The ins, outs and reverberations of seismic testing

By Rachel Morgan shalereporter.com | Posted: Monday, March 4, 2013 6:00 am

The rumblings against the proposed 3D seismic testing in Beaver and Allegheny counties continues.

The Houston-based Seitel Data Ltd. hosted another presentation and public forum Monday, this time for residents of Hopewell Township. Last week, two similar meeting were held in South Heights and Aliquippa. A second meeting in Aliquippa is scheduled for Wednesday.

While residents continued to voice their concerns regarding seismic testing's potential effects on water supplies, structures and aging infrastructures in the townships, as well as the company's liability regarding any possible damages, The Times thought it would be helpful for residents everywhere to familiarize themselves with the process of Seitel's proposed seismic testing before signing any permits.

The seismic testing process begins with Seitel sending out permit letters asking for permission for surface and mineral rights – depending on a homeowner's location – which they did earlier this year.

John Gordon of Discover Acquisition Services, a contracted company for Seitel, said there are two permits that can be issued – a surface permit or a mineral permit. Surface permits give Seitel access to the resident's land to lay receivers, drill shot holes – which are essentially 30-feet-deep well bores containing explosives which are set off during seismic testing -- and conduct various other seismic-related activities. Mineral permits are just for permission for the company to view data under the ground. Seitel can't enter into landowners' land if they just sign a mineral permit, Gordon said.

Permits from residents are gained before Seitel gains the appropriate Pennsylvania Department of Environmental Protection permits, which they have not yet secured.

The company then conducts a hazard survey, in which they identify any potential hazards to avoid when conducting seismic testing, such as pipelines, waterlines, wells, roads and rivers. Gordon said they maintain a setback of 300 feet from shot

holes to any well, structure or water source. The company then does an access survey, where they map out properties, the best access points and where gates and access roads are located.

Next, they mark where their equipment will go, including shot holes – the holes they drill and insert explosives into – and geophones, which are essentially sensors that pick up the vibrations that set off from the explosives, bounce off the subsurface rock and then travel back toward the surface.

Next comes the drilling. Seitel drills holes 30 feet deep and 3 to 4 inches in diameter. At the bottom of the hole, they place pentolite, a type of explosive. This is covered in gravel and drill cuttings from the hole. A 3.3-pound can charge – or explosion – is then set off. The charge, Gordon said, can be felt anywhere from 3 to 4 miles away.

The vibrations from the charge travel under the surface, hit off the subsurface rock formations, then come back up to the surface, where they are measured by the geophones that are set up in a grid around the shot holes. There can be as many as 2,000, 3.5-inch long geophones set up in an 8-square mile area. The proposed area for the seismic testing in Beaver and Allegheny is 157 square miles, officials said.

However, sometimes shot holes are not possible, due to location or geography. That's when the vibroseis trucks are used to send the vibrations under the ground. These trucks, which weigh about 48,000 pounds, lower a plate onto the ground and send a vibration into the ground, which travels under the surface and bounces off the underground rock. It then travels back upwards and is measured, similar to how the shot holes work.

Seitel then records the vibrations that return to map out the rock layers underneath the surface, Gordan said. The information is then sold to oil and gas companies looking to extract natural gas from the Marcellus shale in the area.

Seismic testing, Gordon said, shows where the rock is, how thick it is and where fault lines are. It does not show where the natural gas is located.

"That is a common misconception that seismic data shows how 'good' your property is and how much gas there is," Gordon said. Residents are paid $5 per acre should they agree to allow Seitel to conduct seismic testing on their land.

Hopewell Township President of the Board of Supervisors Norm Kraus Jr. said it's up to the residents to make their own decisions. He did, however, say that the township adopted what he called a "strict ordinance" to protect residents.

"The township was very proactive from the start," he said. "We're lucky we have the law firm we do, and they suggested we put a very strict ordinance in place, and that's what we adopted. We take it very seriously, but you have to make your own decision."

Hopewell Township solicitor Michael Jones said that the resolution provides protection for public infrastructure. It also requires that Seitel workers wear identification badges.

It does not, however, provide protection for any issues with private property in regard to water sources, setbacks or damages. He urged residents to negotiate with Seitel to ensure coverage of any damages caused to private property as a result of seismic testing.

SEITEL

Ambridge 3D

3-D Project Timeline

Hopewell High School

John Gordon – Seitel

March 4, 2013

Project Timeline

- Phase 1 – Permitting
- Phase 2 – Hazard Survey
- Phase 3 – Access Survey
- Phase 4 – Source Location Survey
- Phase 5 – Receiver Location Survey
- Phase 6 – Buggy Drilling
- Phase 7 – Layout and Recording, and Vibroseis
- Phase 8 – Project Completion

Phase 1 – Permitting

Determine project boundaries, develop permit database and map of landowners, create permits for landowners within project, and obtain signed permits from landowners. These permits give lon permission to perform our seismic project on each landowner's property, as well as giving permission to view the resultant seismic data obtained below their property. The permits also provide the crew with contact information for the landowners, so that we can keep everyone informed as needed while the project is underway. There is also a section for the landowners to list any special conditions that they want met during the course of the work, such as keeping gates locked for livestock, no cutting fences without landowner's permission, etc.

