

STATE OF ALASKA
ALASKA OIL AND GAS CONSERVATION COMMISSION
333 West 7th Avenue, Suite 100
Anchorage Alaska 99501

Re: THE APPLICATION OF Buccaneer Alaska) Docket Number: AEO-11-01
Operations LLC for an Aquifer Exemption) Aquifer Exemption Order No. 15
Order for the Kenai Loop Field in Townships) **CORRECTED**
5 and 6 North, Range 11 West, Seward)
Meridian, in conformance with 20 AAC) Sterling and Beluga Formations
25.440.) Kenai Loop Field
) Kenai Peninsula Borough, Alaska
)
) November 28, 2012

IT APPEARING THAT:

1. By application received March 16, 2012, Buccaneer Alaska Operations LLC (Buccaneer), operator of the Kenai Loop Field, requested an order from the Alaska Oil and Gas Conservation Commission (AOGCC) exempting aquifers in the Sterling and Beluga Formations, within the Kenai Loop Field, Kenai Peninsula Borough, Alaska.
2. In accordance with 20 AAC 25.540, notice of opportunity for a public hearing was published in the Alaska Journal of Commerce on April 15, 2012. In addition, on April 10, 2012 the AOGCC published that notice of opportunity for public hearing on the State of Alaska Online Public Notices website, on the AOGCC's website, electronically transmitted the notice to all persons on the AOGCC's email distribution list, and mailed printed copies of the notice to all persons on the AOGCC's mailing distribution list. The tentatively scheduled hearing date was May 17, 2012, but the hearing was subsequently rescheduled to May 22, 2012.
3. The AOGCC has authority to issue an aquifer exemption. 20 AAC 25.440.
4. The AOGCC held the May 22, 2012 hearing despite not receiving any comments, protests or requests for a public hearing. Buccaneer provided testimony, and the hearing record was left open to allow Buccaneer to respond to questions from the AOGCC.
5. The AOGCC requested clarification of certain items on May 31, 2012. Buccaneer provided responses on June 5, 2012 and July 5, 2012.
6. The information submitted by Buccaneer and public well history records for the Kenai Loop #3 well are the basis for this order.

FINDINGS:

1. Operator: Buccaneer operates the Kenai Loop Field, which is located within the limits of the City of Kenai, Kenai Peninsula Borough, Alaska.

2. Extent of Proposed Aquifer Exemption Area: The exemption area proposed in Buccaneer's Request for Freshwater Exemption lies within the Kenai Loop Field, and is described as:

T5N, R11W, S4: NW $\frac{1}{4}$ NW $\frac{1}{4}$, NE $\frac{1}{4}$ NW $\frac{1}{4}$, NW $\frac{1}{4}$ NE $\frac{1}{4}$, Seward Meridian (SM);

T5N, R11W, S5: NE $\frac{1}{4}$ NE $\frac{1}{4}$, SM;

T6N, R11W, S28: SW $\frac{1}{4}$ SW $\frac{1}{4}$, SE $\frac{1}{4}$ SW $\frac{1}{4}$, SW $\frac{1}{4}$ SE $\frac{1}{4}$, SM;

T6N, R11W, S29: SE $\frac{1}{4}$ SE $\frac{1}{4}$, SM;

T6N, R11W, S32: NE $\frac{1}{4}$, SE $\frac{1}{4}$, SM; and

T6N, R11W, S33: All, SM.

3. Affected Strata: Buccaneer's request for freshwater aquifer exemption is for those portions of the Sterling and Beluga Formations that are stratigraphically equivalent to the interval from 3,980 to 7,539 feet measured depth (MD) in well Kenai Loop #3. These measured depths are equivalent to 3,961 and 7,191 feet true vertical depth (TVD).¹

4. Geology: The proposed exempted aquifers are Tertiary-aged, fluvial-derived reservoir and non-reservoir deposits assigned to the Kenai Group. This group is subdivided into (in descending order) the Sterling, Beluga, Tyonek, Hemlock, and West Foreland Formations. These formations account for most of the commercial oil and gas production in the Cook Inlet Basin.

The proposed exempted aquifers lie in the lower portion of the Sterling Formation and the upper portion of the Beluga Formation between 3,980 feet (3,961 feet TVD) and 7,539 feet MD (7,191 feet TVD).

