AP - 010

STAGE 1 & 2 WORKPLANS

DATE:

March 22, 1999

PHILLIPS PIPE LINE COMPANY

March 24, 1999

Ground Water Abatement Plan AP-10
Line NM-1-1 Site
Phillips Pipe Line Company

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

Dear Mr. Olson:

Phillips Pipe Line Company has enclosed a Stage 1 Abatement Plan for the crude oil release that occurred near Hobbs, New Mexico in Lea County on October 27, 1998. PPL wishes to implement this plan as soon as possible in order to determine the limits of impacts of this release.

If you need more information regarding this plan, please contact me at 918-661-3557.

Sincerely,

Anthony C. Walker

Anthony "Tony" C. Walker
Phillips Pipe Line Company
Staff Environmental Representative
3 B11 Adams Building

ACW: St1AbPlanCvrLtr.doc

cc: Mr. Chris Williams
State of New Mexico
Energy Minerals and Natural Resources Dept.
Oil Conservation Division
District 1
P.O. Box 1980
Hobbs, New Mexico 88241-1980

Mr. Chris Higgins (cover letter only)
Higgins and Associates, L.L.C.
9940 East Costilla Avenue
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303/708-9846
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March 22,1999

Mr. Tony Walker
Phillips Pipe Line Company
3B11 Adams Building
Bartlesville, Oklahoma 74004

RE: Stage I Abatement Plan for the Hobbs, New Mexico Gathering Line Release, Line NM-1-1SITE

Dear Mr. Walker:

Higgins and Associates, L.L.C. (Higgins and Associates) has prepared the following Stage I Abatement Plan as per the New Mexico Oil Conservation Division (OCD) Rule 19.E.3 for conducting assessment activities at the referenced site. The abatement plan presents a summary of the project background, a description of assessment activities conducted to date, a general description of the geology/hydrogeology, a discussion of the distribution of the hydrocarbon impacts, the scope of work for Stage I assessment activities, and a schedule for implementation of the activities.

Project Background

The subject site is located in Unit N, Section 9, Township 19 South, Range 38 East, NMPM, Lea County, New Mexico. The property on which the release occurred is largely undeveloped arid land. The primary land use is grazing land for cattle. There are no surface bodies of water within 0.5 miles of the site. Several pipelines are located in the area as illustrated on Figure 1 (attached). Two crude oil production wells are located near the pipeline release. One well is in production and is located approximately 400 feet east/southeast of the pipeline release.

Phillips discovered a release of unrefined petroleum products (crude oil) associated with a local well field gathering pipe line located near the town of Hobbs, New Mexico. Two gathering lines parallel each other at the release site. One line is a six inch diameter line and the second line is an eight inch diameter line. The lines are separated by approximately one foot and are installed three to four feet beneath ground surface. The line leak was noted by the detection of oil impacts on the ground surface in the area of the release. The quantity of crude oil released is not known.

Phillips excavated approximately 1,500 cubic yards of petroleum impacted soil from around and below the release location. The limits of the excavation were approximately 30 feet wide by 120 feet long and averaged approximately 12 feet deep with the deepest extent around 18 feet. Petroleum impacts remained in the floor and side walls of the excavation and therefore the excavation activities were halted

until the lateral extent of impacts could be defined.

Phillips personnel supervised the installation of a 4-inch diameter, 46 foot deep, monitoring well (MW-1) to determine the vertical extent of soil impacts and to determine if the groundwater had been impacted. The well was located approximately 10 feet north of the excavation. Visual contamination was observed during drilling activities from a depth of two feet to the total depth. Groundwater was encountered at approximately 40 feet. Approximately 13 feet of crude oil was detected on the water table. The geology and hydrogeology will be discussed below.

Phillips initiated a product recovery program from monitoring well MW-1 on December 12, 1998. The program consists of periodic bailing of the product from the MW-1 utilizing a bailer. As of February 19, 1999 approximately 1,243 gallons of crude oil have been recovered from the water table.

