owner	Mineral Claim/Lease
T36N, R74W (Cont'd)			
Sec. 33: N½ SW¼	Smith Sheep Company	USA	Claim
Sec. 33: S½ SW¼; SW¼ SE¼	Smith Land Company	Smith Mineral Trust	Lease
Sec. 33: N½ SE¼; SE¼ SE¼	Smith Land Company	USA	Claim
Sec. 34: E½ W½, SW¼ SW¼	Smith Land Company	USA	Claim
Sec. 34: W½ NW¼, NW¼ SW¼	USA	USA	Claim
Sec. 34: E½	Smith Land Company	Smith Mineral Trust	Lease
Sec. 35: All	USA (Quivira Mining Company Land Patent)	Quivira Mining Company	Patented Claims
Sec. 36: All	State of Wyoming	State of Wyoming	Lease
T35N, R75W			
Sec. 13: SE¼	Pacific Power & Light 2840 East Yellowstone Highway Casper, Wyo. 82601	USA	Claim
Sec. 24: N½ NE¼	Pacific Power & Light	USA	Claim

DOMSALLA HEIRS
MINERAL OWNERSHIP

Domsalla Limited Partnership 622 Morgan Street Mills, Wyoming 82644	1/3 Interest
Eileen Domsalla Branch 744 West 15th Street Casper, Wyoming 82601	1/3 Interest
Harvie A. Domsalla 671 Longview Drive Douglas, Wyoming 82633	1/9 Interest
Cherie A. Domsalla Heldt route 1 - HCR-88 - Box 89 Lisco, Nebraska 69148	1/9 Interest
Eileen Domsalla Milam 4302 Cheyenne Drive Laramie, Wyoming 82070	1/9 Interest

OVERSIZE PAGE(S)

****

NOT CONVERTED INTO ELECTRONIC IMAGE FORM.

****

PAPER COPY IS AVAILABLE IN NRC FILE CENTER.

APPENDIX B

SURFACE AND MINERALS OWNERS ON LAND ADJACENT TO PERMIT AREA

SOUTH POWDER RIVER BASIN

CONVERSE COUNTY, WYOMING

SURFACE AND MINERAL OWNERS ON
LAND ADJACENT TO PERMIT AREA

SURFACE OWNERS

T35N, R73W	INTEREST LOCATED IN SECTIONS
United States Government Bureau of Land Management P.O. Box 2420 Mills, Wyoming 82644	6
T36N, R73W	
Duck Creek Ranches P.O. Box 146 Douglas, Wyoming 82633	17, 18, 20
Vollman Ranches, Inc. P.O. Box 13 Douglas, Wyoming 82633	17, 19, 20, 28, 29, 30, 31, 32, 33
Smith Land Company 207 North 4th Street Douglas, Wyoming 82633	31
T35N, R74W	
United States Government Bureau of Land Management P.O. Box 2420 Mills, Wyoming 82644	1, 19, 21
Smith Sheep Company 107 North 4th Street Douglas, Wyoming 82633	1, 2, 11, 12, 13, 14, 15
Smith Land Company 207 North 4th Street Douglas, Wyoming 82633	6, 7, 14, 15, 20, 21, 22
Florence P. Coates, et al Glenrock, Wyoming 82637	19, 20

APPENDIX "B" (Con't)

T36N, R74W	INTEREST LOCATED IN SECTIONS
Duck Creek Ranches P.O. Box 146 Douglas, Wyoming 82633	13, 14
Linda Kay Birkner 3245 Rio Drive, Apt. 610 Falls Church, VA 22401	14
Moore Sheep Company c/o Eddie Moore Douglas, Wyoming 82633	15
Smith Sheep Company 207 North 4th Street Douglas, Wyoming 82633	15, 21, 28, 29, 31, 32
Richard T. Hornbuckle Route 3 Douglas, Wyoming 82633	15
United States Government Bureau of Land Management P.O. Box 2420 Mills, Wyoming 82644	29
State of Wyoming Commissioner of Public Lands 122 West 25th Street Cheyenne, Wyoming 82003	16, 32
T35N, R75W	
Pacific Power & Light 2840 East Yellowstone Highway Casper, Wyoming	12, 13, 24

OTHER PARTIES WHO HAVE A VALID
LEGAL ESTATE WITHIN THE PERMIT BOUNDARY

Mountain States Telephone & Telegraph Company
155 North Beech Street
Casper, Wyoming 82601

Pacific Power & Light Company (Power Lines)
2840 East Yellowstone Highway
Casper, Wyoming 82601

