



## ORDER 18-90-001 (Amendment #2)

### Kiskatinaw Seismic Monitoring and Mitigation Area Special Project Order

- A. Under section 75(1)(c) of the *Oil and Gas Activities Act*, the Oil and Gas Commission (Commission) designates an innovative method of carrying out oil and gas activities and related activities as a special project in the following area:
- Kiskatinaw Seismic Monitoring and Mitigation Area (KSMMA) Special Project Order (Appendix I)
- B. Per section 75(2) of the *Oil and Gas Activities Act*, the special project designation in this Order is subject to the following conditions:

#### Pre-Operation Requirements:

A permit holder of any well wholly in the KSMMA (see Appendix I) must, prior to initiating hydraulic fracturing operations involving horizontal, multi-stage fracturing in a well (hydraulic fracturing operations) on or after May 28, 2018:

1. Submit a seismic monitoring and mitigation plan with any notice of operation that includes hydraulic fracturing operations. The seismic monitoring and mitigation plan must include:
  - a. A pre-assessment of seismic hazard.
  - b. A seismic monitoring and mitigation outline.
2. Notify persons and other entities of hydraulic fracturing operations at a well in accordance with the requirements set out in Appendix II.
3. Notify the Commission not less than 24 hours and not more than 72 hours before hydraulic fracturing operations begin on a common drilling pad.

#### Active Operation Requirements:

A permit holder of any well wholly located in the KSMMA must, during hydraulic fracturing operations:

1. Deploy an accelerometer within three km of the well trajectory.
2. Have access to a seismic array that will give real-time seismicity readings.
3. On request, submit a summary of monitoring reports to the Commission.

#### Seismic Thresholds During Operations:

The Commission Earthquake Catalog is the magnitude of record for all events. Action by the permit holder is to be initiated upon the first detected actionable magnitude. If the Commission magnitude is higher than the magnitude detected on the permit holders' array, further action will be required at the level appropriate to the Commission recorded magnitude.

Permit holders' actions following seismic activity within 5km of a well trajectory with hydraulic fracturing operations:

1. If the well permit holder or the Commission record a seismic event with a magnitude of 1.5 or greater event, the well permit holder must communicate the initial event to the Commission within 24 hours and develop a protocol satisfactory to the Commission to maintain communication regarding any subsequent magnitude 1.5 or greater events during hydraulic fracturing activities on the common drilling pad. The permit holder must maintain a record of all magnitude 1.5 or greater events during hydraulic fracturing operations.

2. The minimum level at which the well permit holder must take action and initiate their mitigation plan is magnitude 2.0.
3. If the well permit holder or the Commission record a seismic event with a magnitude of 3.0 or greater, the well permit holder must suspend hydraulic fracturing operations on the common drilling pad immediately.
  - a. If the seismic event can be attributed to a specific well from the common drilling pad, then all wells within the same stratigraphic unit and dominant direction shall be prohibited from fracturing operations for a minimum 5 calendar days. Otherwise, all wells from the common drilling pad will be suspended for a minimum 5 calendar days. Operations to reduce reservoir pressure, such as flowing back, may be permitted with the written consent from the Commission. Wells that are exempt from suspension under this clause may continue hydraulic fracturing activities with the written consent from the Commission.
  - b. If a subsequent event of magnitude 3.0 or greater occurs during the suspension period outlined in a. above, the suspension period will recommence with a 5 calendar day suspension.
  - c. After 5 calendar days, the suspended well(s) from a. above may continue operations provided the permit holder has submitted a revised completion and mitigation program that is specifically focused on reducing further seismicity from hydraulic fracturing operations.
  - d. Any well recommencing fracturing activities as outlined in c. above will have the following restrictions:
    - i. Any seismic event of magnitude 2.2 or greater, will result in the immediate 12 hour pause of the well identified as causing the event;
    - ii. Any seismic event of magnitude 2.7 or greater, will result in the immediate suspension of all wells on the common drilling pad for a minimum 5 calendar days. Operations to reduce reservoir pressure, such as flowing back, may be permitted with the written consent from the Commission.
    - iii. Resumption of fracturing activities may continue after a technical conference with the Commission and upon submission of a revised completion program focused on reducing further seismic events from the well pad.
    - iv. Wells that are exempt from suspension under clause a. above may continue hydraulic fracturing activities with the written consent from the Commission.
4. If the common drilling pad is identified as being responsible for a cluster of seismic events, the Commission may require the suspension of hydraulic fracturing activities according to the following restrictions:
  - a. A cluster is defined here as five or more unique seismic events that are reported as felt and/or are in excess of magnitude 2.5 within a 72 hour period identified as being caused by fracturing activities from a common drilling pad.
  - b. A common drilling pad suspended due to a cluster of seismic events will pause activity for 24 hours. If a cluster of seismic events can be attributed to a specific well from the common drilling pad, then all wells within the same stratigraphic unit and dominant direction shall be prohibited from fracturing operations for 24 hours. Otherwise, all wells from the common drilling pad will be suspended for a minimum 24 hours. Operations to reduce reservoir pressure, such as flowing back, may be permitted with the written consent from the Commission. Wells that are exempt from suspension under this clause may continue hydraulic fracturing activities with the written consent from the Commission.
  - c. Resumption of fracturing activities may proceed pursuant to a technical conference with the Commission and upon submission of a revised completion program focused on reducing further seismic events from the well pad.