A geophysical survey was conducted at the site by Ground Truth Technology, Inc. (GTT) during the period of February 1, 1999 through February 6, 1999. The objective of the survey was to obtain preliminary information on the lateral and vertical distribution of petroleum hydrocarbons prior to installation of additional monitoring wells. The investigation consisted of conducting two geophysical methods as outlined below:

- Surface Induction Profiling ("SIP"). The SIP process provides general information concerning the lateral extent of the petroleum impacts by identifying areas of high resistivity in the subsurface. The SIP survey consisted of an induction coil and a receiver both of which were placed on the surface. A grid was developed and surveyed on a 100 X 100 foot spacing and the SIP soundings were collected over a 25 foot by 25 foot grid spacing within the surveyed grid.

- Vertical Induction Profiling ("VIP"). The VIP survey provides specific information concerning the vertical extent of the petroleum impacts. The VIP survey was conducted by placing the induction coil at various surface stations and raising the receiver from the bottom of MW-1 with a wire line. Readings were collected at 1/10th foot intervals along the well bore. The locations of the VIP lines were selected based on the results of the SIP survey.

The SIP survey consisted of 316 soundings covering an area of approximately 4.4 acres. The VIP survey consisted of 41 soundings taken along linear transects around the point of release. Five VIP lines were run based on the results of the SIP survey. One line was located approximately 100 feet west of MW-1 along a north/south direction. Two lines were located east approximately 75 and 100 feet respectively from the pipeline, and ran in a north/south direction. The fifth line was located in a east/west direction perpendicular to a high resistivity anomaly detected by the SIP survey. The lateral range of the VIP survey from monitoring well MW-1 was approximately 200 feet. Several high resistivity anomalies were identified both by the SIP and VIP surveys. These anomalies will be discussed in the hydrocarbon

distribution section.

An Abernaki Corporation PetroXtractor product recovery system is scheduled to be installed in monitoring well MW-1 during the week of March 22, 1999. The Abernaki PetroXtractor has been specifically designed to recover oil from 2, 4, or 6 inch diameter wells up to depths of 100 feet. The PetroXtractor makes use of the differences in specific gravity and surface tension between oil and water. These physical characteristics allow the unit's continuous belt, which extends from the top of the well into the oil/water interface, to attract floating oil in the well. The oil adheres to the belt and then travels through tandem wiper blades located at the well head scraping the oil off both sides of the belt and into a discharge hose. Due to the remote location of the subject site, the PetroXtractor has been designed to operate from a 12 volt battery system which is charged by a solar power unit. Product collected by the PetroXtractor will be stored in a 120 barrel storage tank located adjacent to the well. The tank will be contained within an earthen berm designed to hold the capacity of the tank plus an allowance for precipitation.

Geology and Hydrogeology

The regional geology surrounding the site is alluvium (unconsolidated) overlaying the Ogalalla Formation. The Ogalalla is also known as the High Plains aquifer which extends north to south from South Dakota to New Mexico and Texas. The Ogalalla was formed during the formation of the Rocky Mountains (Larimide orogeny - late Cretaceous to end of Paleocene). The Ogalalla Formation primarily consists of outwash alluvium deposited by the streams draining the newly formed Rocky Mountains. Caliche deposits are encountered in those areas considered under semiarid to arid conditions. The caliche was (and continues to be) formed as a result of the vertical movement of water through the unconsolidated alluvium from rainfall recharge (downward) and evaporation (upward). The calcium carbonate and/or calcium sulfate forms out of solution and creates a cementation effect. The origin of the calcarious material is either eolian (wind blown dust) or eroded limestone within the alluvium of the Ogalalla.