MGTC, Inc. (Natural Gas Lines)
120 North Center
Casper, Wyoming 82601

Converse County Commissioners (County Road)
Douglas, Wyoming 82633

NAMES AND LAST KNOWN ADDRESSES OF OWNERS OF OIL & GAS INTERESTS ON ADJACENT LANDS

	Interests Located in Sections
T35N, R73W	
Diamond Shamrock Expl. Co. Box 631 Amarillo, Texas 79173	6
Phillips Petroleum Co. 8055 E. Tufts Ave. Pkwy. Denver, Colorado 80237	6
T35N, R74W	
Anderson, Donald B. P. O. Box One Roswell, New Mexico	6
Apache Corporation 1660 Lincoln St., Suite 2016 Denver, Colorado 80264	1, 7, 19, 20, 21, 22
Charney, Joan 555 - 17th Street, Suite 1000 Denver, Colorado 80202-3910	6
Conoco, Inc. P. O. Drawer 1267 Ponca City, Oklahoma 74063	7, 20

APPENDIX "B" (Cont'd)

T35N, R74W (Cont'd)	INTERESTS LOCATED IN SECTIONS
DEPCO, Inc. 1000 Petroleum Bldg. 110 - 16th Street Denver, Colorado 80202	2, 6
Grynberg, Stephen M. Grynberg, Miriam Z. 5000 South Quebec, Suite 500 Denver, Colorado 80237	7
Harper Oil Company Box 5928 T.A. Denver, Colorado 80217	6
I.C. Gas Amcana, Inc. 320 South Boston, Suite 1900 Tulsa, Oklahoma 74103	1, 2, 12, 13, 14, 15, 22
I.G.C. Petroleum Co. 2700 - 140 Fourth Ave., S.W. Calgary, Alberta, Canada T2P353	1, 2, 12, 13, 14, 15, 22
Kerr-McGee Corporation P. O. Box 25861 Oklahoma City, Oklahoma 73125	11
Moncrief, W. A., Sr. Moncrief Building Ninth & Commerce Fort Worth, Texas 76102	7, 12, 13, 19, 20, 21
Monsanto Oil Company 700 S. Colorado Blvd., Suite 500 Denver, Colorado 80222	1
NICOR Exploration Co. 1667 Cole Bldg. Golden, Colorado 80401	2, 6
Petromark Resources Company 7170 S. Braden, Suite 200 Tulsa, Oklahoma 74136	1, 2, 12, 13, 14, 15, 22
Phillips Petroleum Co. 8055 E. Tufts Ave. Pkwy. Denver, Colorado 80237	1, 21

	INTERESTS LOCATED IN SECTIONS
T35N, R74W (Cont'd)	
Reading & Bates Petroleum Co. 3200 Mid-Continent Tower Tulsa, Oklahoma 74103	1, 2, 12, 13, 14, 15, 22
Samedan Oil Corporation 1616 Glenarm Place, Suite 2550 Denver, Colorado 80202	11
Shell Western E&P, Inc. Box 831 Houston, Texas 77001	6, 7
Southport Exploration Co. Box 21648 Oklahoma City, Oklahoma 74121	2
Woods Petroleum Co. ATTN: J. Barry Suite 700, 1 Lakeview Energy Center 3817 N. W. Expressway Oklahoma City, OK 73112	1, 7, 12, 13, 19, 20, 21, 22
Yates, S. P. 207 South Fourth Street Artesia, New Mexico 88210	15
T35N, R75W	
Apache Corporation 1660 Lincoln St., Suite 2016 Denver, Colorado 80264	13, 24
Moncrief, W. A., Sr. Moncrief Building Ninth & Commerce Fort Worth, Texas 76102	12, 13, 24
Woods Petroleum Co. ATTN: J. Barry Suite 700, 1 Lakeview Energy Center 3817 N. W. Expressway Oklahoma City, OK 73112	12, 13, 24

APPENDIX "B" (Cont'd)

T36N, R73W	INTERESTS LOCATED IN SECTIONS
Britol Ventures, Inc. 1360 Post Oak Boulevard, Suite 1800 Houston, Texas 77056	17
Charney, Joan 555 - 17th Street, Suite 1000 Denver, Colorado 80202-3910	19
Charney Oil Company 401 Lincoln Tower Bldg. 1860 Lincoln St. Denver, Colorado 80295	17
Conoco, Inc. P. O. Drawer 1267 Ponca City, Oklahoma 74603	28, 31, 32
E. P. Operating Company 1817 Wood Street Dallas, Texas 75201	18, 20
Norcen Petroleum, Inc. 715 - 5th Aveniue, S.W. Calgary, Alberta, Canada T2P2X7	17
Phillips Petroleum Co. 8055 E. Tufts Ave. Pkwy. Denver, Colorado 80237	30
Ross, S. F. 115 Sage Road P. O. Box 4182 Ketchum, Idaho 83186	19
Shell Western E&P, Inc. Box 831 Houston, Texas 77001	17, 18, 19, 20, 28, 31, 33
Superior Oil Company P. O. Box 1521 Houston, Texas 77251	17
T-Bar-S Oil Company 820 Division St. Billings, Montana 80203	20, 29, 31

