3R - 445

04 / 19 / 2013

GROUND WATER REMEDIATION WORKPLAN

3R-445

ENERGEN
RESOURCES

April 19, 2013

New Mexico Oil Conservation Division
1220 South St. Francis Drive
Santa Fe, New Mexico 87505
Attn: Glenn von Gonten

Re: **Julander Federal #1E**
Groundwater Investigation Work Plan

Dear Mr. von Gonten:

Enclosed, for your review and approval, is a Groundwater Investigation Work Plan for the subject well location. The work plan was prepared by Animas Environmental Services.

If there are any questions or concerns with this submittal, please contact me at 505-324-4131.

Sincerely,

Ed Hasely
Sr. Environmental Engineer
Energen Resources

Attachment: AES Groundwater Investigation Work Plan

Cc: HSE File
Facility File
Correspondence

Animas Environmental Services, LLC
www.animasenvironmental.com
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505-564-2281
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Prepared for:
Glenn von Gonten
New Mexico Oil Conservation Division
1220 South St. Francis Drive
Santa Fe, New Mexico 87505

Prepared on behalf of:
Energen Resources Corporation
Attn: Ed Hasely
2110 Afton Place
Farmington, New Mexico 87401

Groundwater Investigation Work Plan

Julander Federal #1E
San Juan County, NM

April 18, 2013

Prepared by:
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1.0 Introduction

Animas Environmental Services, LLC (AES), on behalf of Energen Resources Corporation (Energen), has prepared this work plan for a groundwater investigation associated with a release of approximately 96 barrels (bbls) natural gas condensate, which was discovered on January 14, 2013, at the Julander Federal #1E. The release resulted when a valve on the production tank froze and broke. In response to the release, Energen excavated hydrocarbon contaminated soils and installed one investigation well to determine if groundwater had been impacted.

1.1 Site Location and NMOCD Ranking

The release is located on private land within the NE¼ SW¼, Section 31, T29N, R11W, San Juan County, New Mexico. Approximate latitude and longitude of the release are N36.67936 and W108.03514, respectively. Based on measurements made in the investigation well, depth to groundwater is approximately 40 feet below ground surface (bgs). However, groundwater elevation is expected to fluctuate with seasonal changes and irrigation of the adjacent alfalfa and grass fields. A topographic site location map is included as Figure 1.

In accordance with the New Mexico Oil Conservation Division (NMOCD) *Guidelines for Remediation of Leaks, Spills, and Releases* (October 1993), the release location was assigned a ranking score to establish release action levels. The ranking score was obtained in part by reviewing available records of nearby oil/gas wells using the NMOCD online database; however, no records were found to aid in the assessment. Additionally, the New Mexico Office of the State Engineer (NMOSE) database was reviewed for the presence of nearby water wells. Two private wells were identified from the database; one reported at approximately 290 feet to the southwest and another at approximately 550 feet to the northeast. Depth to water in these wells is reported to be approximately 45 feet.

Google Earth and the New Mexico Tech Petroleum Recovery Research Center online mapping tool (http://ford.nmt.edu/react/pitrules_index.html) were accessed to aid in the identification of downgradient surface water. An unnamed wash which discharges to the San Juan River is located approximately 920 feet west of the release location. Based on this information and the known depth to groundwater, the release location was assigned a ranking score of 30 by AES.

1.2 Release Information and Mitigation

As a result of the freezing and breaking of a production tank valve, a release of approximately 96 bbls of natural gas condensate within the production tank secondary

containment area was discovered on January 14, 2013. Subsequently, Energen excavated and transported off-site approximately 3,356 cubic yards of petroleum hydrocarbon contaminated soil. The excavation extended to an approximate depth of 45 feet bgs, where water seepage into excavation occurred and excavation conditions became unstable. Therefore, the excavation was backfilled, and one investigation well, MW-1, was installed to determine if groundwater had been impacted. Groundwater laboratory analytical results from MW-1 reported 23.8 µg/L benzene, 289 µg/L toluene, 401 µg/L ethylbenzene, and 3,287 µg/L xylene concentrations. Benzene and xylene concentrations exceeded the New Mexico Water Quality Control Commission (WQCC) standards of 10 µg/L (benzene) and 620 µg/L (total xylene).

2.0 Proposed Groundwater Investigation

Based on the analytical results described in the previous section, a groundwater investigation is proposed in order to delineate the extent of the dissolved phase hydrocarbon contaminants associated with the release. The investigation procedures are designed to be protective of both surface water and groundwater and are based upon protocols outlined in AES' Standard Operating Procedures (SOPs). SOPs follow applicable NMOCD guidelines, American Society for Testing and Materials (ASTM) standards, and applicable U.S. Environmental Protection Agency (USEPA) methods and guidelines for soil and groundwater sampling.