The hydrogeology of the Ogalalla aquifer can vary tremendously on a relatively small scale due to the wide grain-size distribution of the alluvial sediments. The regional water table slopes from west to east. The saturated thickness of the Ogalalla ranges from 0 feet to the west to upwards of 1,000 feet to the east. In the area of Hobbs, New Mexico, the saturated thickness may be 10 to 150 feet. Depth to groundwater is shallower to the west and gradually gets deeper to the east. Aquifer recharge is primarily rainfall; aquifer discharge is a combination of streams or springs and evapotranspiration.

Based on information obtained from the drilling of monitoring well MW-1, the site specific geology consists primarily of caliche mixed with sands and some gravel. The upper 23 feet of the hole was drilled with hollow stem augers. A layer of limestone was encountered at a depth of 23 to 25 feet below ground surface (bgs) which required changing the drilling method to air rotary. The limestone was described as

very hard and dry while the caliche above the limestone was described as moist with a sheen on the outside of the split spoon. The lateral extent of the limestone is not known and may be discontinuous. Below the limestone layer the lithology is logged as caliche becoming "mostly sand with depth". This description indicates that the level of cementation of the caliche is decreasing with depth.

Groundwater was encountered in monitoring well MW-1 at approximately 40 feet. Thirteen feet of crude oil was detected on the water table. The depth to water following a bail down test was 36.97 feet with the top of the free phase hydrocarbons at 27.16 feet. Due to the presence of the crude oil, the actual depth to water is unknown but is anticipated to be between 30 and 35 feet. The actual site groundwater flow direction, gradient, and other specific hydrogeologic conditions (conductivity, permeability, velocity, and saturated thickness) are unknown at this time. However, based on topography the groundwater gradient is anticipated to be to the south/southeast.

Hydrocarbon Distribution

The known phases of petroleum impacts associated with this site are adsorbed phase hydrocarbons and liquid phase hydrocarbons. The presence/absence of dissolved phase hydrocarbons has not been determined. The lateral extent of petroleum impacts to the soil and groundwater are not known. Petroleum impacts were apparent throughout the limits of the excavation from near surface to the total depth. Fingers of petroleum were apparent in the side walls of the excavation indicating that shallow migration of crude oil occurred along zones of increased permeability. Also, shallow excavations advanced along the pipeline to the north and south of the release point indicate that crude oil migrated along the pipeline. Petroleum impacts to the soil were also noted during the drilling of MW-1 from a depth of two feet to the total depth of 50 feet.

As stated above, the lateral extent of petroleum impacts have not been defined. However, the results of the geophysical surveys appear to have provided preliminary data concerning the distribution of petroleum impacts at the site. The SIP survey detected several areas of high resistivity within the 4.4 acre study area. Whether or not all of these areas are associated with petroleum impacts can not be determined with the available information. However, one area identified by the SIP survey which is likely associated with the Phillips pipeline release originates just north of the release location and extends in a south/southwest direction for approximately 250 feet. The anomaly is approximately 100 feet to 150 feet wide. Other anomalies were noted in the study area which may be associated with crude oil production operations separate from the Phillips release. Further evaluation of the SIP results can be made after obtaining information of the subsurface geology and hydrocarbon distribution through the installation of monitoring wells and soil borings.

As discussed above, one VIP survey line was run across the resistivity anomaly which is most likely associated with the Phillips release. The results of this VIP line showed two zones of high resistivity, one

shallow and one deep. The shallow zone occurred at approximately 5 feet in depth and extended to a depth of 25 feet. This depth interval could represent the limestone layer that was described in the well log for MW-1. The second zone of high resistivity was noted between 35 and 40 feet. This zone could represent LPH on the water table.

The results of the SIP survey combined with the VIP survey indicate that the LPH plume may extend for approximately 250 feet south of the release point. The greatest accumulation of LPH may be located south of MW-1.

