

BURLINGTON RESOURCES

SAN JUAN DIVISION

August 6, 1998

Certified: P 103 693 124

Bill Olson
New Mexico Oil Conservation Division
2040 S. Pacheco
Santa Fe, NM 87505

AUG - 7 1998

**RE: Groundwater Investigation and Remediation Plan
San Juan Basin, New Mexico**

Dear Mr. Olson:

As requested in your July 9, 1998 letter, attached is a comprehensive Groundwater Investigation and Remediation Plan for Burlington Resources (BR) pit closure sites in the San Juan Basin that may impact groundwater. The plan addresses "typical" sites, which should cover the majority of BR's sites in the San Juan Basin with potentially impacted groundwater. Sites falling outside the scope of this plan due to complexity or associated risk will be handled on an individual basis with site specific plans approved by the New Mexico Oil Conservation Division.

If you have questions or additional information is needed, please contact me at (505) 326-9841.

Sincerely,



Ed Hasely
Sr. Staff Environmental Representative

Attachment - Groundwater Investigation and Remediation Plan

cc: Denny Foust - NMOCD Aztec
Bruce Gantner - BR

ENCLOSURE

PNM - 2

GROUNDWATER INVESTIGATION AND REMEDIATION PLAN

SAN JUAN BASIN, NEW MEXICO

AUGUST, 1998

Prepared for:

**New Mexico Oil Conservation Division
2040 South Pacheco
Santa Fe, New Mexico 87505**

Prepared by:

**Burlington Resources Oil and Gas Company
3535 East 30th Street
Farmington, New Mexico 87402**

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Groundwater Investigation and Remediation Plan

San Juan Basin

August, 1998

INTRODUCTION

Burlington Resources Oil and Gas Company (BR) is submitting this Groundwater Investigation and Remediation Plan to address possible water quality impacts identified during implementation of the unlined surface impoundment closure program in the San Juan Basin of New Mexico. This groundwater management approach is proposed in order to expedite the decision process in the event impacted groundwater is suspected at a specific site and to quickly identify the appropriate groundwater quality management strategy in order to streamline groundwater remediation and water quality protection.

OBJECTIVES

The objective of this Groundwater Investigation and Remediation Plan is to properly address the protection of groundwater resources and human health and the environment. Recognizing that individual groundwater sites can vary significantly, BR is proposing a generic approach to address typical sites with impacted groundwater encountered in the San Juan Basin. Sites with groundwater impacts that fall outside of the typical scenarios discussed in this plan will be managed on an individual basis with the NMOCD, and would thereby require a site-specific plan.

Groundwater closure standards for contaminants most likely to be present in groundwater beneath unlined surface impoundments associated with oil and gas exploration/production activities are summarized in Table 1. These standards are the typical closure standards required to satisfy remediation objectives for groundwater per NMOCD guidelines for unlined surface impoundment closure (NMOCD, February 1993).

GROUNDWATER INVESTIGATION

Basically, BR's pit closure process will follow the decision tree shown in Figure 1. Impacted soil will be excavated and if groundwater is encountered or suspected to be impacted, a groundwater investigation will be conducted. Another scenario where groundwater may be investigated is when it is not technically or economically feasible to completely remove all the impacted soil and groundwater impact is a concern.

The purpose of conducting a groundwater investigation of the site is to determine if groundwater impact has occurred and, if so, to define site conditions and gather data necessary to select and design an effective remediation strategy. As the basic information necessary for effective remediation selection and design is similar for all sites, BR will follow a generic groundwater investigation plan to address the required data gathering activities.