2.1 Pre-Field Permits and Coordination

2.1.1 Access Agreements

No access agreements are anticipated for this project, based upon the proposed scope of work.

2.1.2 Office of State Engineer Permits

Following installation of the monitoring wells, the drilling contractor will submit a Well Record and Log (Form WR-20) to the New Mexico Office of the State Engineer (NMOSE).

2.1.3 Utilities Notification

The drilling contractor will utilize the New Mexico One-Call system to identify and mark all underground utilities at the site before the start of any proposed field activities which could impact buried utilities. Any local utilities not participating in the New Mexico One-Call system will be contacted separately by the drilling contractor for utility locations.

2.1.4 Health and Safety Plan

AES has a company health and safety plan in place, and all on-site personnel are 40-hour HazWoper trained in accordance with OSHA regulations outlined in 29 CFR 1910.120(e). Prior to the start of the site investigation, AES will prepare a comprehensive site-specific Job Safety Analysis (JSA) addressing the site investigation activities and associated soil and groundwater sampling. All employees and subcontractors are required to read and sign the JSA to acknowledge their understanding of the information contained within the JSA. The JSA will be implemented and enforced on site by the assigned Site Safety and Health Officer.

2.2 Installation of Soil Borings

AES proposes to install three soil borings which will be completed as 1-inch diameter groundwater monitor wells (MW-2, MW-3, and MW-4) to delineate the extent of the dissolved phase petroleum hydrocarbon impacts. Soil borings will be advanced to an approximate depth of 50 feet bgs with a Simco truck-mounted direct push rig, which is equipped with a 2-inch outer diameter (OD) core barrel. Direct push drilling will be provided by Kyvek Energy Services, Aztec, New Mexico. The locations of the proposed soil borings/monitor wells are shown on Figure 2.

2.3 Soil Sampling and Analyses

2.3.1 Sample Collection

Each soil boring will be continuously sampled using a core-barrel sampler. Soil samples collected will be field screened for volatile organic compounds (VOCs) with a photo-ionization detector (PID) organic vapor meter (OVM). In the event that field screening results exceed 100 parts per million, two soil samples will be collected from that boring for laboratory analysis. Generally, these samples will be collected from the vadose zone where the highest OVM-PID reading is observed and from the capillary fringe just above groundwater.

For each soil boring, a Soil Boring Log will be completed. These logs will record sample identification, depth collected, and method of collection, as well as observations of soil moisture, color, density, grain size, plasticity, contaminant presence, and overall stratigraphy.

2.3.2 Field Screening

Samples will be field screened for VOC vapors utilizing a PID-OVM calibrated with isobutylene gas to obtain preliminary data regarding potential hydrocarbon impacted soil. Field screening will follow AES SOPs, applicable ASTM standards and USEPA guidelines. The highest (peak) PID-OVM readings will be recorded onto the soil boring logs.

2.3.3 Laboratory Analyses

Discrete samples collected for laboratory analysis will be placed into new, clean, laboratory-supplied containers, which will then be labeled, placed on ice, and logged onto a sample chain of custody record. Samples will be maintained on ice until delivery to the analytical laboratory, Envirotech in Farmington, New Mexico or Hall Environmental Analysis Laboratory (Hall) in Albuquerque, New Mexico. Soil samples will be laboratory analyzed for:

- Benzene, toluene, ethylbenzene, and xylene (BTEX) per U.S. Environmental Protection Agency (USEPA) Method 8021B; and
- TPH for gasoline range organics (GRO) and diesel range organics (DRO) per USEPA Method 8015B.

2.4 Groundwater Monitor Well Installation and Sampling

2.4.1 Groundwater Monitor Well Installation and Construction

Each soil boring will be completed as a groundwater monitor well (MW-2, MW-3, and MW-4). Monitoring well construction will consist of 1.4-inch outside diameter (OD) [0.75-inch inside diameter (ID)] Schedule 40 PVC screen and 1.0-inch blank riser casing. The screened interval will extend 15 feet across the water table. The wells will be constructed of a 1.4-inch OD (0.75-inch ID) pre-packed screen (0.010-inch slot). The screen is factory packed with 20/40 Colorado silica sand. A bentonite seal will be placed above the sand pack, and concrete grout with approximately 5 percent bentonite will be poured from the top of the bentonite plug up to within 0.5 feet of ground surface. A concrete collar and steel surface-grade well vault will be installed on the well to prevent unauthorized access and damage from runoff and debris within the wash. The existing 2-inch diameter monitor well, MW-1, will also be surface completed in the same manner. A monitor well construction schematic is presented on Figure 2.