Project Approach

The assessment activities outlined in this abatement plan have been developed to obtain additional information concerning the lateral and vertical extent of petroleum hydrocarbons in the subsurface. This information will be used to prepare a Stage II Abatement Plan for evaluating and selection of the appropriate remedial method. The general project approach is as follows:

- Installation of a series of monitoring wells to define the lateral and vertical extent of petroleum impacts.
- Drilling of soil borings along the pipeline to determine the extent of migration along the line.
- Collection of soil samples for laboratory analysis of benzene, toluene, ethylbenzene, and total xylenes (BTEX) and total recoverable petroleum hydrocarbons (TRPH).
- Collection of soil samples for phospholipid (PLFA) and most probable number (MPN) analysis to determine the types and populations of microbial organisms in the subsurface.
- Collection of groundwater samples from all wells absent of LPH to determine the lateral extent, if any, of dissolved phase hydrocarbons associated with the pipeline release.
- Conducting a series of rising head permeability tests to determine general aquifer characteristics.
- Prepare either a final site investigation report or a work plan for additional assessment activities.
- Prepare a Stage II Abatement Plan to evaluate remedial technologies for addressing the petroleum impacts, and to further define the lateral extent of petroleum hydrocarbons, if needed.

The detailed scope of work to accomplish the above is presented below.

Site Investigation Work Plan

Well Record Search

Available well records will be reviewed to determine the location of domestic or production wells within a one mile radius of the subject site. The location of these wells will be plotted on a topographic map.

Drilling Activities

In order to obtain information of the lateral and vertical extent of petroleum impacts, a series of soil borings and monitoring wells are proposed for the area surrounding the release point. Based on the results of the geophysical survey, combined with the presence of LPH in MW-1, seven monitoring wells and up to six shallow soil borings are proposed as illustrated on Figure 2. The objective of the drilling activities are to define the groundwater gradient beneath the release site and to define the vertical and lateral extent of petroleum impacts to soil and groundwater. Additional drilling activities may be required for complete definition of the petroleum impacts. The locations of the monitoring wells are discussed in the following.

- Monitoring well PMW-2 will be located approximately 100 feet north of MW-1. The objective of this well is to provide an upgradient well for definition of the northern extent of petroleum impacts.

- Monitoring well PMW-3 will be located approximately 140 feet east/southeast of monitoring well MW-1. The objective of this well is to define the lateral extent of impacts to the east.

- Monitoring well PMW-4 will be located approximately 130 feet southwest of monitoring well MW-1. The objective of this well is to define the west/southwest extent of petroleum hydrocarbons and to provide gradient control.

- Monitoring well PMW-5 will be located approximately 100 feet south/southeast of monitoring well MW-1. The purpose of this well is to confirm the results of the VIP survey which indicated both shallow and deep petroleum impacts in this area and to evaluate the thickness of LPH which is anticipated. This well may be used for recovery of LPH, if necessary.

- Monitoring well PMW-6 will be located approximately 100 feet south/southwest of PMW-5. The objective of this well is to define the southerly extent of LPH and to evaluate the presence/absence of dissolved phase petroleum hydrocarbons to the south.

- Monitoring well PMW-7 will be located approximately 150 feet south/southeast of PMW-3. The objective of this well is to define the southeast extent of petroleum impacts and to provide gradient control.

- Monitoring well PMW-8 will be located approximately 300 feet south/southeast of monitoring well MW-1. The objective of this well is to define and monitor the downgradient extent of petroleum impacts.

In addition to the monitoring wells discussed above, shallow soil borings are proposed to be advanced along Phillip's pipeline to determine the lateral extent of petroleum impacts along the line. The borings will be installed at 100 foot intervals in a northwest and southeast direction along the pipeline. The borings will be advanced to a depth of 10 feet or until petroleum impacts are not detected, whichever is deeper. The northern borings will start 100 feet north of MW-1. The southerly borings will commence at the southern limits of the excavation. Up to six soil borings are proposed for this abatement plan.