August 1998

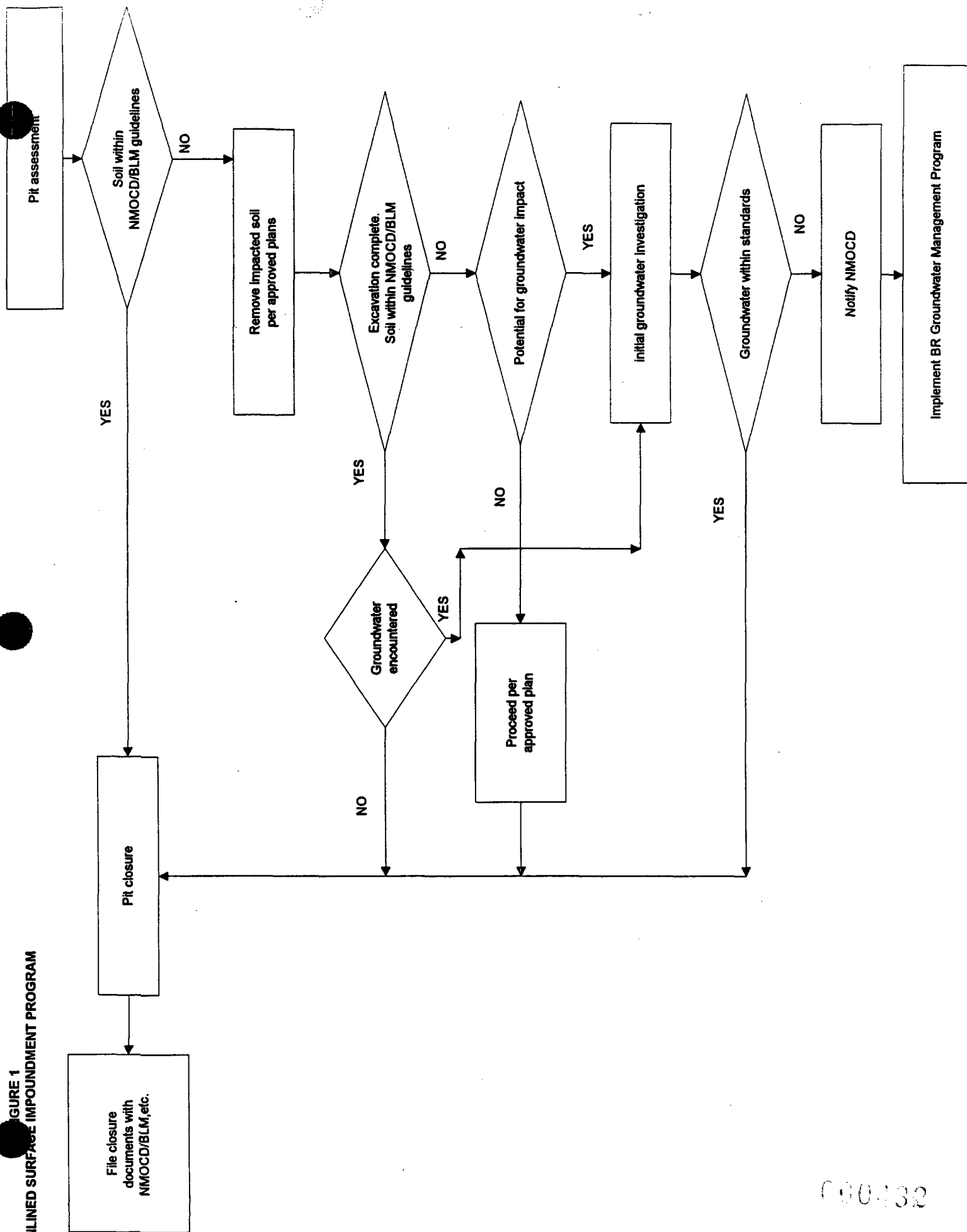
Table 1.
Groundwater Closure Standards
(Units = mg/L)

<u>Constituent</u>	<u>NMWQCC Standard* (Current)</u>
<u>Volatile Organics</u>	
Benzene	0.01
Toluene	0.75
Ethylbenzene	0.75
Xylenes (total)	0.62
<u>Polynuclear Aromatic Hydrocarbons</u>	
Total naphthalene + monomethylnaphthalene	0.03
Benzo-a-pyrene	0.0007
<u>Cations/Anions</u>	
Chloride	250.0
Sulfate	600.0
Nitrate	10.0
<u>Heavy Metals</u>	
Arsenic	0.10
Barium	1.0
Cadmium	0.01
Chromium	0.05
Lead	0.05
Selenium	0.05
Silver	0.05
Mercury	0.002

* Applies to groundwater with Total Dissolved Solids
<10,000 milligrams per liter (mg/L).