Phase 2 – Hazard Survey

Hazard survey begins - GPS survey of roads, rivers, lakes, houses, water wells, and hazardous areas. This usually involves minimal entry on property with a GPS unit, to record the locations. The survey crew utilizes pickup trucks to get to the survey locations, which are generally parked on existing roads and trails while the crew surveys the hazard areas on the properties, on foot or all terrain vehicles.

Phase 3 – Access Survey

Survey crew begins surveying access to the properties for the crews, including fences, gates, trails, etc. Most of this is done with a GPS unit on small 4WD utility vehicles (UTVs), or on foot. The locations for access are marked with blue and white flagging and ribbons. The purpose of these markings was to let the crew members in the following phases of the project know where the best locations were to access the properties.

Phase 4 – Source Location Survey

Survey crew begins GPS surveying of source locations. Source locations are where the drilling crew will drill the "shot-hole", which is a 30 feet deep hole, approximately 3 inches in diameter. Ideally, these locations are arranged in parallel lines that run roughly perpendicular to the receiver lines. The individual locations are spaced 310 feet apart, with the lines separated by 930 feet. There are 15,149 proposed source locations in the project. Each source hole will be loaded with a small seismic charge, consisting of 3.3 lbs of a pentolite based explosive, specifically designed for use in Seismic Surveys. The explosive is made primarily of ammonium nitrate, which is a commonly used fertilizer. It decomposes over time with exposure to water in the hole, and when the charge is set off, leaves behind water, carbon dioxide, and nitrogen gas. These source locations are also surveyed with GPS units and UTVs, or on foot where necessary. The actual source locations are marked with orange survey stakes, with the individual source ID number written on them. The best path for the crew to get from one source location to the next is marked with orange ribbons, which are tied to trees, fences, brush, etc.