The drilling activities will be accomplished utilizing a truck mounted sonic or air rotary drill rig. The sonic drilling method cuts a continuous core allowing detailed description of the subsurface geology and hydrocarbon distribution. If air rotary is used, continuous cores will be collected from wells PMW-3, PMW-4, PMW-5, and PMW-6. Grab soil samples will be collected at five foot intervals from wells PMW-2, PMW-7, and PMW-8. The shallow soil borings will be continuously cored from approximately 5 to 10 feet.

Monitoring wells PMW-2 through PMW-4 and PMW-6 through PMW-8 will be constructed to a depth of 45 to 50 feet utilizing 2 inch diameter schedule 40 PVC screen and casing. The wells are anticipated to be screened from 20 feet to the total depth utilizing 0.020 inch slot screen. If adsorbed phase petroleum impacts are noted shallower than 20 feet, the well screen may be extended to a minimum depth of 10 feet to facilitate possible remedial measures in the future. The well annulus will be backfilled will 10/20 sand to depth of one foot above the screen. A two foot thick bentonite seal will be placed above the sand pack and the remaining well annulus will be backfilled with clean soil or cement grout to a depth of three feet. The remaining well annulus will be filled with cement grout. A locking steel protective riser will be installed over each monitoring well to a height of three feet. A J-plug well cap will be placed on the monitoring well and the well will be secured with a brass lock.

Monitoring well PMW-5 will be constructed as above except that 4 or 6 inch diameter well materials will be utilized. The larger diameter well materials are to facilitate installation of a product recovery system, if warranted. The size of the well will be determined based on the recovery rates of LPH from MW-1 with the PetroXtractor.

Well Development

Following completion each well absent of LPH will be developed by bailing and surging with a bailer and/or a submersible pump. Development water will be collected in 55 gallon drums.

Well Surveying

Following completion of the drilling activities the wells will be surveyed to a common benchmark in order to facilitate collection of groundwater elevation and gradient data.

Aquifer Testing

Rising head permeability tests will be conducted in wells PMW-2, PMW-3, PMW-6, and PMW-8. The tests will be conducted by instantaneous removal of a volume of water from the wells and measuring the rate of groundwater recharge into the well. The aquifer tests will provide general information on the hydraulic conductivity, transmissivity, and storativity of the aquifer. An aquifer pump test may be conducted as part of the Stage II Abatement Plan to provide the above information with a higher degree of accuracy, if necessary.

Sampling and Monitoring Plan

During the drilling activities, a geologist will collect and describe soil samples as described above. Representative soil samples will be collected a five foot intervals or from zones of obvious petroleum impact. The samples will be split into representative portions. One sample will be placed in the appropriate laboratory container and placed on ice for possible analysis. The remaining portion of the sample will be screened with a photoionization detector as outlined in the OCD guidance document. A minimum of one soil sample will be submitted from each boring for laboratory analysis of BTEX by EPA Method 8020 or 8021 and TRPH by EPA Method 418.1. If only one soil sample is submitted, the sample from just above the water table interface will be selected. If two samples are submitted, one sample will be submitted from the zone above the water table with the highest levels of observable hydrocarbon impact and the second sample will be submitted from the water table interface.

In addition to the above sampling, soil samples will be collected from PMW-2, PMW-5, and PMW-8 for PLFA and MPN analysis. The PLFA analysis will provide information on the general types, populations, and stress level of the microbial community upgradient, within, and downgradient of the areas of impact. The MPN analysis will provide information on the populations of specific hydrocarbon degrading organisms.

Following completion of drilling and well development activities, groundwater samples will be collected from all monitoring wells absent of LPH. A minimum of three well volumes of groundwater will be purged from each well with a bailer or a submersible pump. Measurements of temperature, pH, and conductivity will be collected during purging to insure that the water sampled is representative of the surround aquifer. A groundwater sample will be collected from each well for analysis of BTEX by EPA Method 8020 or 8021, major cations and anions, heavy metals by EPA Method 6010, PAH's by EPA Method 8100, and total

dissolved solids. The groundwater samples will be submitted to a New Mexico certified laboratory for analysis.