Post-Operation Requirements:

Submit to the Commission a report respecting monitoring of hydraulic fracturing operations in a format acceptable to the Commission within 30 days of concluding hydraulic fracturing operations.

Exemptions:

Permit holders may provide a written submission to modify and/or remove conditions outlined above.

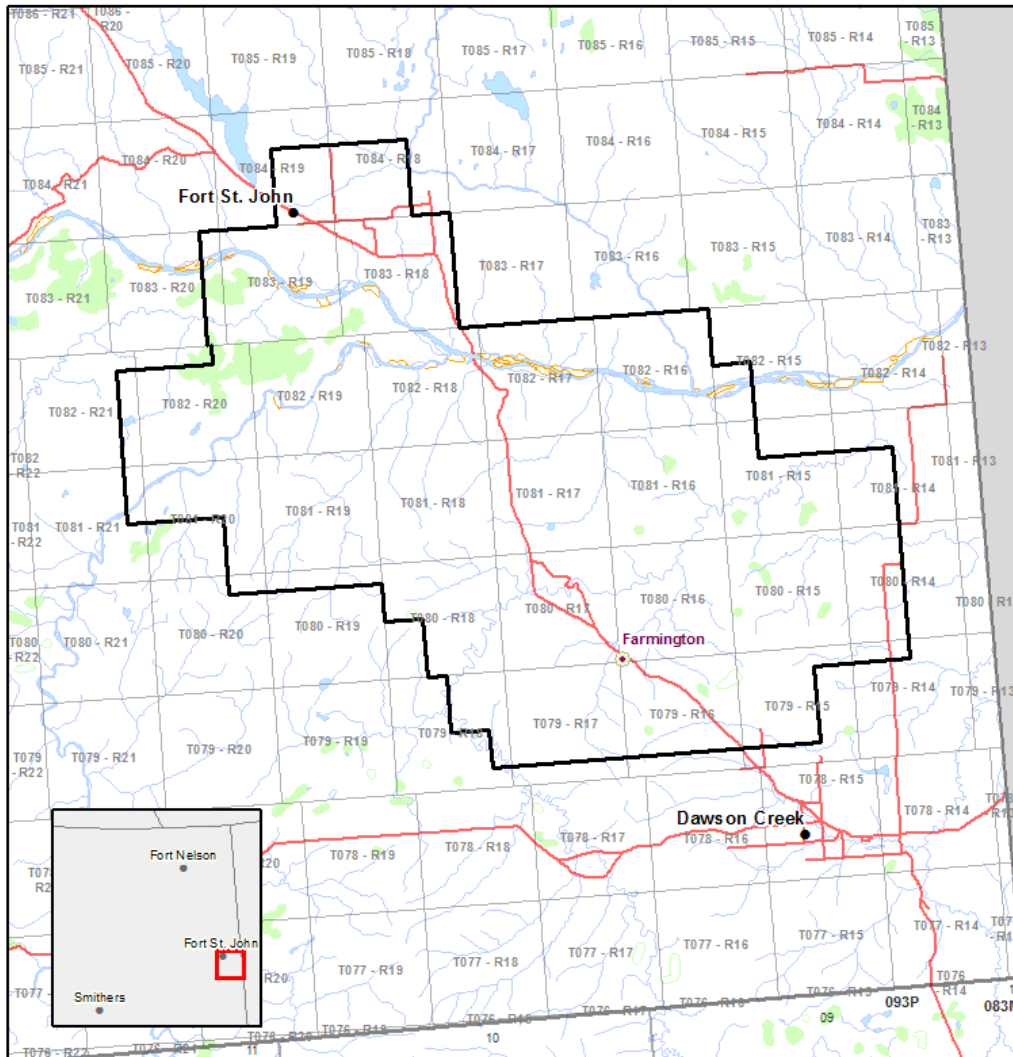
A handwritten signature in black ink, appearing to read "Paul Jeakins", written over a horizontal line.