APPENDIX "B" (Cont'd)

	INTERESTS LOCATED IN SECTIONS
T36N, R74W	
Amoco Production 200 East Randolph Dr. Chicago, Illinois 60601	15
Apache Corporation 1660 Lincoln St., Suite 2016 Denver, Colorado 80264	31, 32
APCOT-FINADEL Joint Venture P. O. Box 2159 Dallas, Texas 75221	32
Armstrong Petroleum Corporation Box 1546 Newport Beach, California 92663	32
Barlow & Horn, Inc. 139 W. Second Street Casper, Wyoming 82601	32
Bel North Petroleum Corp. P. O. Box 17583 T.A. Denver, Colorado 80217	32
Carl Underwood Oil & Gas P. O. Box 3040 Casper, Wyoming 82602	14, 21, 28
Charney, Joan 555 - 17th Street, Suite 1000 Denver, Colorado 80202-3910	14
Charney, Raymond 401 Lincoln Tower Bldg. 1860 Lincoln St. Denver, Colorado 80295	15, 21, 28
Cimarron Corp. 1120 One Energy Square Dallas, Texas 75206	31, 32
Cities Service Oil & Gas Corp. P. O. Box 300 Tulsa, Oklahoma 74102	15

APPENDIX "B" (Cont'd)

	INTERESTS LOCATED IN SECTIONS
T36N, R74W (Cont'd)	
Conoco, Inc. P. O. Drawer 1267 Ponca City, Oklahoma 74603	32
Diamond Shamrock Expl. Co. Box 631 Amarillo, Texas 79173	14, 15, 21, 28
Elf-Aquitane Oil Corp. 5333 Westheimer Road Houston, Texas 77017	15
Getty Oil Company Box 66729 Houston, Texas 77006	15
Kerr-McGee Corporation P. O. Box 25861 Oklahoma City, Oklahoma 73125	14, 29
Mobil Oil Corporation Box 5444 Denver, Colorado 80217	14, 15, 21, 28
Moncrief, W. A., Sr. Moncrief Building Ninth & Commerce Fort Worth, Texas 76102	31, 32
Newhall Land & Farming Company Box 5500 Valencia, California 91355	32
Oklahoma Oil Company 4849 Greeneville Avenue Dallas, Texas 75206	32
Samedan Oil Corporation Suite 1280 633 - 17th Street Denver, Colorado 80202	14, 29
Shell Western E&P, Inc. Box 831 Houston, Texas 77001	13, 14, 28

APPENDIX "B" (Cont'd)

	INTERESTS LOCATED IN SECTIONS
T36N, R74W (Cont'd)	
TXO Production Corp. Fidelity Union Tower Dallas, Texas 75201	32
Texaco Producing, Inc. P. O. Box 3000 Tulsa, Oklahoma 74102	14, 21, 28
Woods Petroleum Co. Attn: J. Barry Suite 700, 1 Lakeview Energy Center 3817 N. W. Expressway Oklahoma City, Oklahoma 73112	15, 31, 32

APPENDIX "B" (Cont'd)

LAND DESCRIPTION

Location Converse County, Wyoming	Surface Owner	Mineral Owner	Mineral Claim/Lease
T35N, R73W			
Sec. 6: NWP	United States Gov. Bureau of Land Mgt. P.O. Box 2420 Mills, Wyoming 82644	United States Gov. Bureau of Land Mgt. P.O. Box 2420 Mills, Wyoming 82644	Claim
T36N, R73W			
Sec. 17: NW¼ SW¼	Duck Creek Ranches P. O. Box 146 Douglas, Wyo. 82633	Walter J. Reynolds Evelyn Reynolds P. O. Box 146 Douglas, Wyoming	Lease
Sec. 17: SE¼; E½ SW¼; SW¼ SW¼	Vollman Ranches, Inc. P. O. Box 13 Douglas, Wyo. 82633	USA	Claim
Sec. 18: N½	Duck Creek Ranches	USA	Claim
Sec. 18: S½	Duck Creek Ranches	Walter J. Reynolds P. O. Box 146 Douglas, Wyo. 82633 Mary Jane Irwin 3606 N. Sherman Blvd. Milwaukee, Wisconsin	1/2 Lease 1/2 Lease
Sec. 19: NW¼; E½ NE¼; NE¼ NE¼	Vollman Ranches, Inc.	Domsalla Heirs (See Attached Sheet)	Lease