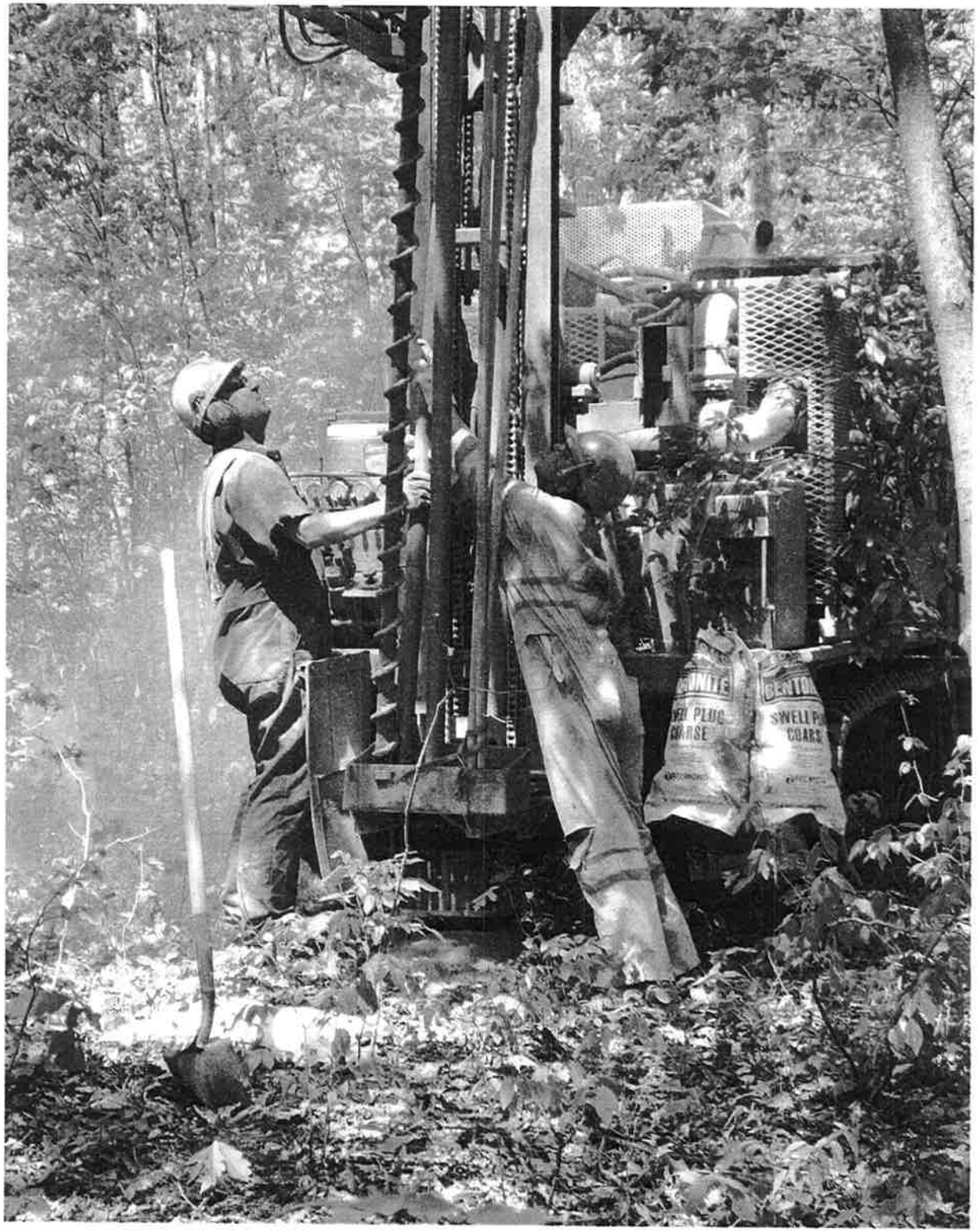
Phase 5 – Receiver Location Survey

Survey crew begins GPS surveying of receiver locations, using UTVs and on foot. The receivers, or "geophones", are basically small microphones that are 3.5 inches long and a half inch in diameter, that are hand placed into the ground. These geophones pick up and record vibrations in the ground. There will be upwards of 2,000 of these geophones recording each source detonation, over an area up to 8 square miles. All of the geophones are laid out in lines, running roughly perpendicular to the source locations. The individual receiver locations are 220 feet apart, with the lines being separated by 880 feet. There are 22,740 proposed receiver locations on the entire job. Unlike other seismic recording systems, these receiver sets are stand-alone, and are not connected to each other by cables. The receiver sets can be moved at any time to accommodate landowner's activities, such as lawn mowing, farming operations, etc.

Phase 6 – Buggy Drilling

Drilling operations with drilling buggies commence. These units are small, versatile tracked drilling rigs. They are relatively small, capable of tighter turns in the woods, which leads to less brush clearing. The tracks also minimize rutting and aide in traversing heavy snow areas. When necessary, small saplings and brush will be cut to allow access to wooded areas. This will be accomplished by small crews of men, with chain saws, leaving behind a clean, cut path. When the drill buggy gets to the location, it will raise it's drill derrick (10-12 foot high), and drill the hole. As soon as the hole is drilled, they will pull