

MEADOW CREEK CROSS SECTIONS TECHNICAL DISCUSSION

Gordon Stabb
November 12/03

FIGURE 1

This cross section addresses lateral communication within the Hangingstone McMurray “A” Pool. Lateral communication in this discussion refers to the potential for lateral pressure communication of gas pools and top water zones in regional sands with gas pools and top water zones in channel sands as a result of sand on sand contact between the two facies. The Hangingstone McMurray “A” Pool contains the wells 00/11-35-82-8W4, 00/16-36-82-8W4 and 00/06-01-83-8W4. The “A” and “B” regional mudstones are correlated to those in the EUB type well 00/12-16-80-9W4/0¹.

The 00/16-36-82-8W4 well of the Hangingstone McMurray “A” Pool contains 3.0 metres of gas (437-440m) in regional sand above the “A” mudstone and 1.5 metres of gas (442-443.5m) in regional sand above the “B” mudstone. The base of gas in 00/16-36-82-8W4 is at 443.5m measured depth (MD), +283.2m above sea level (ASL). In addition, there is 1 metre of water (450-451m) and 6 metres of bitumen (451-457m) above the “B” mudstone. The sands above the “A” and “B” mudstones have a fining up character and are interpreted to be either distributary channels of bayfill delta origin or alternatively are tributary channels related to nearby post “B” mudstone and post “A” mudstone channel incisement. Adjacent post “B” mudstone channel incisement is recognized in 00/06-01-83-8W4. Post “A” mudstone channel incisement is recognized in 00/11-35-82-8W4.

The 00/06-01-83-8W4 well of the Hangingstone McMurray “A” Pool contains 4.0 metres of gas (442-446m) in regional sand above the “A” mudstone. The sand above the “A” mudstone has a fining up character and is interpreted to be either a distributary channel of bayfill delta origin or alternatively a tributary channel related to nearby post “A” mudstone channel incisement.

In its Decision 2003-23: *“The Board interprets the McMurray A and B mudstones as having been removed by channeling where they are not clearly identifiable on logs or in core”*.²

The “B” mudstone is not preserved in 00/06-01-83-8W4. It has been removed by post “B” mudstone channel incisement and replaced with channel deposits. Channel deposits are present from the base of the “A” mudstone (448m) to the Devonian unconformity (494m). Channel sands below the “A” mudstone contain 2 metres of top gas (448-451m), 6.5m of top water (455-461.5) and 32.5 metres of gross bitumen (461.5-494m). The base of gas in 00/06-01-83-8W4 is at 451m MD, +282.2m ASL. Resistivity in the gross bitumen interval ranges from 20 to 400 ohm metres and includes a 12 metre continuous interval with greater than 40 ohm metres (482-494m). In addition it is noteworthy that within the gross bitumen section,

¹ 2003, EUB Decision 2003-023, Chard Area and Leismer Field Athabasca Oil Sands Area, Fig. 11, pp. 61.

² 2003, EUB Decision 2003-023, Chard Area and Leismer Field Athabasca Oil Sands Area, pp. 17.

intervals with 20 to 30 ohm metres resistivity are generally associated with density porosity of greater than 24% and that the intervals are also characterized by diverging density and neutron curves. Petro Canada has found that the divergence of CNFD log curves is a good indicator of a mudstone breccia and oilsand lithology. If the 20 to 30 ohm metre intervals are breccia stringers then the channel sands in 00/06-01-83-8W4 potentially contain up to 32.5 metres of continuous bitumen (461.5-494m).

The 00/11-35-82-8W4 well of the Hangingstone McMurray "A" Pool contains 5.0 metres of gas (445-450m) in post "A" mudstone channel sands. The base of gas at 00/11-35-82-8W4 is at 450m MD, +284.9m ASL. 00/11-35-82-8W4 is exempt from the GB-2003-28 shut in order. The "A" and "B" regional mudstones are not preserved in 00/11-35-82-8W4 and have been removed by channel incisement and replaced by channel sediments. The gamma ray response at 450-451m is not a regional mudstone. The regional mudstones in the Meadow Creek area generally have a density log response of 20-23% sandstone matrix porosity. The gamma ray response at 450-451m is associated with a density porosity of over 30%. The McMurray in 00/11-35-82-8W4 is a channel deposit from the top of the McMurray to the Devonian with no preserved correlative regional mudstones present.