APPENDIX "B" (Cont'd)

Location Converse County, Wyoming	Surface Owner	Mineral Owner	Mineral Claim/Lease
T36N, R73W (Cont'd)			
Sec. 19: SE¼ SE¼	Vollman Ranches, Inc.	USA	Claims
Sec. 20: NE¼; NW¼ NW¼; N½ SW¼ NW¼	Duck Creek Ranches	USA	Claims
Sec. 20: SE¼	Vollman Ranches, Inc.	Domsalla Heirs	Lease
Sec. 28: W½	Vollman Ranches, Inc.	William R. Vollman P. O. Box 13 Douglas, Wyo. 82633	Lease
Sec. 29: NE¼	Vollman Ranches, Inc.	Domsalla Heirs	Lease
Sec. 30: SW¼ SW¼	Vollman Ranches, inc.	William R. Vollman	Lease
Sec. 31: NE¼ NE¼	Vollman Ranches, Inc.	Domsalla Heirs	Lease
Sec. 31: W½ NE¼; SE¼ NE¼; SE¼ SE¼	Vollman Ranches, Inc.	USA	Claims
Sec. 31: SW¼; W½ SE¼	Smith Land Company 207 North 4th Street Douglas, Wyoming 82633	USA	Claims
Sec. 31: NE¼ SE¼	Smith Land Company	Smith Mineral Trust (See Attached Sheet)	Lease

APPENDIX "B" (Cont'd)

Location Converse County, Wyoming	Surface Owner	Mineral Owner	Mineral Claim/Lease
T36N, R73W (Cont'd)			
Sec. 32: N½	Vollman Ranches, Inc.	William R. Vollman	Lease
Sec. 33: NW¼	Vollman Ranches, Inc.	William R. Vollman	Lease
T35N, R74W			
Sec. 1: N½ N½; SE¼; S½ NE¼	USA	USA	Claim
Sec 1: SW¼; S½ NW¼	Smith Sheep Company 207 North 4th Douglas, Wyoming 82633	Smith Mineral Trust	1/4 Lease
		William J. Smith 207 North 4th Street Douglas, Wyo. 82633	1/4 Lease
		J. B. Sullivan & Wyoming Nat'l Bank of Casper Co-Trustees	1/2 Lease
Sec. 2: E½ SW¼, N½ SE¼	Smith Sheep Company	Smith Mineral Trust	1/4 Lease
		William J. Smith	1/4 Lease
		J. B. Sullivan & Wyoming Nat'l Bank of Casper, Co-Trustees	1/2 Lease
Sec. 6: NE¼; N½ SE¼; SE¼ SE¼	Smith Land Company	USA	Claim
Sec. 6: SW¼ SE¼	Smith Land Company	Smith Mineral Trust	Lease

APPENDIX "B" (Cont'd)

Location Converse County, Wyoming	Surface Owner	Mineral Owner	Mineral Claim/Lease
T35N, R74W (Cont'd)			
Sec. 7: S½ S½; NW¼ SW¼; E½ NE¼	Smith Land Company	USA	Claim
Sec. 7: W½ NE¼; N½ SE¼; NE¼ SW¼	Smith Land Company	Smith Mineral Trust	Lease
Sec. 11: W½ SE¼; SW¼ NE¼; SE¼ SE¼	Smith Sheep Company	Smith Mineral Trust	Lease
Sec. 12: W½	Smith Sheep Company	Smith Mineral Trust William J. Smith J. B. Sullivan & Wyo. Nat'l Bank of Casper Co-Trustees	1/4 Lease 1/4 Lease 1/2 Lease
Sec. 13: N½ NW¼	Smith Sheep Company	Smith Mineral Trust William J. Smith J. B. Sullivan & Wyo. Nat'l Bank of Casper Co-Trustees	1/4 Lease 1/4 Lease 1/2 Lease
Sec. 14: N½ NE¼; NE¼ NW¼	Smith Sheep Company	Smith Mineral Trust William J. Smith J. B. Sullivan & Wyo. Nat'l Bank of Casper Co-Trustees	1/4 Lease 1/4 Lease 1/2 Lease

APPENDIX "B" (Cont'd)

