

TLS Report PNR1z

| Management System: | HSE | File Name: | TLS Event Report 181211_112115.docx | |
|--|---|---------------------------------|-------------------------------------|---------------------|
| Approver: | Senior Geoscientist | Version No: | 1 | |
| Reviewer: | HSE&P Manager, Frac Manager, Technical Director | Date of Issue: | | |
| Author: | | Proposed date of Review: | n/a | |
| Version | Section | Revision Information | Date | Reviser |
| 0.1 | All | Draft Publication | | Senior Geoscientist |
| 1.0 | All | Final Publication | 11/12/18 | Senior Geoscientist |
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| Documents are reviewed as per proposed review date, or sooner if a significant change to the operation has taken place, to ensure relevance to the systems and process that they define. | | | | |

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Event Summary

After operations of sleeve 38 of PNR1z, a seismicity related traffic light system trailing event threshold was exceeded. The seismic event had a local magnitude of 1.5 ML. The seismic event hypocenter shown in the map and x-section by the blue dot, was roughly 311.3 from the injection point.

Event Classification

| Green Event | Amber Light | Red Light | Trailing Event (<=0.5ML) | Trailing Event (>0.5ML) |
|-------------|-------------|-----------|--------------------------|-------------------------|
| | | | | X |

Event Details

| Magnitude (ML) | Date | Time (24hr) BST | Last Sleeve Injection |
|----------------|-------------------|-----------------|-----------------------|
| 1.5 | 11/12/2018 | 11:21:15 | 38 |

Hypocenter Information

| X [mEast] BNG | Y [mNorth] BNG | Z [mTVDGL] | Distance to Nearest Injection Point (m) |
|---------------|----------------|-------------|---|
| 336663 | 432832 | 2401 | 311.3 |

Error / Uncertainties

| P Trace Quality | S Trace Quality | Trace Quality | Min Ellipsoid size (m) | Mid Ellipsoid size (m) | Max Ellipsoid size (m) |
|-----------------|-----------------|---------------|------------------------|------------------------|------------------------|
| 0.87 | 0.43 | 0.39 | 148.49 | 148.49 | 438.206 |

Downhole Hypocenter Information

| X [mEast] BNG | Y [mNorth] BNG | Z [mTVDGL] | Distance to Nearest Injection Point (m) |
|---------------|----------------|-------------|---|
| 336350 | 432763 | 2274 | 121.780 |

Ground Motion & Well Integrity

| Max PPV (mm/sec) | Average PPV (mm/sec) | Fit to GMPE (mm/sec) | Annular Pressure Change (psi) |
|------------------|----------------------|----------------------|-------------------------------|
| 1.37 | 0.68 | 0.8 | 0 |