2.4.2 Professional Survey

The location and elevation of the top of each well casing will be surveyed to the nearest 0.01 foot with reference to mean sea level by a licensed surveyor in order to accurately determine the local groundwater depth and flow direction beneath the site. Each well will be tied to an existing USGS benchmark. AES will arrange with a New Mexico Licensed Professional Surveyor to complete the survey upon completion of the monitor well installation.

2.4.3 Monitor Well Development

Following monitor well installation and completion, each well will be developed by a combination of surging and bailing techniques. Groundwater purged from the wells will be

contained in a labeled and sealed 55-gallon drum and transported to Envirotech Landfarm for proper disposal or placed into the separator waste tank where it will be properly disposed of along with the facility's produced water.

2.4.4 Groundwater Sampling

Upon completion and development, the monitor wells will be allowed to sit undisturbed for a minimum of 48 hours. The monitor wells will then be gauged to determine water table elevation and direction of groundwater flow. The wells will then be purged of a minimum of three well volumes, and a groundwater sample will be collected from each well.

Groundwater samples will be collected from each well with a new disposable bailer equipped with a low-flow release valve. Purging data, including pH, temperature, conductivity, oxidation-reduction potential (ORP), and dissolved oxygen (DO), will be measured with a YSI water quality meter and documented on a Water Sample Collection Form along with purged water volume and sample depth. All sampling equipment will be thoroughly decontaminated between uses. Purged water will be contained in a labeled and sealed 55-gallon drum and transported to the Envirotech Landfarm for proper disposal or placed into the separator waste tank where it will be properly disposed of along with the facility's produced water.

2.4.5 Laboratory Analyses

All groundwater analytical samples collected from the monitor wells will be submitted to Hall or Envirotech for analysis of the following parameters:

- BTEX per USEPA Method 8021B.

Once collected, sample containers will be packed per standard protocol with ice in insulated coolers and shipped to the analytical laboratory.

2.5 Equipment Decontamination

In order to prevent cross-contamination between sampling locations, strict decontamination procedures will be employed during the groundwater investigation. All drilling equipment will be decontaminated after completing each soil boring, and sampling equipment (i.e. hand auger, spoon sampler, and other hand tools) will be decontaminated following each use at an individual depth or location.

All decontamination of equipment will be completed within clean 5-gallon plastic buckets, which will contain the effluent. At least two tubs will be used, one designated for push rods and the other for small sampling equipment. On an as-needed basis, effluent from the tubs will be transferred by small pump or bucket into 55-gallon DOT approved drums, which will

then be marked with identification labels and sealed. Decontamination procedures to be utilized are outlined below.

For small equipment such as hand tools and spoon samplers:

1. Physical removal of gross contamination and all debris with brushes;
2. Hand wash with non-phosphate detergent;
3. Hand wash with non-phosphate detergent and water using brush;
4. Rinse with water;
5. Second rinse with water;
6. Air dry.

All decontamination procedures will be completed in strict accordance with AES SOPs and applicable USEPA guidelines. Decontamination effluent will transported to the Envirotech Landfarm for proper disposal or placed into the separator waste tank where it will be properly disposed of along with the facility's produced water.

3.0 Deliverables

Following completion of the groundwater investigation field work, a Groundwater Investigation Report summarizing the investigation activities will be submitted to Energen. The report will include the following:

1. A summary of all work conducted in the implementation of the investigation;
2. Maps of all sampling locations, including soil and groundwater contaminant concentrations and contours;
3. Geologic cross-sections;
4. All laboratory data and quality assurance and quality control information;
5. Professional survey data; and
6. Recommendations for corrective action, if warranted.

4.0 Implementation Schedule

AES proposes the following timeline to implement the investigation. Note, this schedule assumes that **NMOCD approval is received by April 23, 2013**, and that no inclement weather occurs, which could result in a delay in implementing the field work.