Location Converse County, Wyoming	Surface Owner	Mineral Owner	Mineral Claim/Lease
T35N, R74W (Cont'd)			
Sec. 14: S½ NE¼; SW¼ NE¼	Smith Sheep Company	Smith Mineral Trust Northwest Bank of Casper Trustee G. Amspoker Estate Drawer 2799 Casper, Wyo. 82602	1/2 Lease 1/2 Lease
Sec. 14: NW¼ NW¼, SE¼ NE¼	Smith Land Company	Smith Mineral Trust	Lease
Sec. 15: S½ NE¼; SE¼ SW¼	Smith Sheep Company	Smith Mineral Trust	Lease
Sec. 15: S½ NW¼; N½ SW¼; SW¼ SW¼	Smith Land Company	Smith Mineral Trust	Lease
Sec. 15: N½ NE¼	Smith Land Company	Smith Mineral Trust	Lease
Sec. 15: N½ NW¼	Smith Land Company	USA	Claim
Sec. 19: E½; E½ W½; NW¼ SW¼	F. P. Coates, et al Glenrock Wyoming 82637	USA	Claim
Sec. 19: SW¼ SW¼	USA	USA	Claim
Sec. 20: S½; NW¼; S½; NE¼	F. P. Coates, et al	USA	Claim
Sec. 20: N½ NE¼	Smith Land Company	USA	Claim

APPENDIX "B" (Cont'd)

Location Converse County, Wyoming	Surface Owner	Mineral Owner	Mineral Claim/Lease
T35N, R74W (Cont'd)			
Sec. 21: N½ S½; S½ SE¼; SE¼ SW¼	Smith Land Company	Smith Mineral Trust	Lease
Sec. 21: SW¼ SW¼	USA	USA	Claim
Sec. 22: W½	Smith Land Co.	Smith Mineral Trust	Lease
T36N, R74W			
Sec. 13: N½	Duck Creek Ranches	USA	Claims
Sec 14: E½ NE¼	Linda Kay Birnker 3245 Rio Drive, Apt. 610 Falls Church, VA 22401	USA	Claims
Sec. 14: W½ NE¼; S½ NW¼	Duck Creek Ranches	USA	Claim
Sec. 14: N½ NW¼	Duck Creek Ranches	Walter J. Reynolds P. O. Box 146 Douglas, Wyo. 82633	Lease
Sec. 15: NE¼ NE¼	Moore Sheep Company c/o Ed Moore Box 161 Douglas, Wyo. 82633	Moore Mineral Trust c/o Eddie Moore Box 161 Douglas, Wyo. 82633	Lease
Sec. 15: NW¼ NE¼	Richard T. Hornbuckle Route 3 Douglas, Wyo. 82633	Richard T. Hornbuckle Route 3 Douglas, Wyo. 82633	Lease

APPENDIX "B" (Cont'd)

Location Converse County, Wyoming	Surface Owner	Mineral Owner	Mineral Claim/Lease
T36N, R74W (Cont'd)			
Sec. 15: S½; S½ N½	Smith Sheep Company	Smith Mineral Trust	Lease
Sec. 16: SE¼	State of Wyoming Comm. of Public Lands 122 West 25th St. Cheyenne, Wyo. 82003	State of Wyoming Comm. of Public Lands 122 West 25th St. Cheyenne, Wyo. 82003	Lease
Sec. 21: E½	Smith Sheep Company	USA	Claim
Sec. 28: All	Smith Sheep Company	USA	Claim
Sec. 29: N½ SE¼	USA	USA	Claim
Sec. 29: S½ SE¼	Smith Sheep Company	USA	Claims
Sec. 32: N½; W½ SE¼; NE¼ SE¼; S½ SW¼; NW¼ SW¼	Smith Sheep Company	USA	Claim
Sec. 32: NE¼ SW¼	Smith Sheep Company	Smith Mineral Trust	Lease
Sec. 32: SE¼ SE¼	State of Wyoming	State of Wyoming	Lease

APPENDIX "B" (Cont'd)

Location Converse County, Wyoming	Surface Owner	Mineral Owner	Mineral Claim/Lease
T35N, R74W			
Sec. 12: S½	Pacific Power & Light 2840 East Yellowstone Highway Casper, Wyo. 82601	USA	Claim
Sec. 13: All	Pacific Power & Light	USA	Claim
Sec. 24: All	Pacific Power & Light	USA	Claim

SMITH MINERAL TRUST

William J. Smith, Trustee
207 North 4th Street
Douglas, Wyoming 82633

Stephen J. Smith, Trustee
207 North 4th Street
Douglas, Wyoming 82633

Converse County Bank
Trustee Smith Mineral Trust
Douglas, Wyoming 82633

OVERSIZE PAGE(S)

****

NOT CONVERTED INTO ELECTRONIC IMAGE FORM.

