

GENERAL ORDER 2019-007 Amendment 1

Section 49 *Oil and Gas Activities Act*

Issued to:

AQT Water Management Inc.
700-1816 Crowchild Trail NW
Calgary, Alberta T2M 3Y7

Attention: Mr. Tom Johnston

Amendment:

Pursuant to section 49(7) of the *Oil and Gas Activities Act* (the Act), General Order 2019-007 issued on July 12, 2019 to AQT Water Management Inc. (AQT) is amended as follows:

Order:

Pursuant to section 49(1)(e) of the *Oil and Gas Activities Act* (the Act), I, Patrick Smook, order that AQT Water Management Inc.(AQT) must:

1. On or before September 30, 2019 submit to the Commission for review and approval, a detailed proposal prepared by a qualified professional with expertise in hydrogeology for a preliminary groundwater assessment as described in the attached Appendix A.
2. Unless the domestic water well land owner does not consent, complete the collection of baseline groundwater samples from all existing domestic water wells located within 600 metres of the well pad boundary of AQT Ft St John, WA# 03010 located at 11-12-084-19W6M (the Subject Well) by October 31, 2019. The suite of analytical parameters for baseline testing shall include routine water quality parameters, including total dissolved solids, pH, major cations and anions, total and dissolved metals, and dissolved gases (C1-C3).
3. Submit the results of the domestic water well sampling, as required by Item 2, to the Commission by December 31, 2019, including a consultation record of all domestic water well land owners that were contacted in response to this requirement.
4. Employ a qualified professional with expertise in hydrogeology to conduct the preliminary groundwater assessment as per the proposal approved by the Commission, and submit a preliminary groundwater assessment report (as described in Appendix A) to the Commission on or before December 31, 2019, unless an alternative submission date is authorized by the Commission

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Conditions:

- A. This order shall remain in effect until amended or terminated in whole or in part by the Commission.

Reasons:

I make this order for the following reasons:

1. AQT is the permit holder of the Subject Well.
2. AQT is the holder of an approval for produced water and non-hazardous waste disposal into the Cadomin formation of the Subject Well issued by the Commission pursuant to section 75 of the Act under Special Project Order 16-02-002, as subsequently amended (Special Project Approval Order).
3. On May 16, 2019 Commission staff attended the Subject Well and noted the following:
 - a. The surface casing vent (SCV) was found closed and a bucket was observed beside the annulus valve.
 - b. The operator stated he had drained the annulus earlier in the day because the casing annulus was noted to have a pressure of 35 kilopascals.
 - c. The operator was asked to open the SCV and when the vent was opened liquid and gas burst out of the vent.
4. On May 17, 2019 Commission staff attended the Subject Well and noted the following:
 - a. The tubing and annulus were on vacuum.
 - b. The SCV valve was closed and when the operator opened the SCV it was on vacuum.
5. On May 17, 2019 the Commission issued General Order (GO) 2019-006 to AQT requiring AQT to suspend all disposal activities at the Subject Well.
6. AQT conducted well operations on the Subject Well and on May 22, 2019 the integrity of the Subject Well was confirmed to be compromised due to a loss of hydraulic isolation during disposal operations.
7. GO 2019-006 was terminated on July 3, 2019 after Commission staff was satisfied that AQT had re-established hydraulic isolation on the Subject Well and issued Amendment #4 to the Special Project Approval Order.
8. In consultation with Commission engineering staff, Commission hydrogeology staff are of the view that the lack of hydraulic isolation inside and outside the wellbore may have resulted in produced water entering the usable groundwater zone.
9. The base of usable groundwater at the site has been estimated by Commission geology staff to be at a depth of approximately 315 to 341 metres below kelly bushing (mKB). The loss of integrity has been confirmed to include the outer well barrier, and Commission analysis of available data indicates potential depths for

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fluids to enter the usable groundwater zone between 170- 170.5 mKB and at 300 mKB.