Task	***Days from NMOCD Work Plan Concurrence***
Utilities Clearances *(NM One-Call requested on 04-18-13)*	1
Complete installation of soil borings and groundwater monitor wells; collect and submit soil and groundwater samples for laboratory analysis. Schedule professional survey of wells.	10
Receive laboratory analytical reports for soil and groundwater samples. Receive professional survey data.	20
Prepare and submit Groundwater Investigation Report.	30

Respectfully submitted,

Heather M. Woods
Staff Geologist

Ross Kennemer
Principal

5.0 References

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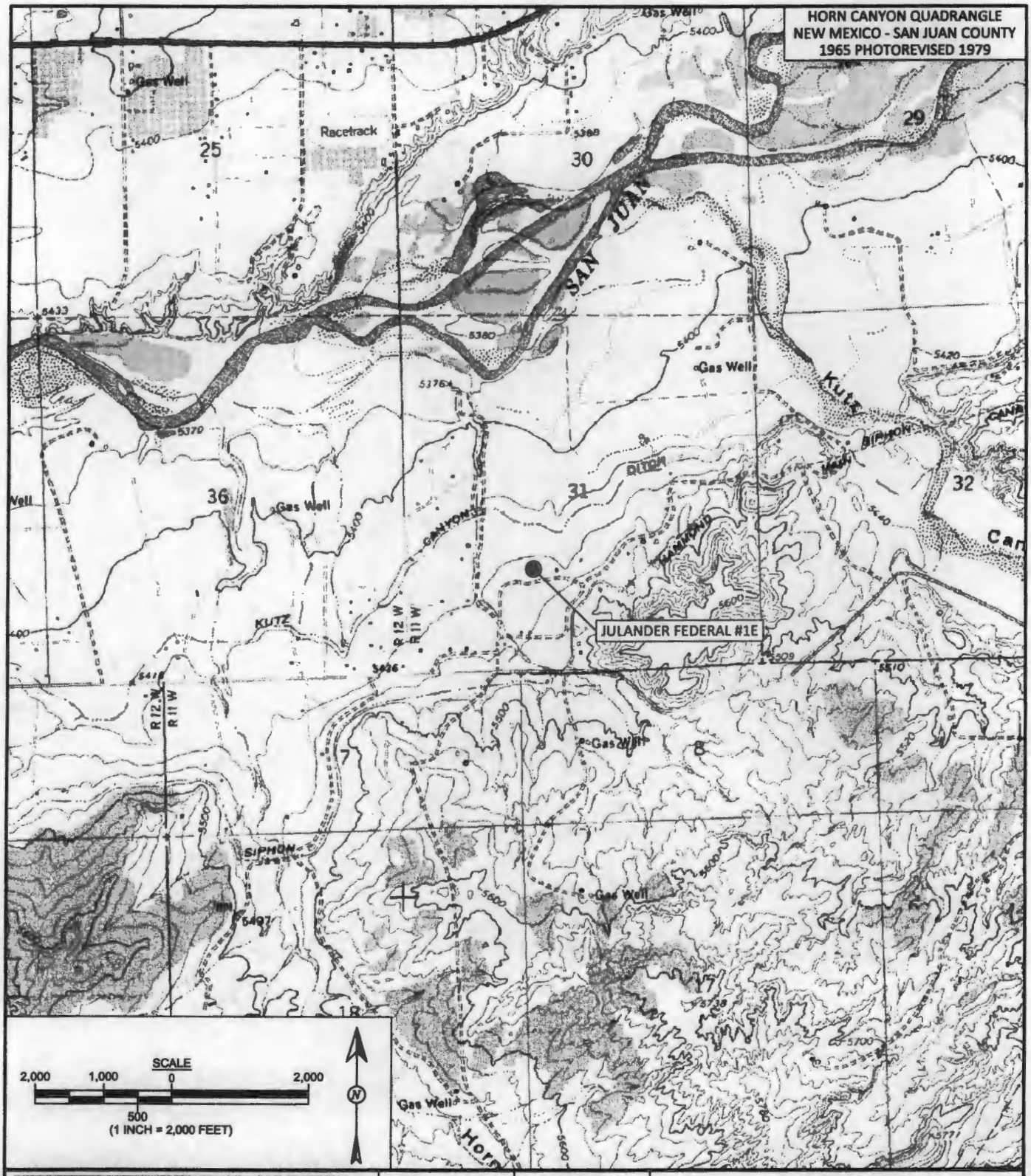
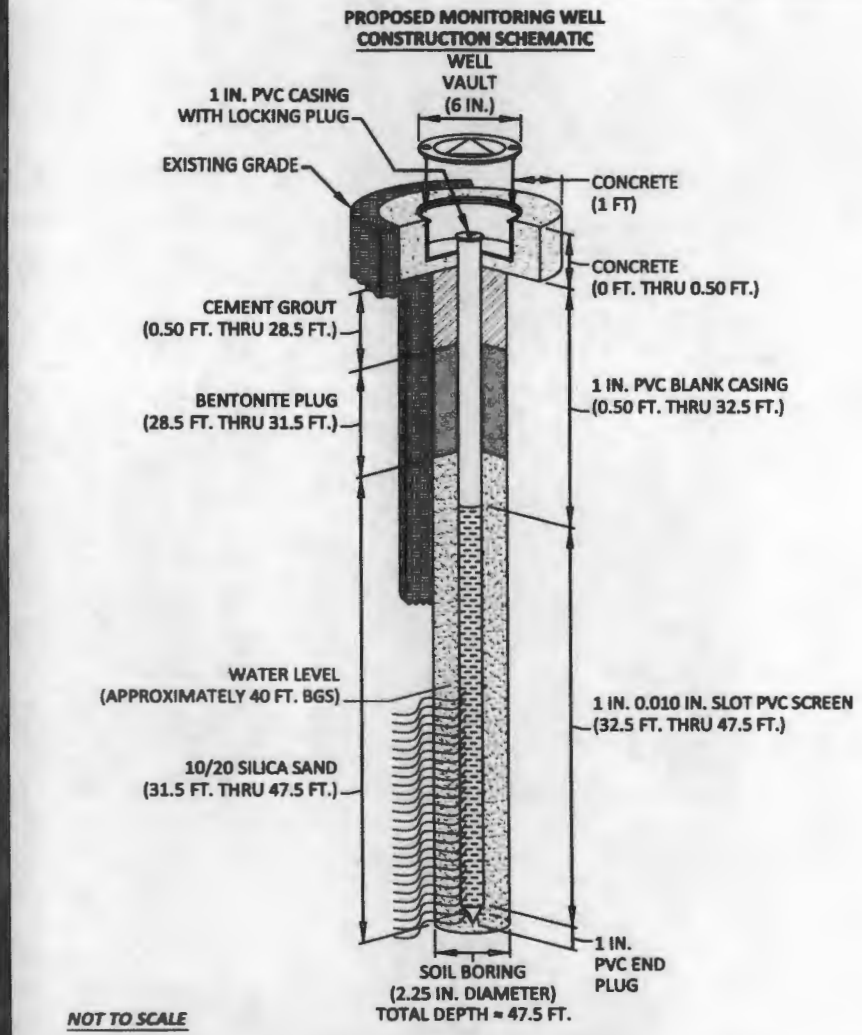
USEPA. 1992. SW-846, 3rd Edition, *Test Methods for Evaluating Solid Waste: Physical Chemical Methods*, dated November, 1986, and as amended by Update One, July, 1992.