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FIGURE 1
UNLINED SURFACE IMPOUNDMENT PROGRAM



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If groundwater beneath an unlined surface impoundment is suspected to have been negatively impacted from an unlined surface impoundment, BR will perform an initial investigation of the groundwater. A temporary or permanent monitoring well will be installed in or immediately adjacent to the suspected source area to determine if the groundwater is impacted. This initial groundwater monitoring well (source well) will be sampled and analyzed for benzene, ethylbenzene, toluene, and xylene (BTEX). If the BTEX values are below the closure standards, then no further groundwater investigation is required. If the BTEX values are above the standards, additional work will be required to define the impact. The NMOCD will be notified upon discovery of groundwater impacts.

If the source well indicates there has been groundwater impact, a single, downgradient monitoring well will be installed. If the horizontal extent of the groundwater impact and/or the direction of groundwater flow is not adequately defined, then additional wells may be needed. The additional monitoring wells will be located upgradient, downgradient, or cross-gradient from the source well to adequately characterize groundwater flow and quality. These wells may be permanent, temporary, or driven well points/piezometers.

Surface and top of casing elevations will be surveyed to the nearest 0.01 foot for use in determining groundwater flow direction.

Information collected during the groundwater assessment will include lithologic logs, well completion diagrams, analytical work, groundwater flow direction, and pit closure details.

MONITORING WELL CONSTRUCTION

Permanent monitoring wells will be constructed of 2-inch diameter PVC with 5 feet of screen above the water table and 10 feet of screen below the water table, subject to site/drilling conditions. Sand pack, bentonite seal and grout will be used to complete the wells which will have a concrete pad and be fitted with locking caps. The wells may be completed with a concrete pad flush to the ground surface in high traffic areas. A typical permanent well completion diagram is provided in Appendix A.

Temporary monitoring wells will be constructed of 2-inch diameter PVC with a minimum of 5 feet of slotted screen. Temporary wells may use a natural sand pack with a bentonite seal above the water table, subject to site/drilling conditions. Driven well points/piezometers will use a natural sand pack and will not have a bentonite seal in most cases. If continued monitoring of temporary wells is anticipated, concrete pads, temporary protective casing, and/or bumpers, etc. will be added to secure the well locations.

SAMPLING PROCEDURES

Each well will be developed in order to obtain a representative groundwater sample. Development will be complete when pH and specific conductance stabilize and turbidity is reduced.

Groundwater samples will be collected following well purging (removal of a minimum of 3 well volumes, or until dry). Groundwater samples will be collected using laboratory supplied containers and preservatives. Zero headspace techniques will be used for those samples requiring analysis for volatile constituents. Samples will be stored on ice and delivered within required holding periods under chain-of-custody procedures to the analytical laboratory.

Based on the typical contaminants associated with oil and gas exploration/production activities, sampled water will be analyzed for the following constituents.

Total Dissolved Solids (TDS)	-	Standard Methods
Benzene, Toluene, Ethylbenzene, Xylenes (BTEX)	-	EPA 602/8020
Cations/Anions	-	EPA or Standard Methods
Heavy Metals	-	EPA 6010 or 7000 Series

If free product or a sheen is detected in a monitoring well to be sampled, samples will only be collected for analysis of polynuclear aromatic hydrocarbons (PAHs) using EPA Method 8100. Additional analytical work may also be conducted to assist in the evaluation of subsurface conditions and remediation design. The presence of non-exempt RCRA Subtitle C wastes are not anticipated and therefore, no analyses will be run for RCRA hazardous waste characteristics.