up the drill pipe, and load the hole with the charge. The holes are filled with gravel, and any cuttings or powdered rocks from the drilling are used to fill the holes, and the remains are spread out around the hole. The lead wires will be buried for later retrieval, and the stake with flagging will be replaced to mark the hole's location. This entire process takes under 30 minutes per hole in most cases.


BULL MAY ADVANCE FROM REAR WHEN LIGHTS FLASH

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EXPLOSIVES

Phase 7 – Layout and Recording

Layout and recording crew arrives - The receiver sets are loaded into large, orange duffle bags, which are carried by a small helicopter and dropped at strategic locations for the layout crew to distribute. Each bag holds several sets of cables and geophones, along with a battery and box. The use of a helicopter to drop them across the project means that the layout crew can cover large areas in a short period of time. When the crew sets off and records the sources, they will have 12 lines actively recording on either side of the shots. When they finish all of the sources between each set of lines, they will pick up the furthest back line, and lay it out on the front edge of the spread. This way, they will be constantly "leap-frogging" the equipment from South to North. As they pick up the equipment and shoot off the charges at each source location, the crew will be picking up all of the flagging, ribbons, stakes, and other trash items they used during the project.


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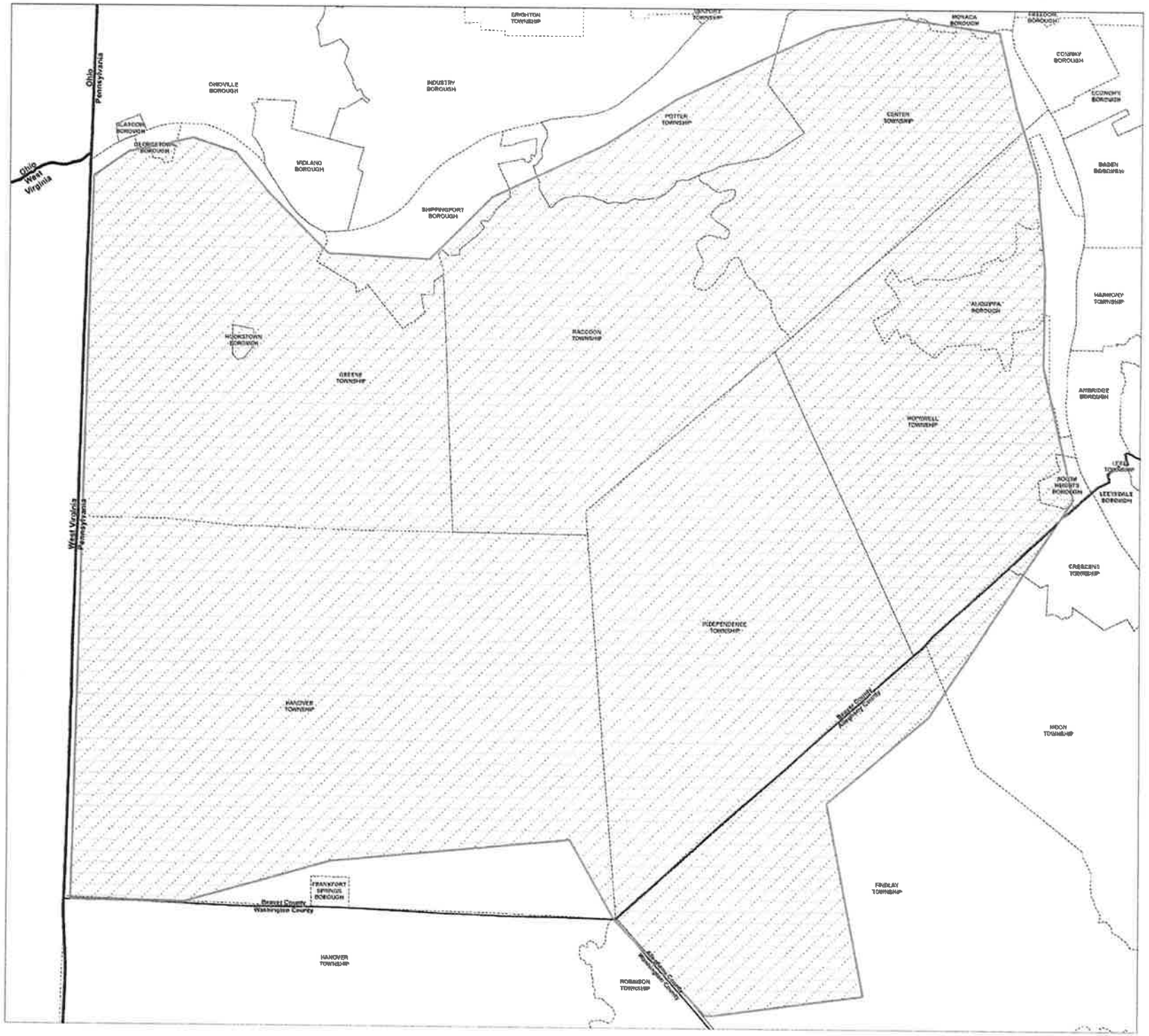
Phase 7 Continued – Vibroseis