Paul Jeakins  
Commissioner and CEO  
BC Oil and Gas Commission

DATED AT the City of Victoria, in the Province of British Columbia, this 16<sup>th</sup> day of April 2021

**Appendix I:**

**Map: Kiskatinaw Seismic Monitoring and Mitigation Area (KSMMA)**



**Map Legend**

Kiskatinaw Seismic Monitoring and Mitigation Area (KSMMA) Outline: **——**

**KSMMA Description:**

T79 R14W6 Sec 31-33, T79 R15W6 Sec 7-10, 14-22, 27-36, T79 R16W6 Sec 7-36, T79 R18W6 Sec 12, 13, 22-27, 34-46, T80 R14W6 Sec 4-9, 16-21, 28-33, T80 R15W6 Sec 1-36, T80 R16W6 Sec 1-36, T80 R17W6 Sec 1-36, T80 R18W6 Sec 1-4, 9-16, 19-36, T80 R19W6 31-36, T80 R20W6 Sec 35, 36, T81 R14W6 Sec 4-9, 16-21, T81 R15W6 Sec 1-24, 29-32, T81 R16W6 Sec 1-36, T81 R17W6 Sec 1-36, T81 R18W6 Sec 1-36, T81 R19W6 Sec 1-36, T81 R20W6 Sec 1, 2, 11-14, 19-36, T81 R21W6 Sec 24, 25, 36, T82 R15W6 Sec 5-8, 17, 18, T82 R16W6 Sec 1-36, T82 R17W6 Sec 1-36, T82 R18W6 Sec 1-36, T82 R19W6 Sec 1-36, T82 R20W6 Sec 1-30, 35, 36, T82 R21W6 1, 12, 13, 24, 25, T83 R18 Sec 1-36, T83 R19 W6 Sec 1-36, T83 R20 Sec 1, 12, 13, 24, 25, 36



**Appendix II:**

**NOTIFICATION REQUIREMENTS**

- (1) Subject to (4), a permit holder must give the information set out in (2) an individual who resides on land that is located in the KSMMA and within 3 km of the well trajectory (resident)
- (2) Subject to (4), the information provided under (1) must include:
  - (a) a description of what activities will be taking place, where the activities will be located and when the activities will happen;
  - (b) an explanation that the activities may induce seismic events;
  - (c) a description of what seismic events are like and impacts that might occur with seismic events;
  - (d) well permit holder contact details, and an explanation that the Commission may require the well permit holder to contact recipients as a result of a seismic event;
  - (e) a description of how these activities are regulated and contact information for the BC Oil and Gas Commission (Commission);
  - (f) an outline of seismic monitoring and mitigation plans;
  - (g) a description of monitoring and measurement as well as reporting; and
  - (h) additional information as may be practical, necessary or required in the circumstance.
- (3) Subject to (4), the information given under (1) must be provided no less than two days prior to initiating hydraulic fracturing operations as follows:

PERSON OR OTHER ENTITY	NOTIFICATION METHOD
An individual who resides on land that is: <ul style="list-style-type: none"> <li>• located <u>within</u> district municipalities of Fort St. John or Taylor</li> <li>• located within the KSMMA; and</li> <li>• located within 3 km of the well trajectory.</li> </ul>	Notification will preferably be provided verbally and in-person, or by phone. Alternatively, notification may be accomplished using the following method(s): <ul style="list-style-type: none"> <li>(a) by leaving a copy with the individual or an agent of that individual;</li> <li>(b) by sending a copy by ordinary mail or registered mail to the address at which that individual resides or carries on business;</li> <li>(c) by sending a copy by electronic mail to the electronic mail address provided by that individual;</li> <li>(d) by leaving a copy in a mail box or mail slot for the address at which that individual resides or carries on business;</li> <li>(e) by attaching a copy to a door or other conspicuous place at the address at which that individual resides;</li> <li>(f) through other means that ensures adequate notification, including but not limited to public meeting, broadcast, publication, and public posting.</li> </ul>

<p>A person who resides on land that is:</p> <ul style="list-style-type: none"> <li>• located <u>outside</u> the district municipalities of Fort St. John or Taylor;</li> <li>• located within the KSMMA; and</li> <li>• located within 3 km of the well trajectory.</li> </ul>	<p>Notification will preferably be provided verbally and in-person, or by phone. Alternatively, notification may be accomplished using the following method(s):</p> <ul style="list-style-type: none"> <li>(a) by leaving a copy with the individual or an agent of that individual;</li> <li>(b) by sending a copy by ordinary mail or registered mail to the address at which that individual resides;</li> <li>(c) by sending a copy by electronic mail to the electronic mail address provided by that individual;</li> <li>(d) by leaving a copy in a mail box or mail slot for the address at which that individual resides;</li> <li>(e) by attaching a copy to a door or other conspicuous place at the address at which that individual resides.</li> </ul>
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- (4) The Commission, on written request, may exempt a person from one or more of the requirements set out in (1) to (3) above and, on making an exemption, substitute other requirements.



## **GUIDANCE: Kiskatinaw Seismic Monitoring and Mitigation Area Special Project Order**

The Kiskatinaw Seismic Monitoring and Mitigation Area (KSMMA) Special Project Order (Appendix I)

### Pre-Operation Requirements:

A permit holder of any well wholly in the KSMMA (see Appendix I) must, prior to initiating hydraulic fracturing operations involving horizontal, multi-stage fracturing in a well (hydraulic fracturing operations) on or after May 28, 2018:

4. Submit a seismic monitoring and mitigation plan with any notice of operation that includes hydraulic fracturing operations. The seismic monitoring and mitigation plan must include:  
*Guidance: When submitting a notice of operation via eSubmission for a well within the Kiskatinaw SMMA, the following documents must be uploaded as supplementary documents in either word (.doc/.docx) or portable document format (.pdf).*
  - a. A pre-assessment of seismic hazard.
  - b. A seismic monitoring and mitigation outline. *Guidance: Please follow the pre-assessment template available on bcogc.ca: [https://www.bcogc.ca/files/operations-documentation/Induced-Seismicity-Data-and-Submission/Seismic-Pre\\_Assessment-Template\\_2020JUN01.pdf](https://www.bcogc.ca/files/operations-documentation/Induced-Seismicity-Data-and-Submission/Seismic-Pre_Assessment-Template_2020JUN01.pdf)*
5. Notify persons and other entities of hydraulic fracturing operations at a well in accordance with the requirements set out in Appendix II. *Guidance: See Appendix II for additional information*
6. Notify the Commission not less than 24 hours and not more than 72 hours before hydraulic fracturing operations begin on a common drilling pad. *Guidance: The permit holder must inform the Commission prior to beginning fracturing (pumping) operations within the timeframe given. Notification to the Commission must be one to three days before fracturing (pumping) begins via email (OGC.ResourceConservation@bcogc.ca). This is not for notification of equipment moves or setup. One notification for all wells on a common drilling pad is sufficient.*