Quality Assurance Plan

Industry accepted standard operating practices will be followed for all field activities to insure the quality of the data obtained. These procedures are summarized as follows:

- Soil sampling equipment will be decontaminated between core intervals. The decontamination procedures will be based on the type of drilling method employed (ie. sonic or air rotary). Down hole drilling equipment will be decontaminated utilizing a high pressure washer between borehole locations. The wash water will be captured in a decontamination area and transferred to storage containers.

- Well development and purging activities for the monitoring wells will be conducted from the cleanest well (based on field observations) to the most contaminated well to minimize potential cross contamination between wells.

- All reusable groundwater sampling equipment will be decontaminated utilizing an alconox wash and distilled water rinse prior to sampling activities and between each well.

- Groundwater samples will be collected utilizing new disposable bailers. One duplicate sample will be collected during the sampling activities. In addition to the duplicate sample, one trip blank sample will be analyzed for the cooler containing the samples for BTEX analysis.

- The soil and groundwater samples will be collected in the appropriate sample containers, labeled, sealed with custody seals, and placed on ice. The samples will be logged on a chain of custody form and submitted to the laboratory for analysis.

- New disposable gloves will be utilized for all sampling activities and will be discarded between samples.

Public Notification Plan

The public notification process will be followed as outlined in Rule 19.G. Public Notification and Participation.

Reporting

Following completion of the above assessment activities an assessment report will be prepared which details the results of the assessment activities. This report will either be considered a final assessment report if delineation of the plume is complete or will contain a scope of work for additional assessment activities. Following definition of the petroleum impacts a Stage II Abatement Plan will be prepared to evaluate and select the appropriate remedial approach for addressing the petroleum hydrocarbons detected in the subsurface.