One alternative method of getting energy into the ground is the use of vibroseis, or "vibe" trucks. These are large (48,000 lbs) trucks, with wide tires that have a large metal plate on hydraulic rams in the middle. The plate lowers down to the ground, and the truck applies pressure with the hydraulics, using the weight of the truck to press it firmly to the surface. The trucks run in series of 3 to 4 trucks in a row, and are all synched to vibrate at the same time on a set frequency ramp. They will be utilized on roads, especially in town where it is impossible to get shot-holes in due to how close the houses are. Vibes are a very low-impact energy source, which allows their use much closer to houses than is possible with shots.


STOP

Phase 8 – Project Completion

Project completion – As the crew proceeds throughout the project, any damages that occur to landowner's property will be assessed and repaired, or if the landowner so chooses, they will be paid to do the repairs themselves. Any damages to crops or marketable timber will be paid for at this time as well. The crew members are provided with business cards, with the permit agents and permit office phone numbers on them, so that landowners can quickly report any problems that occur. Once all of the sources are detonated, and the last cables are picked up, the crew will move to their next assigned project, and the 3-D project will be officially finished.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SHIPPINGPORT BOROUGH
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RACCOON TOWNSHIP
GREENE TOWNSHIP
AMBRIDGE BOROUGH
HOPEWELL TOWNSHIP
LEET TOWNSHIP
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LEETSDALE BOROUGH
CRESCENT TOWNSHIP
INDEPENDENCE TOWNSHIP
HANOVER TOWNSHIP
Beaver County
Allegheny County
MOON TOWNSHIP
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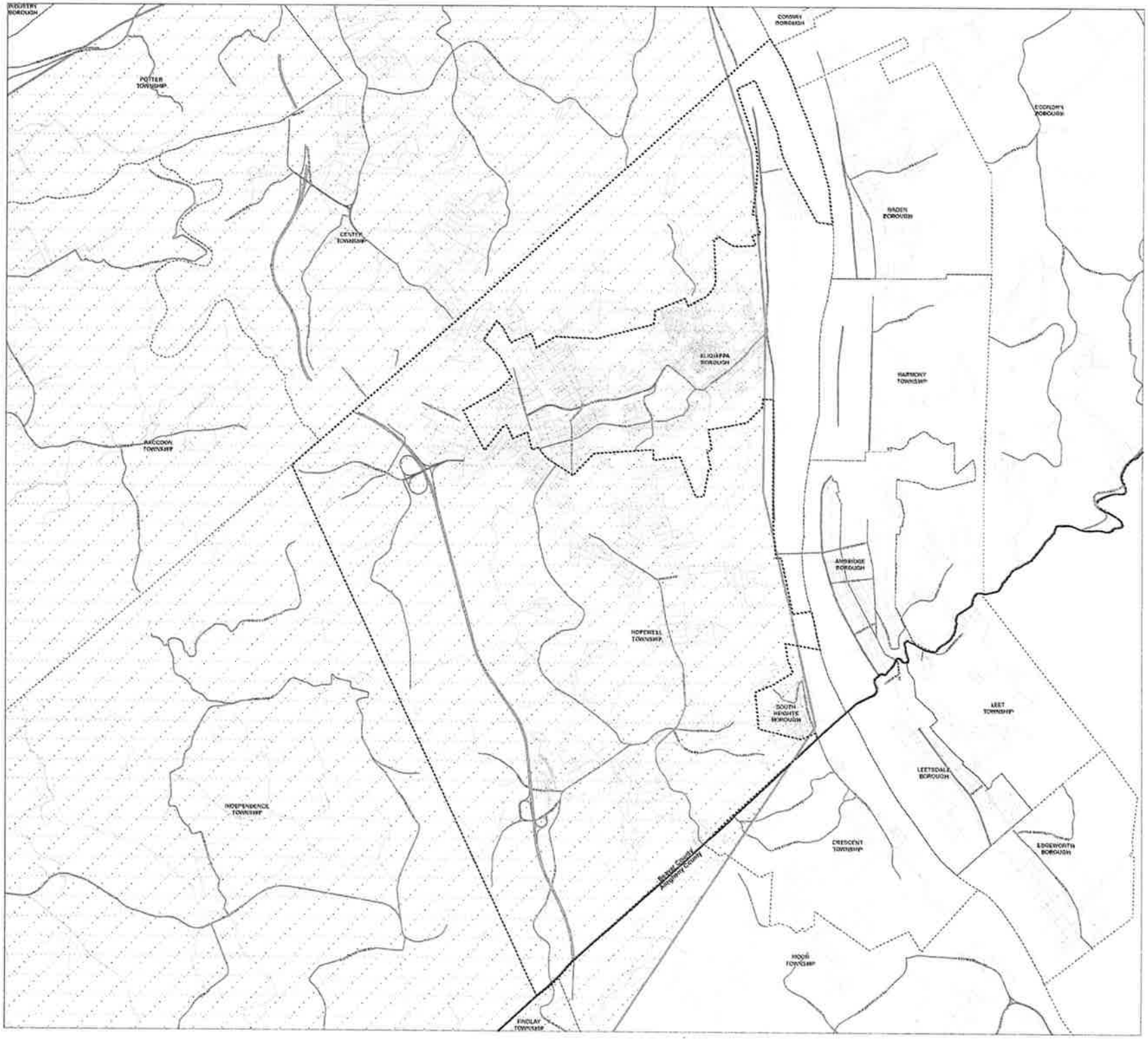
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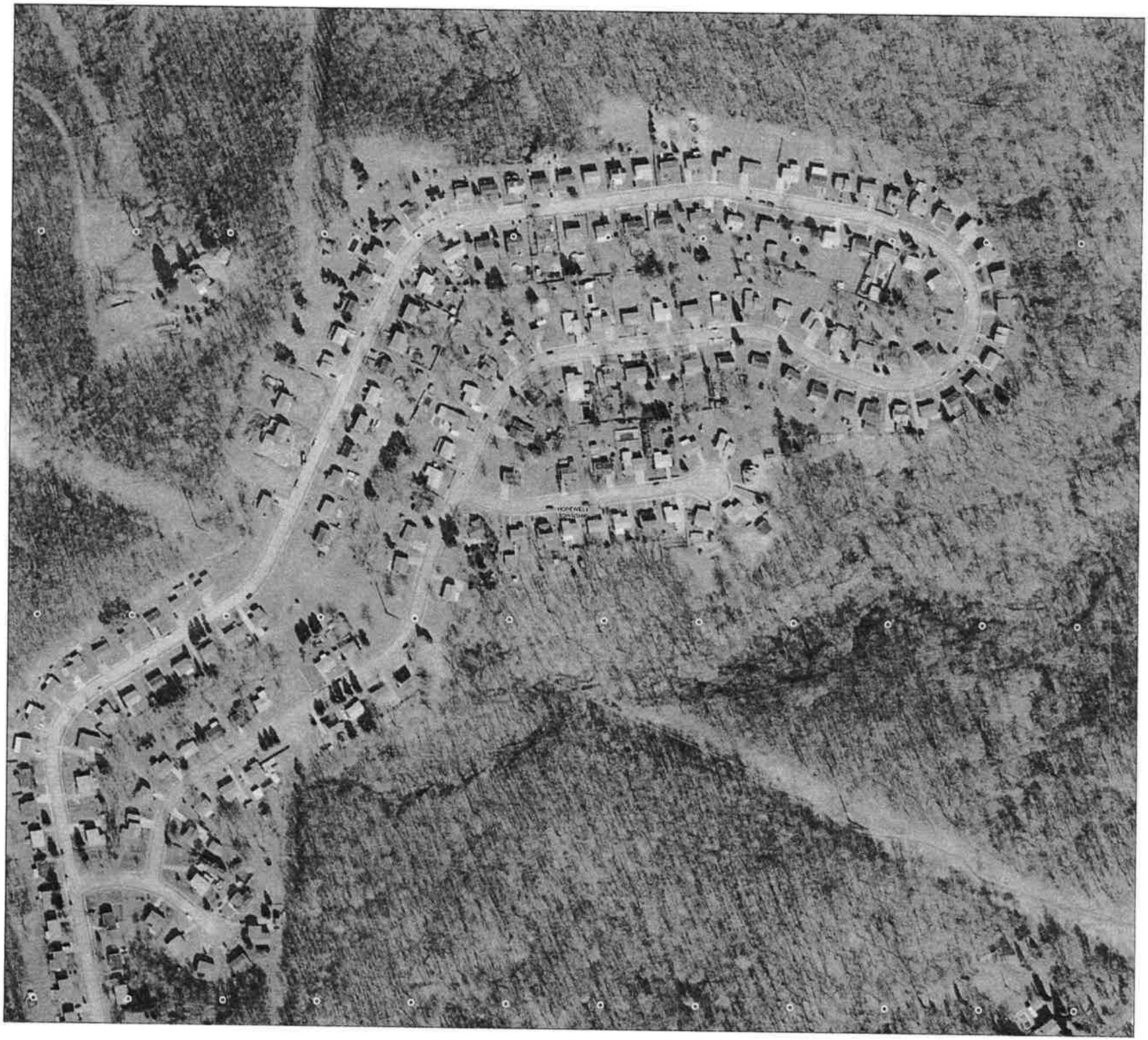