### Active Operation Requirements:

A permit holder of any well wholly located in the KSMMA must, during hydraulic fracturing operations:

1. Deploy an accelerometer within three km of the well trajectory. *Guidance: Minimum of one ground motion monitor per common drilling pad location.*
  - *Must be located within three km of the well trajectory.*
  - *If additional ground motion monitors are deployed within five km of the common drilling pad, include, in the ground motion report, any ground motion data obtained from these monitors.*
  - *Monitoring during all fracturing (pumping) operations during hydraulic fracturing activities. Monitoring during flowback is encouraged, but not required. If monitoring is on-going during flowback, any events of 0.008g and above or reported felt events must be included in the final report.*
  - *Ground motion monitors must meet the following minimum criteria:*
    - *Dynamic range: +/- 2g.*
    - *Minimum detectability of 0.005g.*
  - *The Commission may, at any time, request ground motion monitoring data.*
2. Have access to a seismic array that will give real-time seismicity readings. *Guidance: The permit holder must have access to real-time, continuous seismic monitoring and analysis during all fracturing operations that provide a magnitude of completeness of magnitude 1.5 for a radius of five km around the well trajectories.*



3. On request, submit a summary of monitoring reports to the Commission. *Guidance: The permit holder may be requested to submit seismic event location data (lat, long, date, time, magnitude) for all seismic events equal to or above magnitude 1.5 or as requested by the Commission.*

#### Seismic Thresholds During Operations:

The Commission Earthquake Catalog is the magnitude of record for all events. Action by the permit holder is to be initiated upon the first detected actionable magnitude. If the Commission magnitude is higher than the magnitude detected on the permit holders' array, further action will be required at the level appropriate to the Commission recorded magnitude. *Guidance: The Commission follows a Local Magnitude determination as outlined in the INDB 2021-05: <https://www.bco.gc.ca/news/adoption-of-local-magnitude-determination-indb-2021-05/>*

Permit holders' actions following seismic activity within 5km of a well trajectory with hydraulic fracturing operations:

5. If the well permit holder or the Commission record a seismic event with a magnitude of 1.5 or greater event, the well permit holder must communicate the initial event to the Commission within 24 hours and develop a protocol satisfactory to the Commission to maintain communication regarding any subsequent magnitude 1.5 or greater events during hydraulic fracturing activities on the common drilling pad. The permit holder must maintain a record of all magnitude 1.5 or greater events during hydraulic fracturing operations. *Guidance: The permit holder must communicate all events, including magnitude, location, date and time for any seismic event equal to or greater than magnitude 1.5.*
6. The minimum level at which the well permit holder must take action and initiate their mitigation plan is magnitude 2.0. *Guidance: the well permit holder's submitted mitigation response plan must initiate at magnitude 2.0 or less.*
7. If the well permit holder or the Commission record a seismic event with a magnitude of 3.0 or greater, the well permit holder must suspend hydraulic fracturing operations on the common drilling pad immediately.
  - a. If the seismic event can be attributed to a specific well from the common drilling pad, then all wells within the same stratigraphic unit and dominant direction shall be prohibited from fracturing operations for a minimum 5 calendar days. Otherwise, all wells from the common drilling pad will be suspended for a minimum 5 calendar days. Operations to reduce reservoir pressure, such as flowing back, may be permitted with the written consent from the Commission. Wells that are exempt from suspension under this clause may continue hydraulic fracturing activities with the written consent from the Commission.
  - b. If a subsequent event of magnitude 3.0 or greater occurs during the suspension period outlined in a. above, the suspension period will recommence with a 5 calendar day suspension.
  - c. After 5 calendar days, the suspended well(s) from a. above may continue operations provided the permit holder has submitted a revised completion and mitigation program that is specifically focused on reducing further seismicity from hydraulic fracturing operations.
  - d. Any well recommencing fracturing activities as outlined in c. above will have the following restrictions:
    - i. Any seismic event of magnitude 2.2 or greater, will result in the immediate 12 hour pause of the well identified as causing the event;
    - ii. Any seismic event of magnitude 2.7 or greater, will result in the immediate suspension of all wells on the common drilling pad for a minimum 5 calendar days. Operations to reduce reservoir pressure, such as flowing back, may be permitted with the written consent from the Commission.