If no cations/anions, heavy metals, or PAHs are detected above background or NMWQCC standards, future samples will only be analyzed for the constituent that was exceeded.

REMEDIATION PLAN

BR's basic approach to groundwater remediation is source removal and groundwater monitoring. The source removal promotes natural attenuation to restore hydrocarbon impacted groundwater. The groundwater monitoring will ensure the process is effective. If monitoring reveals that source removal is not adequately addressing the groundwater concerns at a certain site, more aggressive actions will be considered. Any remediation technique not covered in this general plan will be submitted to and approved by the NMOCD prior to implementation.

Source removal consists of excavating soils, within technical and economic feasibility, that may be negatively impacting the groundwater. The excavation and handling of the soils will be conducted as per BR's (Meridian Oil, Inc.'s) approved Unlined Pit Closure Plan dated March 21, 1994, including an addendum dated January 25, 1995.

Groundwater monitoring will be conducted to ensure the source removal activity is sufficient to adequately address the impacts to the groundwater. The monitoring wells located at or near the source and downgradient of the source will be sampled on a quarterly basis. When an individual monitoring well has shown compliance with NMWQCC groundwater standards for four (4) consecutive quarters, the quarterly monitoring will be discontinued for that individual well. These monitoring wells dropped from the quarterly sampling will be sampled at the time of final site closure to demonstrate that successful closure has been achieved.

If the quarterly monitoring does not demonstrate statistically significant improvement in groundwater within four (4) quarters, BR will evaluate the need to modify the site-specific remedy to enhance performance. Further investigation of potential upgradient or secondary sources may be needed. If the modified remediation plan includes actions other than additional source removal, additional monitoring wells and/or continued monitoring, a site specific plan will be submitted for approval to the NMOCD. Upon completion of the modified remediation plan, BR will continue groundwater monitoring to ensure groundwater concerns are adequately addressed.

COMPLETION AND TERMINATION

The proposed decision tree for site closure and remedial action termination is shown on Figure 2.