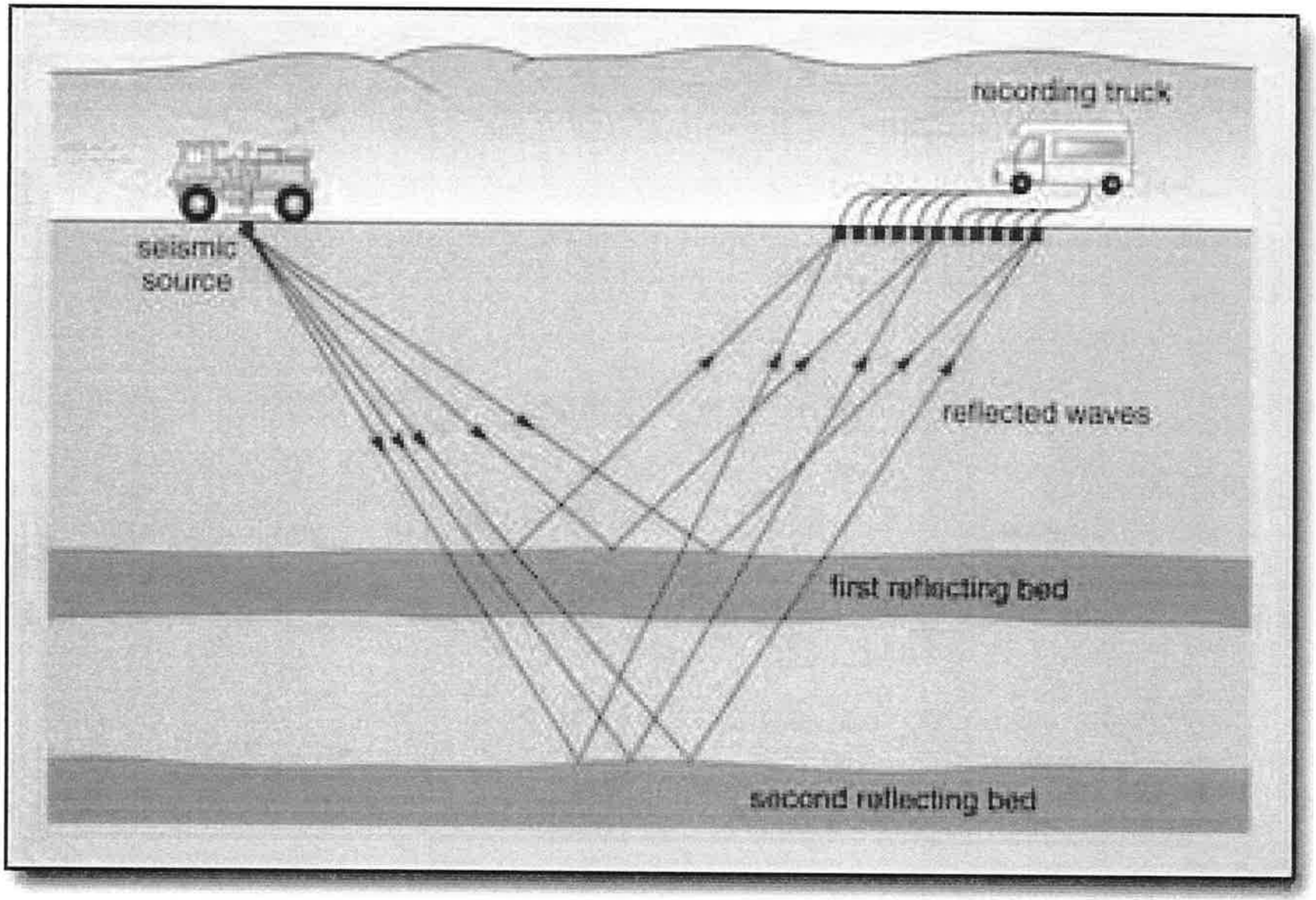
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seismic source
reflected waves
first reflecting bed
second reflecting bed