Upper confinement for the proposed exempted interval consists of several laterally continuous, tuffaceous claystone and siltstone layers and thin coal seams that lie between 3,065 feet MD / TVD and 3,980 feet MD (3,961 feet TVD) and assigned to the lower Sterling Formation. Several laterally persistent, tuffaceous siltstone, claystone and thin coal layers that will arrest upward fracture growth and provide additional upper confinement for injected fluids lie between 5,453 feet (5,289 feet TVD) and 5,720 feet (5,530 feet TVD) that lie within the uppermost Beluga Formation.

Buccaneer's planned injection interval lies in the Beluga Formation between 5,721 feet (5,531 feet TVD) and 7,025 feet (6,704 feet TVD). Such a large interval is planned because the Beluga Formation typically has a low net-sand-to-gross-thickness ratio. This formation generally consists of scattered fluvial sandstone layers encased in relatively impermeable siltstone, claystone and coal.²

Lower confinement and fracture-arrest will be provided by numerous, laterally continuous tuffaceous claystone, and siltstone layers and thin coal seams that are common between 7,026 feet (6,705 feet TVD) and 7,539 feet (7,191 feet TVD) and

¹ All depth- and thickness-related footages presented herein for the proposed exempted interval and the associated confining intervals refer to the Kenai Loop #3 well.

² See Levinson, R. A., 2011, Beluga River Gas Field, Cook Inlet, Alaska, in 2011 Western Region Meeting, SPE and Pacific Section AAPG, Anchorage, Alaska, Program with Abstracts, p.71 - 72

assigned to the Beluga Formation. Additional lower confinement for injected fluids will be provided by tuffaceous siltstone, claystone and coal layers that lie between 7,540 feet (7,192 feet TVD) and 7,750 feet (7,395 feet TVD).

5. Groundwater Hydrology: The State of Alaska has records for 22 shallow water wells within the proposed exemption area. The deepest of these was drilled 360 feet below ground surface by the City of Kenai near the airport. The other wells range in depth from 12 to 140 feet below ground surface, with most (75%) being shallower than 60 feet below ground surface. Alaska's Division of Mining, Land and Water has location information for 15 of these shallow water wells.³ One well lies 700 feet from Kenai Loop #3.⁴ The other 14 wells are situated at least 1,700 feet from the proposed exempted interval in Kenai Loop #3.⁵
6. Formation Water Salinity: Based on well log calculations, Buccaneer concludes that the total dissolved solids (TDS) concentration of formation waters within the proposed exempted interval inside the proposed exemption area are greater than 3,000 mg/l. Using similar methods, the AOGCC calculated TDS concentrations ranging from 6,500 to 8,500 mg/l for the proposed exempted interval and the associated confining intervals.⁶ These calculated TDS concentrations are supported by a formation water sample obtained during testing within the planned injection interval. Onsite analysis of that water sample yielded a measurement of 6,000 mg/l chlorides.⁷
7. Suitability of Sediments as Drinking Water Aquifers: Pursuant to 20 AAC 25.440 (a) (1), the aquifer exemption requested by Buccaneer is supported by the following:
 - a. the Kenai Loop area encompasses plentiful surface and groundwater to a depth of at least 360 feet below ground surface;
 - b. aquifers within the proposed exempted interval are sufficiently deep that recovery of drinking water is economically impractical;
 - c. aquifers within the proposed exempted interval contain methane gas;⁸ and
 - d. formation water TDS concentrations in the proposed exempted interval within the proposed exemption area are greater than 3,000 mg/l as indicated by well log calculations supported by onsite analysis of one water sample.
8. Concurrence of the U.S. Environmental Protection Agency (EPA): Pursuant to 20 AAC 25.440 (d) (1), the EPA was provided the opportunity to review this order prior to issuance. The EPA concurs with the AOGCC's findings and conclusions to exempt

³ Sources: Mr. R. Ireland of the Division of Mining, Land and Water and the Alaska Department of Natural Resources' (DNR) Well Log Tracking System database, which is available on the Internet at <http://dnratwmlwims02.dnr.state.ak.us/welts/>

⁴ Sources: Division of Mining, Land and Water website at <http://www.navmaps.alaska.gov/AlaskaLandStatus/> and DNR Land Administration System Case File No. ADL 42528

⁵ Source: Division of Mining, Land and Water website cited above

⁶ AOGCC's calculation techniques are compatible with EPA Guidance Document "Survey of Methods to Determine Total Dissolved Solids Concentrations" (EPA LOE Contract No. 68-03-3416, Work Assignment No. 1-0-13, KEDA Project No. 30-956, October 1988, Revised October 1989).