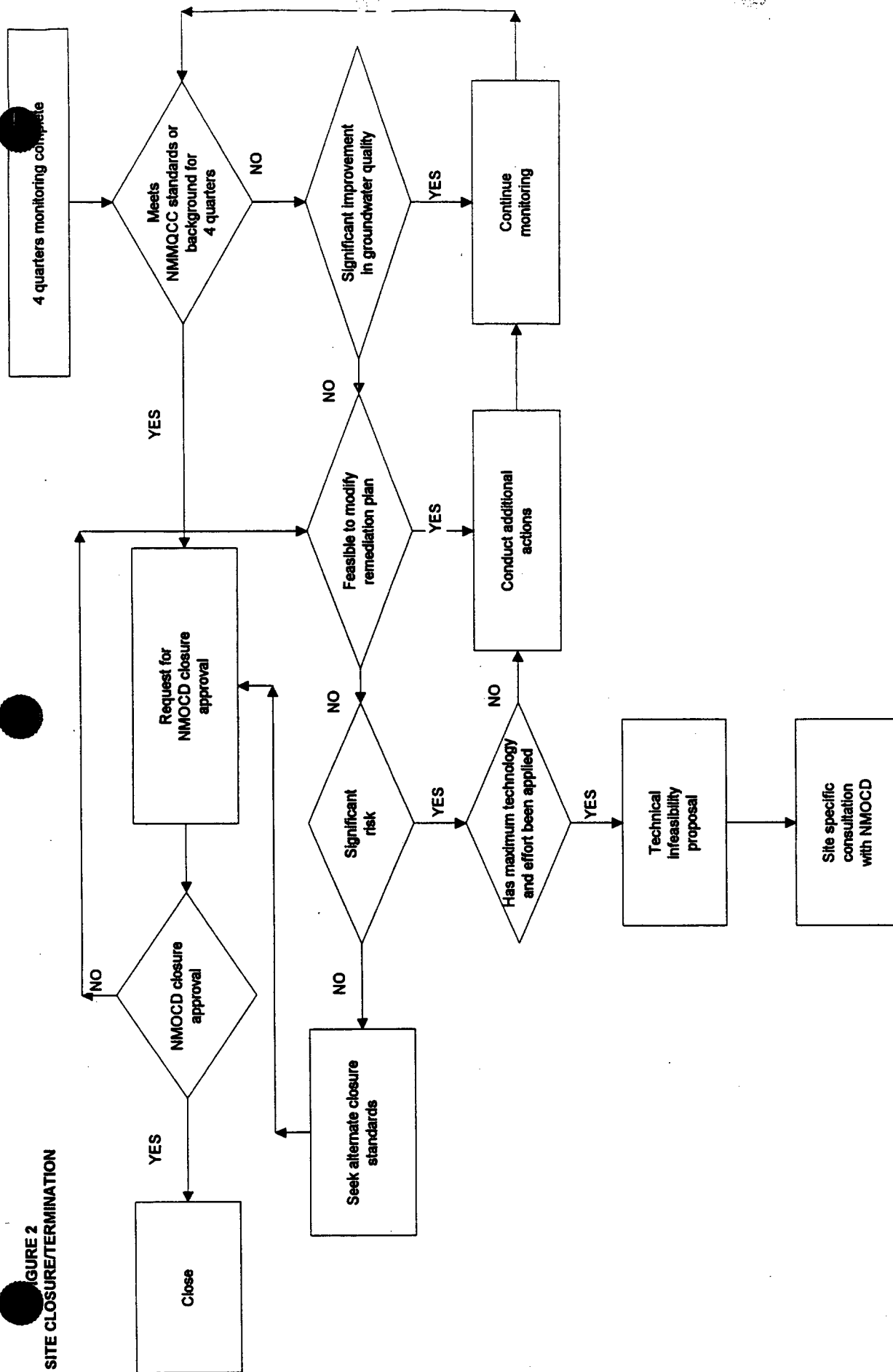
BR proposes that site remediation be considered complete after four (4) consecutive quarters of monitoring where groundwater quality meets NMWQCC standards or background concentrations. As discussed above, any groundwater monitoring wells that were previously dropped from sampling will be sampled at this time to ensure successful closure has been achieved.

If remediation standards are not met and do not appear to be attainable, BR will perform additional evaluations. If our evaluation suggests that limited benefit will be derived from continued system operations or enhancements, a technical infeasibility proposal may be submitted to the NMOCD. The proposal will show that the use of economical feasible technology will not yield significant improvement in groundwater quality. Alternative completion standards may also be proposed if it can be shown that no significant risk to human health and the environment will occur.

REPORTING

BR will submit Remediation Completion Reports to the NMOCD for sites achieving closure or termination criteria. This report will summarize the remedial activities performed at the site, provide data to demonstrate that closure has been attained, and describe any post-closure activities required to restore the site. BR does not anticipate that sites meeting closure standards will require any ongoing monitoring or maintenance activities. Sites that are considered under technical infeasibility or other exceptions to the closure criteria may require alternate post-closure care activities.