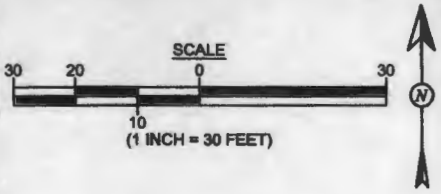
USEPA. 2001. Contract Laboratory Program (CLP) Guidance for Field Samplers. OSWER 9240.0-35, EPA 540-R-00-003. June, 2001.

FIGURES



Animas Environmental Services, LLC	DRAWN BY: C. Lameman	DATE DRAWN: April 11, 2013	**FIGURE 1**
	REVISIONS BY: C. Lameman	DATE REVISED: April 11, 2013	**TOPOGRAPHIC SITE LOCATION MAP** ENERGEN RESOURCES JULANDER FEDERAL #1E NE¼ SW¼, SECTION 31, T29N, R11W SAN JUAN COUNTY, NEW MEXICO N36.67936, W108.03514
	CHECKED BY: H. Woods	DATE CHECKED: April 11, 2013	
	APPROVED BY: E. McNally	DATE APPROVED: April 11, 2013	





Animas Environmental Services, LLC

DRAWN BY: C. Lameman	DATE DRAWN: April 11, 2013
REVISIONS BY: C. Lameman	DATE REVISED: April 11, 2013
CHECKED BY: R. Kennemer	DATE CHECKED: April 11, 2013
APPROVED BY: E. McNally	DATE APPROVED: April 11, 2013

FIGURE 2

PROPOSED WELL LOCATIONS AND PROPOSED WELL SCHEMATIC
ENERGEN RESOURCES
JULANDER FEDERAL #1E
NE¼ SW¼, SECTION 31, T29N, R11W
SAN JUAN COUNTY, NEW MEXICO
N36.67936, W108.03514