10. Spills at surface due to fluid leakage through the SCV also occurred. A shallow groundwater monitoring program (<10m depth) has been in place at the site since 2016 as a condition of the Special Project Approval Order. Sampling has not been completed since the May 2019 incident.
11. There are domestic water well records indicated to the west, northwest, and northeast of the Subject Well. The closest water well record is indicated to be 390m in distance.
12. A groundwater assessment program will provide information with respect to whether produced water entered the usable groundwater zone and if further action is required to contain/address any contamination.
13. On July 12, 2019 GO 2019-007 was issued to AQT.
14. On August 12, 2019 the Commission received a document entitled “Preliminary Groundwater Assessment Plan – FSJ 11-12-084-19 W6M” from AQT prepared by Baseline Water Resource Inc. (the Proposal).
15. The Commission has reviewed the Proposal as submitted and determined it does not satisfy Item 1 of GO 2019-007.
16. AQT failed to include a detailed proposal for the installation of monitoring wells with “rationale for the monitoring well locations, depths, and construction” based on a presentation and review of well integrity information, incident data and geological, hydrogeological data in the Proposal.
17. The Proposal also states that “if requested by the land owner” AQT will conduct domestic water well monitoring. However, Appendix A of GO 2019-007 requires domestic water well sampling to occur unless landowner consent cannot be obtained.
18. In order to obtain an accurate baseline, and to provide groundwater chemistry evidence to confirm the domestic water wells have not been impacted as a result of the incident, domestic water well sampling needs to be conducted in a timely manner.
19. I am of the opinion this order is necessary to protect the environment.

Review and Appeal

AQT may request a review of this order under section 70 of the Act by submitting a request for review to: ogc.determinationreviews@bcogc.ca.

AQT may appeal this order to the Oil and Gas Appeal Tribunal under section 72 of the Act. The process for appeals may be found at www.ogat.gov.bc.ca and a notice of appeal may be sent to the Oil and Gas Appeal Tribunal at:

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Oil and Gas Appeal Tribunal
PO Box 4925 Stn Prov Govt
Victoria, BC V8W 9V1

A handwritten signature in black ink, appearing to read "Patrick Smook". The signature is stylized with a large, looping initial "P" and a long horizontal stroke extending to the right.

Patrick Smook
Acting Vice President, Operations
BC Oil and Gas Commission

DATED AT Fort St. John, in the Province of British Columbia, this 22nd day of August,
2019.

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APPENDIX A – PRELIMINARY GROUNDWATER ASSESSMENT REQUIREMENTS

The preliminary groundwater assessment program shall involve:

- 1) The installation of two dedicated groundwater monitoring wells to permit sampling of groundwater and monitoring of groundwater levels. Unless authorized by the Commission, monitoring wells shall be installed to minimum depths of 200 m below ground and constructed to enable groundwater sampling at depth intervals coincident with, and representative of, porous zones, with consideration of the depths of well integrity issues and potential disposal fluid release depths. The rationale for monitoring well locations, depths, and construction shall be included with the proposal for this assessment program. Specifically, the proposal shall include a description of proposed monitoring well drilling, installation, and logging methodologies and proposed monitoring well design details, supported by documented review and analysis of all supporting geological, hydrogeological, well integrity and incident data.
- 2) Sampling and analysis of samples from existing on site shallow groundwater monitoring wells for the same parameters as previous sampling events.
- 3) The submission of a preliminary groundwater assessment report to the Commission by December 2, 2019 with respect to 1 and 2 above, and which shall include:
 - a. a description of the site and surrounding area
 - b. a desktop hydrogeological analysis of the local and regional conditions, supported with cross sections and maps
 - c. a summary of disposal well construction and relevant well integrity issues
 - d. a description of the methodologies employed for the assessment
 - e. details of monitoring well installation and construction, including geological conditions encountered during drilling
 - f. presentation of all analytical and water level monitoring results in tabular and/or graphical form as appropriate (with appended laboratory reports)
 - g. a discussion of the results in the context of local and regional hydrogeology, environmental impact, and risk to groundwater, and
 - h. recommendations for further investigation based on the results, and a proposed long term monitoring program.

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Issued to:

AQT Water Management Inc.
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Calgary, Alberta T2M 3Y7

Attention: Mr. Tom Johnston

Order:

Pursuant to section 49(1)(e) of the *Oil and Gas Activities Act* (the Act), I, Patrick Smook, order that AQT Water Management Inc.(AQT) must:

1. On or before August 15, 2019 submit to the Commission for review and approval, a detailed proposal prepared by a qualified professional with expertise in hydrogeology for a preliminary groundwater assessment as described in the attached Appendix A.
2. Employ a qualified professional with expertise in hydrogeology to conduct the preliminary groundwater assessment as per the proposal approved by the Commission, and submit a preliminary groundwater assessment report to the Commission on or before December 2, 2019.