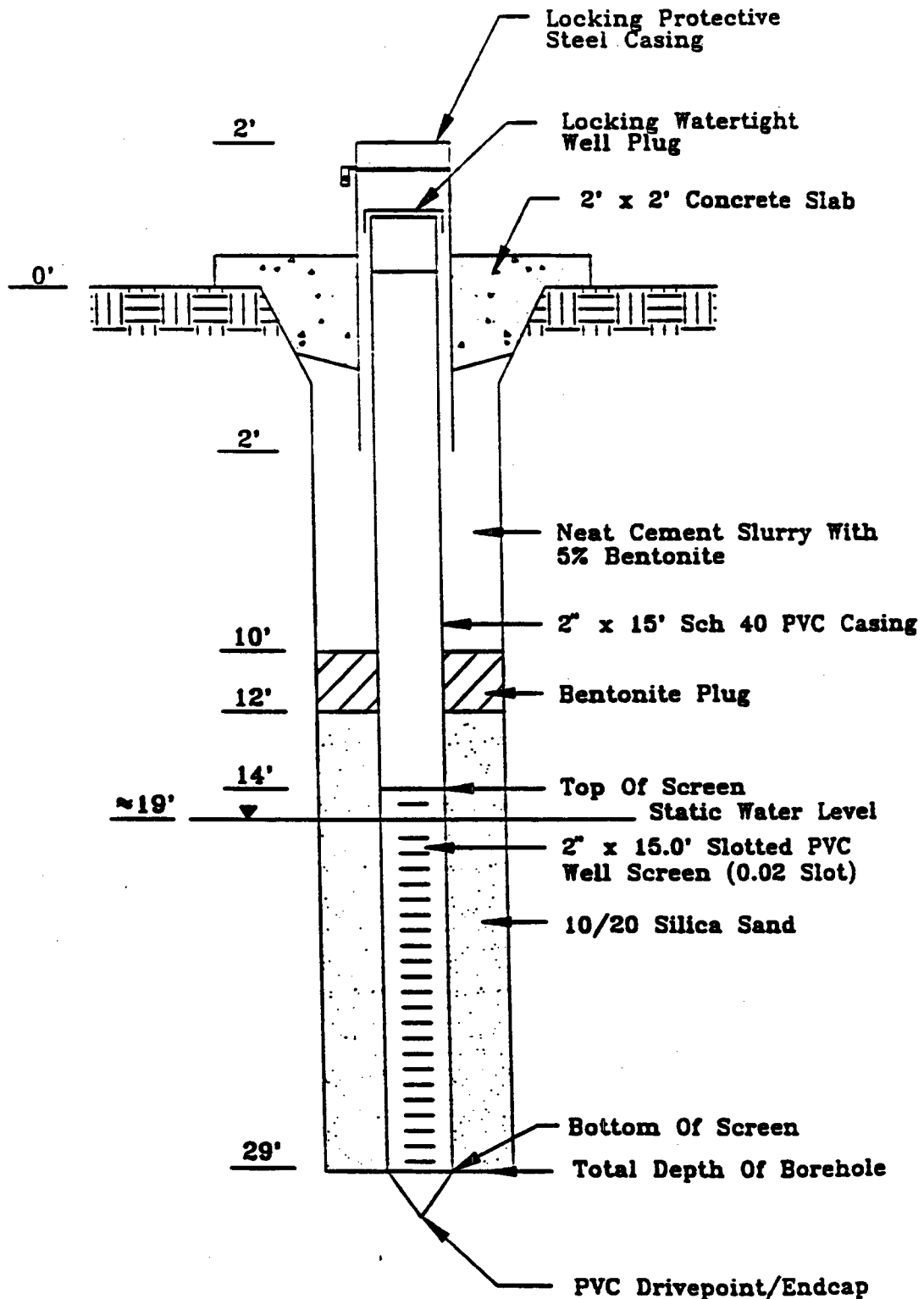
FIGURE 2
SITE CLOSURE/TERMINATION



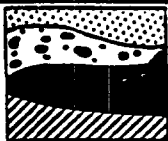
BR will also submit annual program progress reports (by April 1 of each year) that summarize the status of our site closure/groundwater management program for the preceding year. Details on individual site progress, including lithologic logs, well completion diagrams, analytical data, and pit closure reports, will be submitted. Actual requests for site closure approval (Remediation Closure Reports) may be submitted separately or included in the annual report.

APPENDIX A

TYPICAL WELL COMPLETION DIAGRAM



GCL



CLIENT: PNM/GCNM

DATE: 7/19/95

REV. NO.: 0

AUTHOR: BC

DRAWN BY: MP

CK'D BY: MDG

FILE: ABRMSCD

**TYPICAL MONITOR WELL
COMPLETION DIAGRAM:**

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