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Injection Information

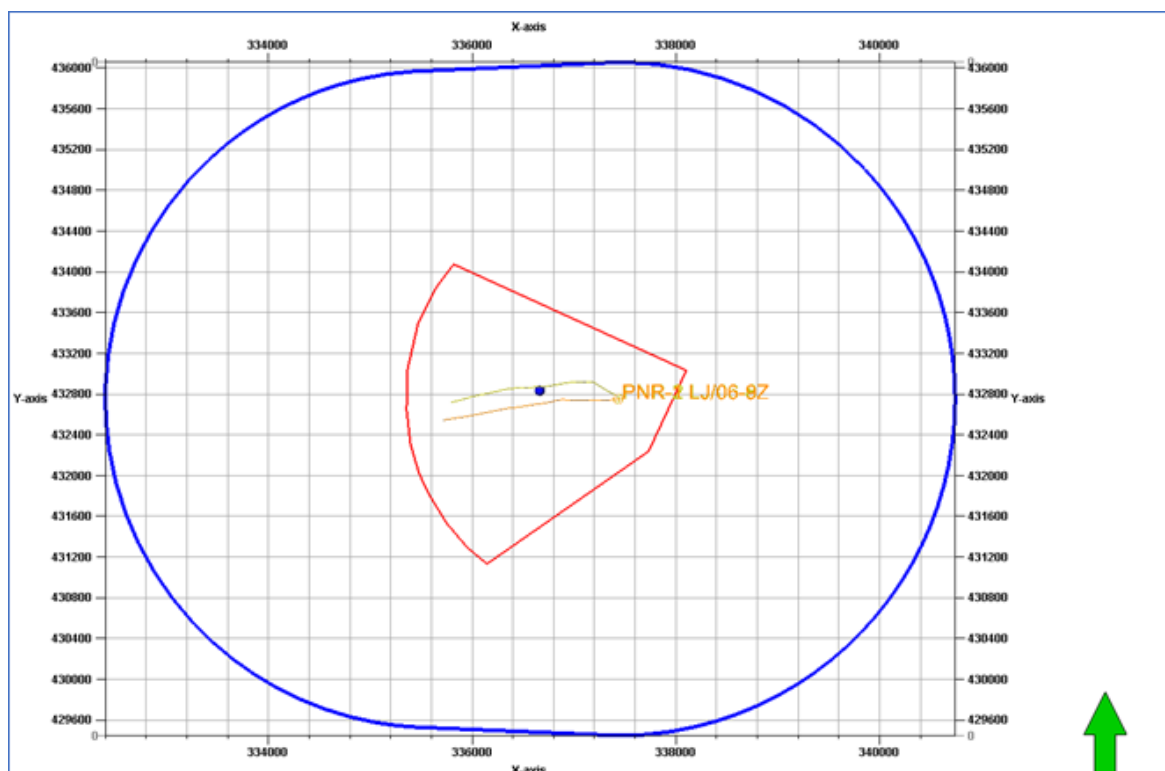
| Sleeve | Fluid Volume Injected (m³) | Proppant Volume Injected (tonnes) | Average Rate (m³/min) | Max Treatment Pressure (surface) (bar) | Average Treatment Pressure (surface) (bar) |
|--------|----------------------------|-----------------------------------|-----------------------|--|--|
| 38 | 269.7 | 27.87 | 3.58 | 621 | 527 |

| Stage (cumulative) | Fluid Volume Injected (m³) (cumulative) | Proppant Volume Injected (tonnes) (cumulative) | Flow Back (m³) (cumulative) |
|--------------------|---|--|-----------------------------|
| 17 | 2937 | 181 | 668 |

Forward Injection Schedule / Additional Mitigation

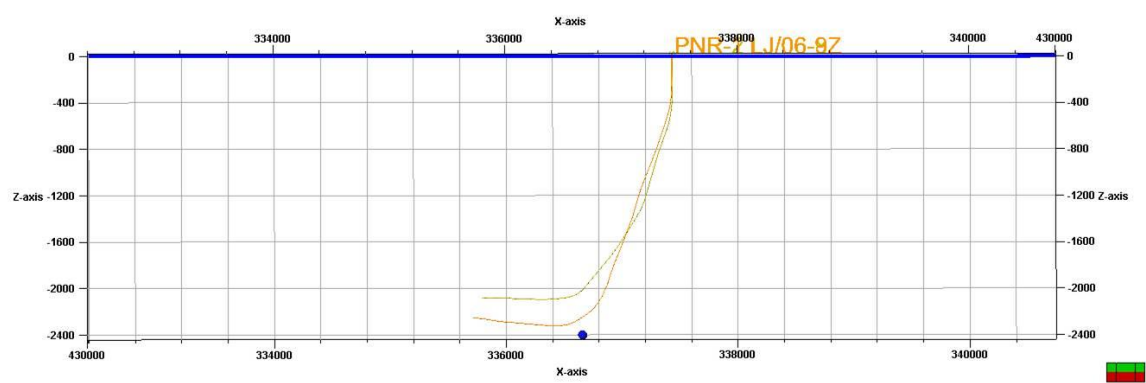
| Waiting Time (hr) (<0.0ML) | Next Stage | Proposed Volume (m³) | Mini Frac | Additional Mitigation |
|----------------------------|------------|----------------------|-----------|-----------------------|
| 18 | 39 | 400 | no | |