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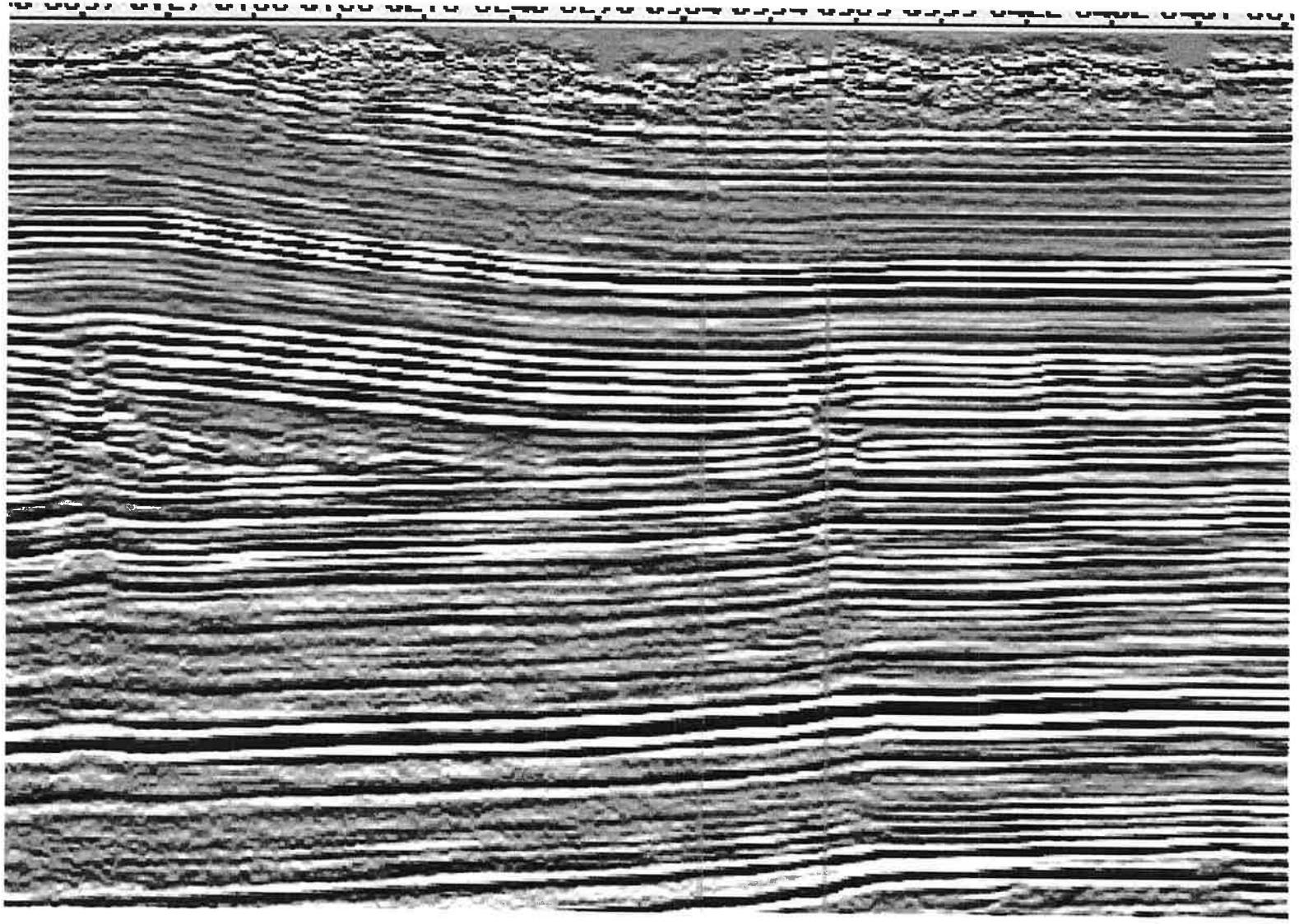
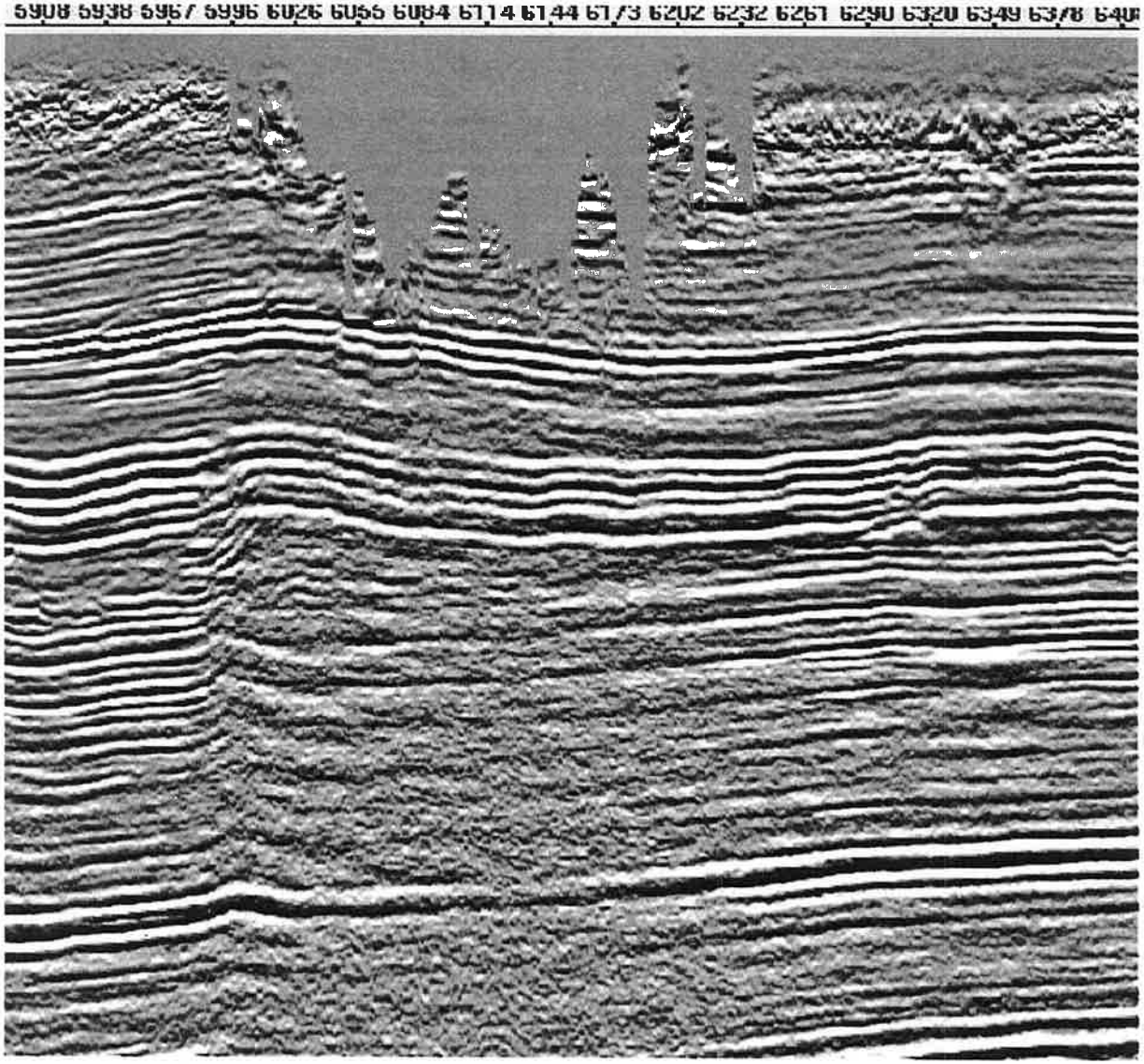