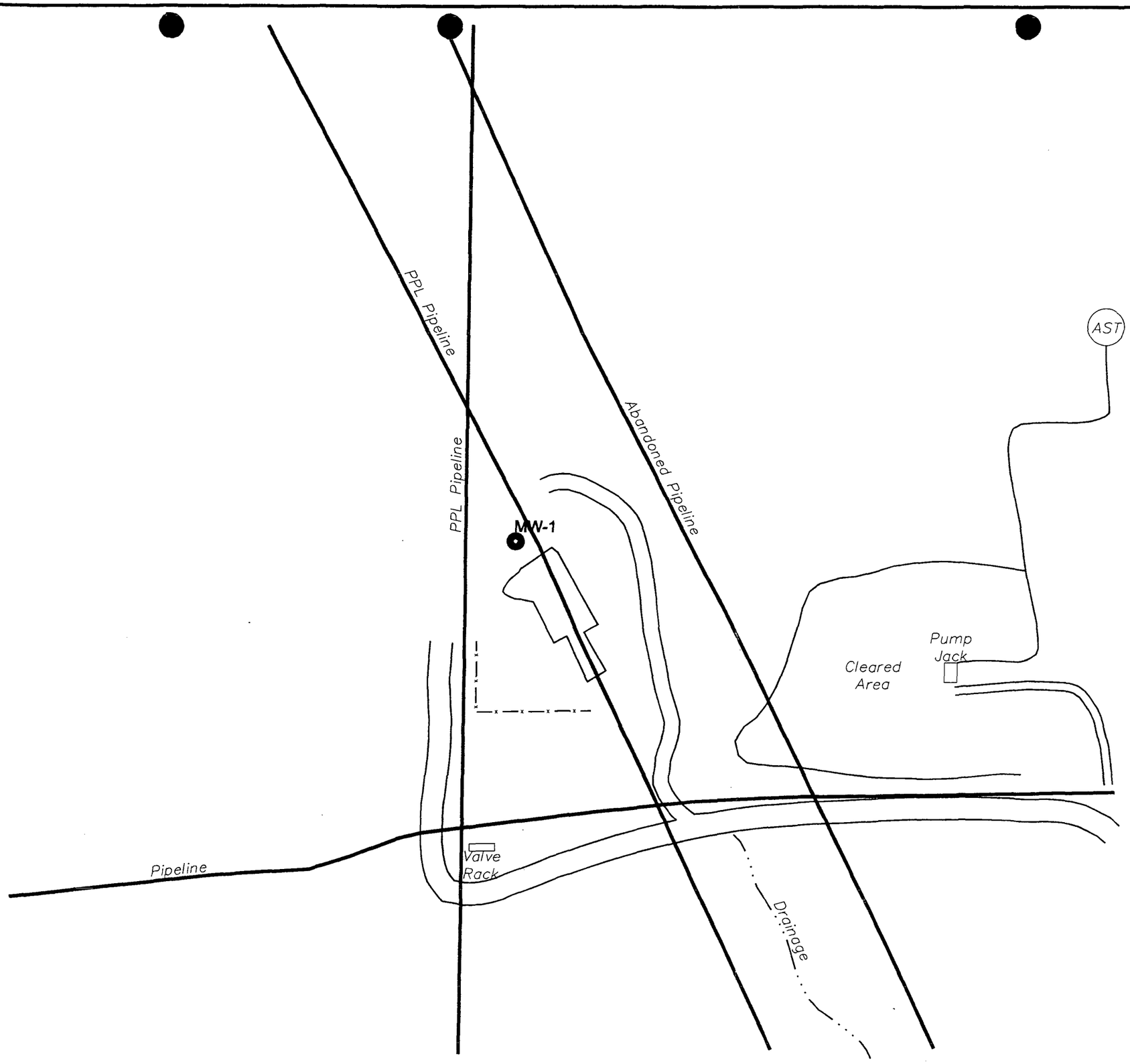
Schedule

Due to the uncertainty of the time period for acceptance of the plan and the public notification process for final plan approval, the actual schedule for implementation of the above activities can not be determined at this time. However, Higgins and Associates will proceed forward with implementation of the plan upon receipt of final approval from OCD. If available, the drilling contractor will be scheduled to perform the drilling within two weeks following plan acceptance. Completion of the scope of work and preparation of a detailed assessment report is anticipated to take 60 to 90 days from the date of plan approval.

Higgins and Associates appreciates the opportunity to provide Phillips Pipe Line Company with environmental consulting services. Should you have any questions concerning this work plan please contact me at 303/708-9846.

Sincerely,
Higgins and Associates, L.L.C.

Chris Higgins
NMUSTB Certified Scientist #234
President



LEGEND

MW-1 ● Monitor Well
(location of well and excavation size is approximate)