****

PAPER COPY IS AVAILABLE IN NRC FILE CENTER.

APPENDIX C

LEGAL DESCRIPTION OF LANDS IN PERMIT AREA

SOUTH POWDER RIVER BASIN

CONVERSE COUNTY, WYOMING

APPENDIX "C"

This appendix "C" represents the location of lands by legal subdivision, section, township, range, county, and municipal corporation, if any, (W.S. 35-11-406,(a),(vi)) and the number of acres in each description. No mining activity may take place on land for which there is not in effect a valid mining permit (W.S. 35-11-405). To include additional lands within a permit area it is necessary to amend the permit (W.S. 35-11-406,(a),(xii)), so care should be taken to include all lands necessary to the mining and reclamation operation as defined in W.S. 35-11-103, (e),(viii). All acreage figures should be obtained from official survey documents or recent surveys if available. An original U.S.G.S. topographic map with the permit area clearly outlined should accompany each permit application.

SW¼; W½ SE¼; NE¼ SE¼; SE¼ NE¼	Section 19	T 36 N	R 73 W	Acres 320*
E½ W½; W½ SW¼	Section 20	T 36 N	R 73 W	Acres 240*
W½; SE¼	Section 29	T 36 N	R 73 W	Acres 480*
E½; NW¼; N½ SW¼; SE¼ SW¼	Section 30	T 36 N	R 73 W	Acres 600*
NW¼	Section 31	T 36 N	R 73 W	Acres 160
S½	Section 13	T 36 N	R 74 W	Acres 320
S½	Section 14	T 36 N	R 74 W	Acres 320
All	Section 22	T 36 N	R 74 W	Acres 640
All	Section 23	T 36 N	R 74 W	Acres 640
All	Section 24	T 36 N	R 74 W	Acres 640
All	Section 25	T 36 N	R 74 W	Acres 640
All	Section 26	T 36 N	R 74 W	Acres 640
All	Section 27	T 36 N	R 74 W	Acres 640
All	Section 33	T 36 N	R 74 W	Acres 640
All	Section 34	T 36 N	R 74 W	Acres 640

COUNTY OF Converse, Wyo. Subtotal Above Acres 7560

Municipal Corp. - Total Permit (Amendment) Acres 16200

Reviewed (Compiled), DEQ/LQD _____ Date _____ Applicant Signature _____ Date 3/28/88

Checked, DEQ/LQD _____ Date _____ Permit No. _____ TFN _____

*Right to mine not claimed on some lands.

APPENDIX "C"

This appendix "C" represents the location of lands by legal subdivision, section, township, range, county, and municipal corporation, if any, (W.S. 35-11-406,(a),(vi)) and the number of acres in each description. No mining activity may take place on land for which there is not in effect a valid mining permit (W.S. 35-11-405). To include additional lands within a permit area it is necessary to amend the permit (W.S. 35-11-406,(a),(xii)), so care should be taken to include all lands necessary to the mining and reclamation operation as defined in W.S. 35-11-103, (e),(viii). All acreage figures should be obtained from official survey documents or recent surveys if available. An original U.S.G.S. topographic map with the permit area clearly outlined should accompany each permit application.

All	Section 35	T 36 N,	R 74 W,	Acres 640
All	Section 36	T 36 N,	R 74 W,	Acres 640
N½; W½ SW¼; S½ SE¼	Section 2	T 35 N,	R 74 W,	Acres 480
All	Section 3	T 35 N,	R 74 W,	Acres 640
All	Section 4	T 35 N,	R 74 W,	Acres 640
All	Section 5	T 35 N,	R 74 W,	Acres 640
All	Section 8	T 35 N,	R 74 W,	Acres 640
All	Section 9	T 35 N,	R 74 W,	Acres 640
All	Section 10	T 35 N,	R 74 W,	Acres 640
W½; N½ NE¼; SE¼ NE¼; NE¼ SE¼	Section 11	T 35 N,	R 74 W,	Acres 480
All	Section 16	T 35 N,	R 74 W,	Acres 640
All	Section 17	T 35 N,	R 74 W,	Acres 640
All	Section 18	T 35 N,	R 74 W,	Acres 640
W½ NW¼	Section 19	T 35 N,	R 74 W,	Acres 80
N½	Section 21	T 35 N,	R 74 W,	Acres 320

COUNTY OF Converse, Wyo. Subtotal Above Acres 8400

Municipal Corp. - Total Permit (Amendment) Acres 16200

Reviewed (Compiled), DEQ/LQD — Date — Applicant Signature — Date 3/28/88

Checked, DEQ/LQD — Date — Permit No. — TFN

APPENDIX "C"