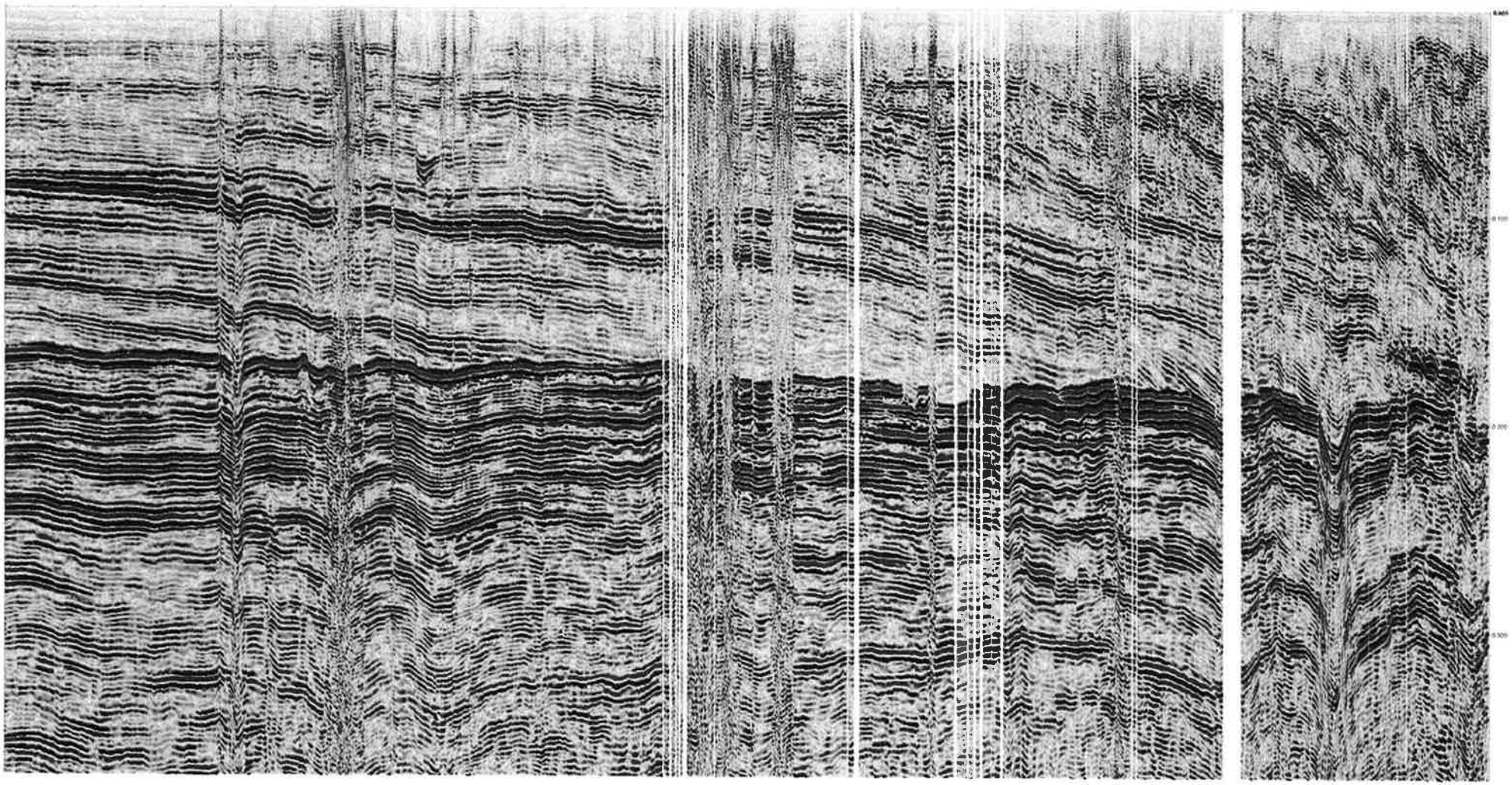


Skips due to permits and resulting data damage



Skips due to mineral no permits



Thank you for coming!!