Conditions:

- A. This order shall remain in effect until amended or terminated in whole or in part by the Commission.

Reasons:

I make this order for the following reasons:

1. AQT is the permit holder of AQT Ft St John, WA# 03010 located at 11-12-084-19W6M (the Subject Well).
2. AQT is the holder of an approval for produced water and non-hazardous waste disposal into the Cadomin formation of the Subject Well issued by the Commission pursuant to section 75 of the Act under Special Project Order 16-02-002, as subsequently amended (Special Project Approval Order).
3. On May 16, 2019 Commission staff attended the Subject Well and noted the following:
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- b. The operator stated he had drained the annulus earlier in the day because the casing annulus was noted to have a pressure of 35 kilopascals.
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4. On May 17, 2019 Commission staff attended the Subject Well and noted the following:
 - a. The tubing and annulus were on vacuum.
 - b. The SCV valve was closed and when the operator opened the SCV it was on vacuum.
5. On May 17, 2019 the Commission issued General Order (GO) 2019-006 to AQT requiring AQT to suspend all disposal activities at the Subject Well.
6. AQT conducted well operations on the Subject Well and on May 22, 2019 the integrity of the Subject Well was confirmed to be compromised due to a loss of hydraulic isolation during disposal operations.
7. GO 2019-006 was terminated on July 3, 2019 after Commission staff was satisfied that AQT had re-established hydraulic isolation on the Subject Well and issued Amendment #4 to the Special Project Approval Order.
8. Commission hydrogeology staff are of the view that the lack of hydraulic isolation inside and outside the wellbore may have resulted in produced water entering the usable groundwater zone.
9. The base of usable groundwater at the site has been estimated by Commission geology staff to be at a depth of approximately 315 to 341 metres below kelly bushing (mKB). The loss of integrity has been confirmed to include the outer well barrier, and Commission analysis of available data indicates potential depths for fluids to enter the usable groundwater zone between 170- 170.5 mKB and at 300 mKB.
10. Spills at surface due to fluid leakage through the SCV also occurred. A shallow groundwater monitoring program (<10m depth) has been in place at the site since 2016 as a condition of the Special Project Approval Order. Sampling has not been completed since the May 2019 incident.
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Victoria, BC V8W 9V1

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Patrick Smook
Acting Vice President, Operations
BC Oil and Gas Commission

DATED AT Fort St. John, in the Province of British Columbia, this 12th day of July, 2019.

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APPENDIX A – PRELIMINARY GROUNDWATER ASSESSMENT REQUIREMENTS

The preliminary groundwater assessment program shall involve:

- 1) The installation of two dedicated groundwater monitoring wells to permit sampling of groundwater and monitoring of groundwater levels. Unless authorized by the Commission, monitoring wells shall be installed to minimum depths of 200 m below ground and constructed to enable groundwater sampling at depth intervals coincident with, and representative of, porous zones, with consideration of the depths of well integrity issues. (The rationale for monitoring well locations, depths, and construction shall be included with the proposal for this assessment program).
- 2) The collection of baseline groundwater samples from all existing domestic water wells located within 600 m of the Subject Well pad boundary (both registered and unregistered water wells, and subject to landowner permission). A record shall be created and maintained of all domestic well landowners who are contacted in response to this requirement. The suite of analytical parameters for baseline testing shall include routine water quality parameters, including TDS, pH, major cations and anions, total and dissolved metals, and dissolved gases (C1-C3).
- 3) Sampling and analysis of samples from existing on site shallow groundwater monitoring wells for the same parameters as previous sampling events.
- 4) The submission of a preliminary groundwater assessment report to the Commission by December 2, 2019 with respect to 1, 2, and 3, above, and which shall include:
 - a. a description of the site and surrounding area
 - b. a desktop hydrogeological analysis of the local and regional conditions, supported with cross sections and maps
 - c. a summary of disposal well construction and relevant well integrity issues
 - d. a description of the methodologies employed for the assessment
 - e. details of monitoring well installation and construction, including geological conditions encountered during drilling
 - f. presentation of all analytical and water level monitoring results in tabular and/or graphical form as appropriate (with appended laboratory reports)
 - g. a discussion of the results in the context of local and regional hydrogeology, environmental impact, and risk to groundwater, and
 - h. recommendations for further investigation based on the results, and a proposed long term monitoring program.