Base Map

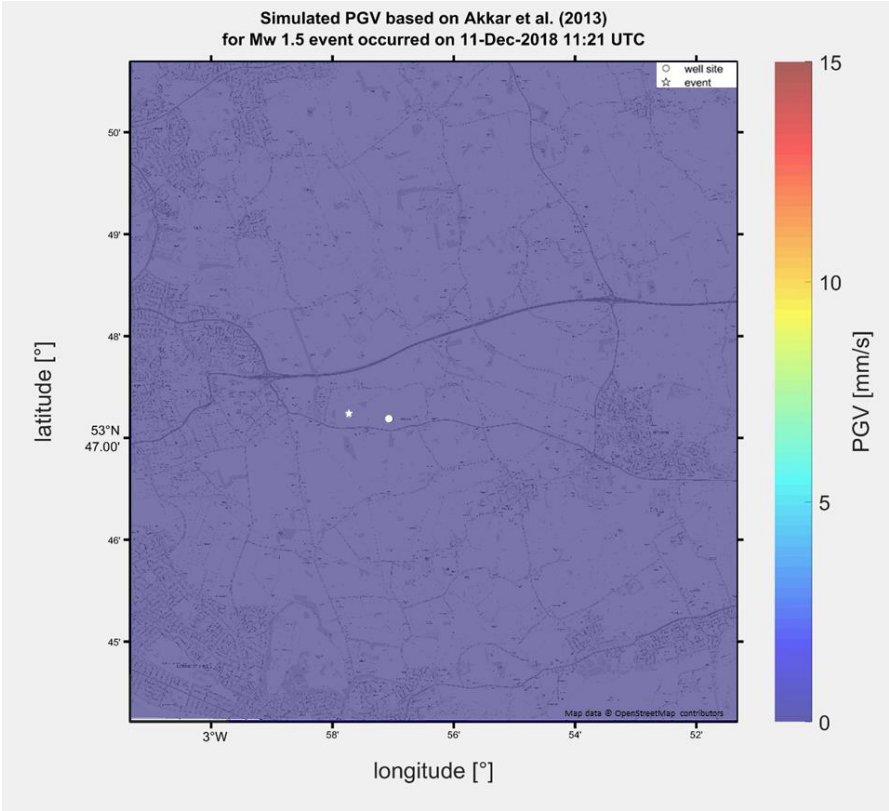


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Cross Section (From South)



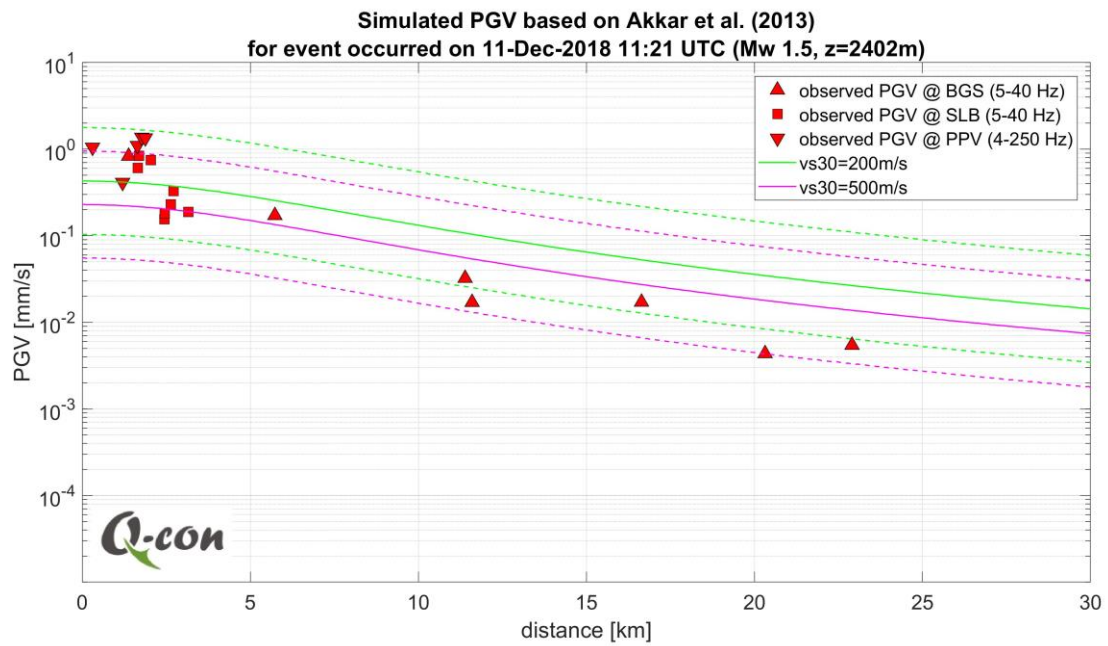
Shake Map



The location of the sensor sites has been redacted on the basis of commercial confidentiality and public safety

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Attenuation Curve



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