⁷ Kenai Loop #3, Daily Drilling Report, October 25, 2011, in AOGCC Well History File No. 211-097 (all information from this well are currently held confidential; the scheduled public release date is Nov. 25, 2013)

⁸ Kenai Loop #3, Formation Log (mud log), compiled by Canrig Drilling Technology, Ltd. during drilling of the well

aquifers occurring in the Sterling and Beluga Formations that are stratigraphically equivalent to the interval between the measured depths of 3,980 and 7,539 feet in the Kenai Loop #3 wellbore, upon the condition that the areal extent of this exemption is limited to a radius of one-half mile from the Kenai Loop #3 wellbore where that wellbore passes through the interval from 3,980 to 7,539 feet measured depth.⁹

CONCLUSIONS:

1. Those portions of freshwater aquifers occurring in the Sterling and Beluga Formations within the proposed exemption area do not currently serve as sources of drinking water. All known and foreseeable ground water consumption from the Kenai Loop vicinity is consistent with plentiful surface water and groundwater resources occurring above a depth of about 360 feet below ground surface.
2. Those portions of freshwater aquifers occurring in the proposed exempted interval within the proposed exemption area contain TDS concentrations greater than 3,000 mg/l, contain methane gas, and are situated at locations and depths that make recovery of formation waters for drinking water purposes economically impractical.
3. The aquifers occurring in the proposed exempted interval within the proposed exemption area cannot reasonably be expected to serve as underground sources of drinking water.
4. The aquifers occurring in the proposed exempted interval within the proposed exemption area qualify as exempt freshwater aquifers under 20 AAC 25.440(a)(1)(A), 20 AAC 25.440 (a)(1)(B), and 20 AAC 25.440(a)(2).

NOW, THEREFORE, IT IS ORDERED THAT aquifers occurring in the Sterling and Beluga Formations that are stratigraphically equivalent to, and lie within a radius of one-half mile of, the interval from 3,980 to 7,539 feet measured depth in the Kenai Loop #3 well are exempt for the purposes of Class II waste disposal operations as provided by 20 AAC 25.440.

Note that this Order does not authorize the injection of any fluids or gas within the exemption area. Disposal Injection Order No. 38 governs injection operations within the exemption area.

DONE at Anchorage, Alaska, and dated November 28, 2012.



Cathy P. Foerster
Chair, Commissioner



Daniel T. Seamount, Jr.
Commissioner



John K. Norman
Commissioner



⁹ Kowalski, E.J., U.S. EPA, 2012, Letter to C. Foerster, AOGCC, November 27, 2012, regarding State of Alaska Aquifer Exemption Order No. 15 Sterling and Beluga Formations, Kenai Loop Field, Kenai Peninsula Borough, Alaska

RECONSIDERATION AND APPEAL NOTICE

As provided in AS 31.05.080(a), within **20** days after written notice of the entry of this order or decision, or such further time as the AOGCC grants for good cause shown, a person affected by it may file with the AOGCC an application for reconsideration of the matter determined by it. If the notice was mailed, then the period of time shall be **23** days. An application for reconsideration must set out the respect in which the order or decision is believed to be erroneous.

The AOGCC shall grant or refuse the application for reconsideration in whole or in part within 10 days after it is filed. Failure to act on it within 10-days is a denial of reconsideration. If the AOGCC denies reconsideration, upon denial, this order or decision and the denial of reconsideration are **FINAL** and may be appealed to superior court. The appeal **MUST** be filed within **33** days after the date on which the AOGCC mails, **OR 30** days if the AOGCC otherwise distributes, the order or decision denying reconsideration, **UNLESS** the denial is by inaction, in which case the appeal **MUST** be filed within **40** days after the date on which the application for reconsideration was filed.

If the AOGCC grants an application for reconsideration, this order or decision does not become final. Rather, the order or decision on reconsideration will be the **FINAL** order or decision of the AOGCC, and it may be appealed to superior court. That appeal **MUST** be filed within **33** days after the date on which the AOGCC mails, **OR 30** days if the AOGCC otherwise distributes, the order or decision on reconsideration. As provided in AS 31.05.080(b), “[t]he questions reviewed on appeal are limited to the questions presented to the AOGCC by the application for reconsideration.”

In computing a period of time above, the date of the event or default after which the designated period begins to run is not included in the period; the last day of the period is included, unless it falls on a weekend or state holiday, in which event the period runs until 5:00 p.m. on the next day that does not fall on a weekend or state holiday.