This appendix "C" represents the location of lands by legal subdivision, section, township, range, county, and municipal corporation, if any, (W.S. 35-11-406,(a),(vi)) and the number of acres in each description. No mining activity may take place on land for which there is not in effect a valid mining permit (W.S. 35-11-405). To include additional lands within a permit area it is necessary to amend the permit (W.S. 35-11-406,(a),(xii)), so care should be taken to include all lands necessary to the mining and reclamation operation as defined in W.S. 35-11-103, (e),(viii). All acreage figures should be obtained from official survey documents or recent surveys if available. An original U.S.G.S. topographic map with the permit area clearly outlined should accompany each permit application.

SE¼ Section 13, T 35 N, R 75 W, Acres 160

N½ NE¼ Section 24, T 35 N, R 75 W, Acres 80

Section ____, T ____ N, R ____ W, Acres ____

Section ____, T ____ N, R ____ W, Acres ____

Section ____, T ____ N, R ____ W, Acres ____

Section ____, T ____ N, R ____ W, Acres ____

Section ____, T ____ N, R ____ W, Acres ____

Section ____, T ____ N, R ____ W, Acres ____

Section ____, T ____ N, R ____ W, Acres ____

Section ____, T ____ N, R ____ W, Acres ____

Section ____, T ____ N, R ____ W, Acres ____

Section ____, T ____ N, R ____ W, Acres ____

Section ____, T ____ N, R ____ W, Acres ____

Section ____, T ____ N, R ____ W, Acres ____

Section ____, T ____ N, R ____ W, Acres ____

COUNTY OF Converse, Wyo. Subtotal Above Acres 240

Municipal Corp. - Total Permit (Amendment) Acres 16200

Reviewed (Compiled), DEQ/LQD ____ Date ____ Applicant Signature [signature] 3/28/88 Date

Checked, DEQ/LQD ____ Date ____ Permit No. ____ TFN ____

APPENDIX "C"
(Form 1 - Item iii)

Lands listed below are within the permit area, but no right to mine on these lands is claimed.

SW¼; W½ SE¼; NE¼-SE¼; SE¼ NE¼	Section 19	T 36 N	R 73 W	Acres 320
SW¼	Section 20	T 36 N	R 73 W	Acres 160
NW¼	Section 29	T 36 N	R 73 W	Acres 160
E½; NW¼; N½ SW¼; SE¼, SW¼	Section 30	T 36 N	R 73 W	Acres 600

TOTAL ACRES 1,240

APPENDIX "C"

LANDS WITHIN THE PERMIT AREA
THAT ARE INCLUDED WITHIN OTHER PERMIT AREAS

GLENROCK COAL COMPANY - PERMIT TO MINE NO. 291-T3

T35N, R74W - CONVERSE COUNTY, WYOMING		ACREAGE
Section 18:	W1/2 W1/2	160
Section 19:	W1/2 NW1/4	80

T35N, R75W - CONVERSE COUNTY, WYOMING		
Section 13:	SE1/4	160
Section 24:	N1/2 NE1/4	80

OVERSIZE PAGE(S)

****

NOT CONVERTED INTO ELECTRONIC IMAGE FORM.

****

PAPER COPY IS AVAILABLE IN NRC FILE CENTER.

File
Not BK

SEQUOYAH FUELS CORPORATION

POST OFFICE BOX 25861 • OKLAHOMA CITY OKLAHOMA 73125

September 23, 1988

Mr. Roger Shaffer, Administrator
Land Quality Division
Department of Environmental Quality
Herschler Building
122 West 25th St.
Cheyenne, Wyoming 82002

ATTN: Mr. Rick Engelmann

RE: Smith Ranch Project
In-Situ Mining
Application
DEQ TFN 2 6/99

Dear Mr. Shaffer:

In our letter to you dated August 30, 1988 on the above referenced subject, one of the enclosed maps, Map B-2, had an incorrect page number.

Please replace Map B-2, page C-4a with the enclosed map, Map B-2, page B-19a.