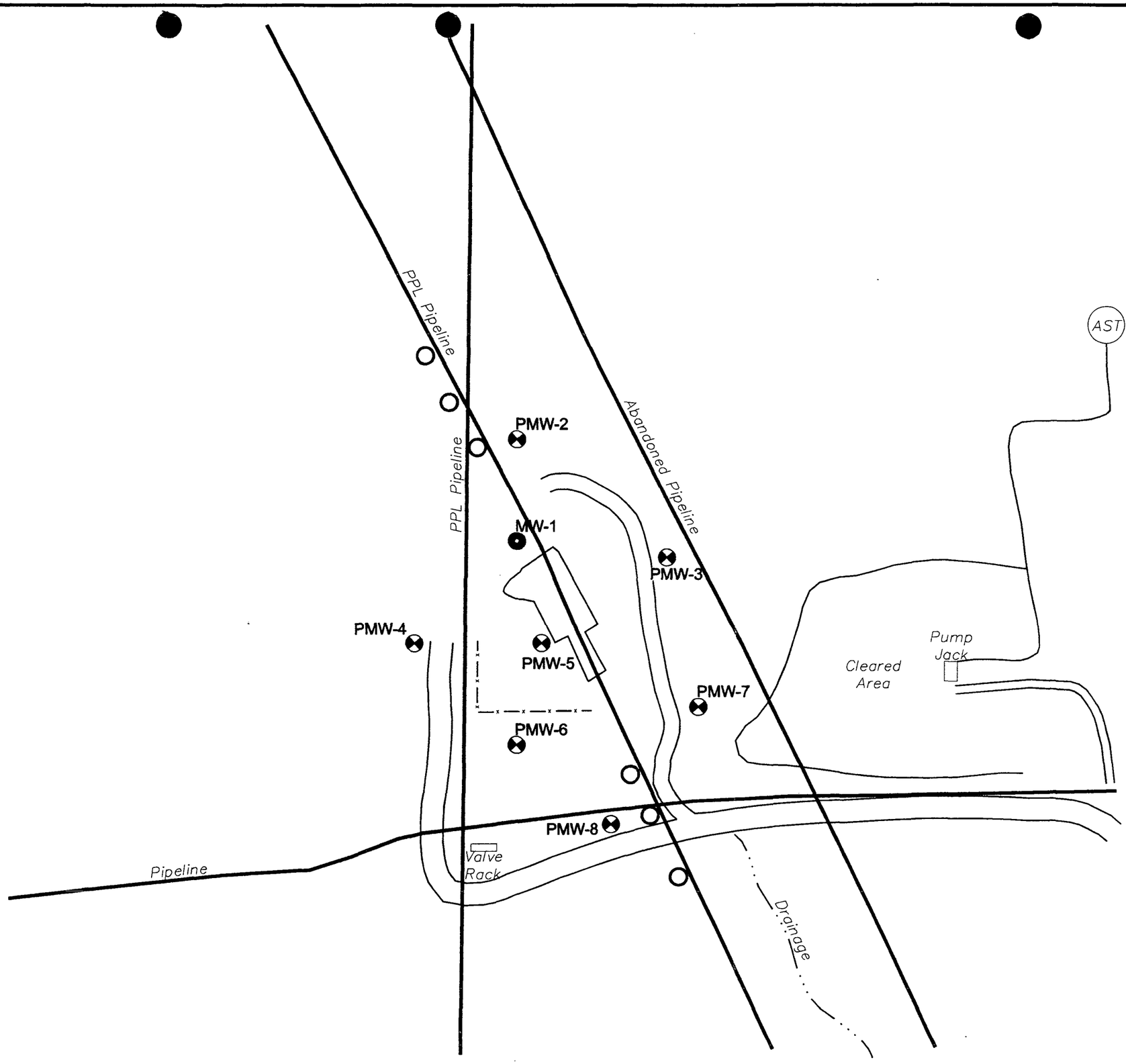
N

0 100 200
Scale (ft)

HIGGINS AND ASSOCIATES, L.L.C.

Project No.:	Date Map Generated: 3/22/99	Date Data Collected:	Figure No. 1

Authored	Title:
CH	SITE PLAN
Checked: CJ	
Detailed: ML	Client: Phillips Pipeline
	ACAD File: SITEMAP2.DWG
	Location: Hobbs New Mexico



LEGEND

- MW-1 — Monitor Well (location of well and excavation size is approximate)
- PMW-7 — Proposed Monitor Well
- Soil Boring

N

0 100 200

Scale (ft)

HIGGINS AND ASSOCIATES, L.L.C.

Project No.:	Date Map Generated: 3/22/99	Date Data Collected:	Figure No. 2

Authored: CH	Title: PROPOSED MONITOR WELL LOCATION
Checked: CJ	Client: Phillips Pipeline
Detailed: ML	ACAD File: SITEMAP2.DWG
	Location: Hobbs New Mexico