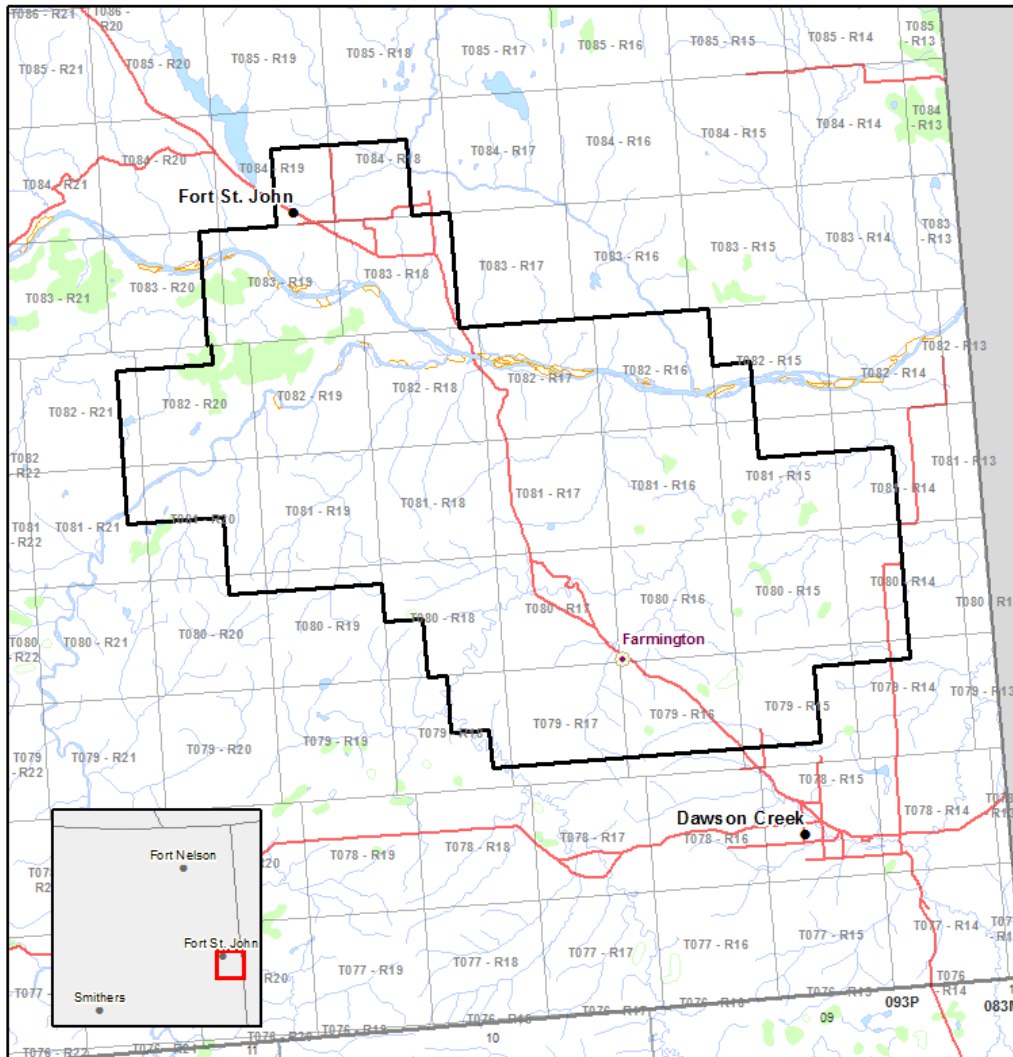
- iii. Resumption of fracturing activities may continue after a technical conference with the Commission and upon submission of a revised completion program focused on reducing further seismic events from the well pad.
    - iv. Wells that are exempt from suspension under clause a. above may continue hydraulic fracturing activities with the written consent from the Commission.
8. If the common drilling pad is identified as being responsible for a cluster of seismic events, the Commission may require the suspension of hydraulic fracturing activities according to the following restrictions:
  - a. A cluster is defined here as five or more unique seismic events that are reported as felt and/or are in excess of magnitude 2.5 within a 72 hour period identified as being caused by fracturing activities from a common drilling pad.
  - b. A common drilling pad suspended due to a cluster of seismic events will pause activity for 24 hours. If a cluster of seismic events can be attributed to a specific well from the common drilling pad, then all wells within the same stratigraphic unit and dominant direction shall be prohibited from fracturing operations for 24 hours. Otherwise, all wells from the common drilling pad will be suspended for a minimum 24 hours. Operations to reduce reservoir pressure, such as flowing back, may be permitted with the written consent from the Commission. Wells that are exempt from suspension under this clause may continue hydraulic fracturing activities with the written consent from the Commission.
  - c. Resumption of fracturing activities may proceed pursuant to a technical conference with the Commission and upon submission of a revised completion program focused on reducing further seismic events from the well pad.