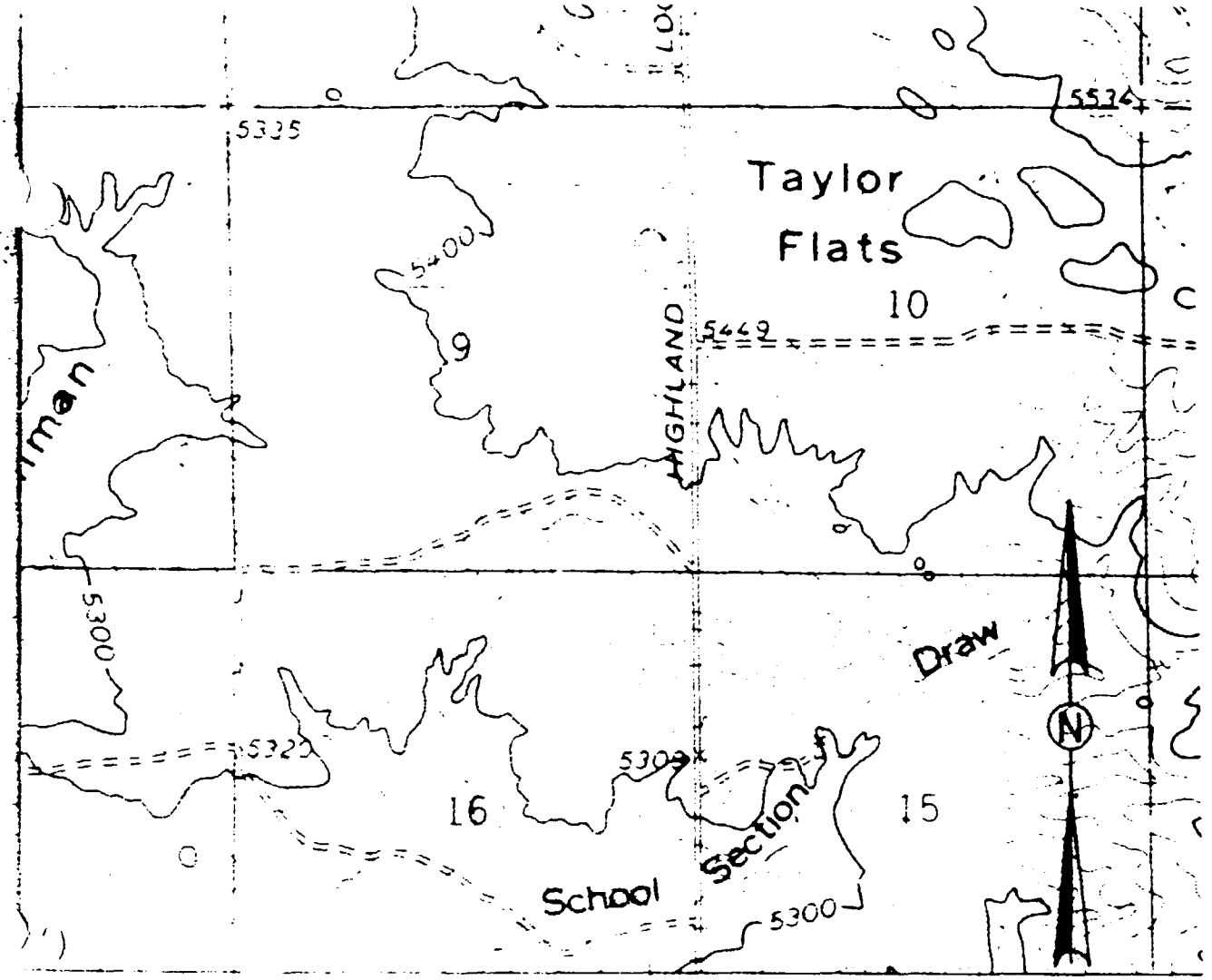
Sincerely,

Marvin D. Freeman, Director
Chemical Mining Operations

MDF/jlm
Enclosure

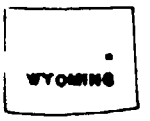
cc: S. Grace - NRC - w/attachment
J. Stauter - w/attachment
L. May - w/attachment

RECEIVED
SEP 26 1988
NUCLEAR LICENSING



Parts of map include the following U.S.G.S. maps:

Highland Flats, Wyo.
Gilbert Lake, Wyo.
Fifty Five Ranch, Wyo.
Hylton Ranch, Wyo.



QUADRANGLE LOCATION

MAP B-2

REVISIONS		
NO	DATE	BY
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

MINERAL OWNERSHIP WITHIN ONE HALF MILE OF PERMIT BOUNDARY
SOUTH POWDER RIVER BASIN
CONVERSE COUNTY, WYOMING

SEQUOYAH FUELS CORPORATION

ENGINEERING BY	DATE	DIVISION	CHEMICAL MINING
DRAWN BY	DATE	SCALE 1" = 2,000'	SHEET OF
CHECKED BY	DATE	SHEET SIZE 24" x 32" ESTAR	FILE NUMBER
APPROVED BY	DATE	DRAWING NUMBER	
APPROVED BY	DATE		