Post-Operation Requirements:

1. Submit to the Commission a report respecting monitoring of hydraulic fracturing operations in a format acceptable to the Commission within 30 days of concluding hydraulic fracturing operations. *Guidance: This requirement refers to the submission of a ground motion monitoring report. A ground motion monitoring report must be submitted to the Commission in pdf format outlining accelerometer deployment locations and a data summary.*
  - *If applicable, one csv report, using the Commission's standard format, summarizing all ground motions equal to 0.008g and greater or reported events that were felt at surface regardless of intensity and one SEED format file for each of the aforementioned ground motions.*
  - *For each event of 0.008g and above or felt event, the SEED file containing instrument response and waveform from 30 seconds before the observed event and 60 seconds after must be submitted.*
  - *The ground motion monitoring reports must be submitted within 30 days of the completion of hydraulic fracturing activities via email to [welldatamail@bcogc.ca](mailto:welldatamail@bcogc.ca).*
  - *File naming:  
WANUM\_GMMR\_YYYYMMDD\_OPTIONALDESCRIPTION.PDF/CSV/SEED*
  - *Ground motion monitoring reports are considered to be information obtained from or about a well. As such, they will be treated as well reports and well data, as per 17 (1) of the Oil and Gas Activities Act General Regulation.*

**Appendix I:**

**Map: Kiskatinaw Seismic Monitoring and Mitigation Area (KSMMA)**



**Map Legend**

Kiskatinaw Seismic Monitoring and Mitigation Area (KSMMA) Outline: **——**

**KSMMA Description:**

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## Appendix II:

### NOTIFICATION REQUIREMENTS

- (5) Subject to (4), a permit holder must give the information set out in (2) an individual who resides on land that is located in the KSMMA and within 3 km of the well trajectory (resident)
- (6) Subject to (4), the information provided under (1) must include:
  - (i) a description of what activities will be taking place, where the activities will be located and when the activities will happen; *Guidance: Include well pad(s) location and well trajectories.*
  - (j) an explanation that the activities may induce seismic events;
  - (k) a description of what seismic events are like and impacts that might occur with seismic events;
    - a. well permit holder contact details, and an explanation that the Commission may require the well permit holder to contact recipients as a result of a seismic event; *Guidance: If a resident or stakeholder informs the well permit holder during their communication that they do not wish to be contacted in the event of a seismic event, the well permit holder is not required to follow up. A resident or stakeholder may elect at anytime during the activities to change their preference. A seismic event is any event above magnitude 2.5, a confirmed felt event or a seismic event of sufficient magnitude that would be expected to be felt given the seismic history of the operating area.*
  - (l) a description of how these activities are regulated and contact information for the BC Oil and Gas Commission (Commission); *Guidance: 24 hour contact line: 1-800-663-3456*
  - (m) an outline of seismic monitoring and mitigation plans;
  - (n) a description of monitoring and measurement as well as reporting; and
  - (o) additional information as may be practical, necessary or required in the circumstance.