In addition the 00/11-35-82-8W4 well contains 3 metres of top water (458-461m) and 30.5 metres of gross bitumen (462.5-493m) in channel sands. Resistivity in the gross bitumen interval ranges from 20 to 200 ohm metres and includes a continuous 17.5 metre interval with greater than 40 ohm metres (475-493m).

The structural difference in the base of gas between 00/16-36-82-8W4 (+283.2m ASL) and 00/06-01-83-8W4 (+282.2m ASL) is 1.0 metre. The structural difference in the base of gas between 00/16-36-82-8W4 (+283.2m ASL) and 00/11-35-82-8W4 450m MD, +284.9m ASL, is 1.7 metres.

By definition of the EUB Pool Order 444 328001 2001-02-01, the McMurray gas in wells 00/11-35-82-8W4, 00/16-36-82-8W4 and 00/06-01-83-8W4 is in pressure communication. It follows that McMurray gas above the "A" mudstone in 00/16-36-82-8W4 and 00/06-01-83-8W4 is in lateral pressure communication with gas in channel sands at 00/11-35-82-8W4 where the "A" and "B" mudstones are not preserved. Similarly, it follows that McMurray gas above the "B" mudstone in 00/16-36-82-8W4 is in lateral pressure communication with gas in channel sands at 00/06-01-83-8W4 8W4 where the "B" mudstone is not preserved and at 00/11-35-82-8W4 where the "A" and "B" mudstones are not preserved.

In its Decision 2003-23 *"the Board concludes that all McMurray channel gas in the Chard-Leismer area is or has the potential to be associated with underlying bitumen, either through direct vertical continuity or indirectly through lateral continuity of the gas and water zones."*³

Therefore at 00/06-01-83-8W4, the 32.5 metres of prospective bitumen (461.5-494m) in channel sand below the "A" mudstone has the potential to be associated with 2 metres of overlying gas (448-451m) in the channel sand below the "A" mudstone. It follows that that the 32.5 metres of prospective bitumen in 00/06-01-83-8W4 is at risk of lateral pressure

³ 2003, EUB Decision 2003-023, Chard Area and Leismer Field Athabasca Oil Sands Area, pp. 29.

communication since by the pool definition gas below the “A” mudstone in 00/06-01-83-8W4 is in pressure communication with the gas below the “A” mudstone in 00/16-36-82-8W4. Risk to the bitumen arises from lateral communication between gas and top water zones in channel sands below the “A” mudstone at 00/06-01-83-8W4 and gas and top water zones in regional sands below the “A” mudstone at 00/16-36-82-8W4.

In addition, at 00/11-35-82-8W4 the 30.5 metres of prospective bitumen (462.5-493m) in channel sands has the potential to be associated with 5.0 metres of overlying McMurray gas (445-450m) in post “A” mudstone channel sands. It follows that that the 30.5 metres of prospective bitumen in 00/11-35-82-8W4 is at risk of lateral pressure communication since by the pool definition the gas in 00/06-01-83-8W4 and 00/16-36-82-8W4 above the “A” mudstone is in pressure communication with the gas in 00/11-35-82-8W4. Risk to the bitumen arises from lateral communication between the gas zone in post “A” mudstone channel sand at 00/11-35-82-8W4 and gas zones in regional sands above the “A” mudstone at 00/06-01-83-8W4 and 00/16-36-82-8W4.

It is evident that gas production from any of these wells endangers the bitumen resource because of lateral pressure communication between gas in sands above the regional mudstones and gas in the laterally offsetting channel sediments that is associated with prospective oil sand.

It was stated in Decision 2003-23 *“The Board does not interpret the McMurray A regional sand gas pools to be connected with gas within laterally offsetting channel sediments,”*⁴.

In light of:

- The Board’s recognition of pressure communication between the Hangingstone McMurray “A” Pool wells 00/11-35-82-8W4, 00/16-36-82-8W4 and 00/06-01-83-8W4,
- And pending the Board’s agreement that gas occurs within sands above regional mudstones and in adjacent channel sediments in the Hangingstone McMurray “A” Pool in addition to the following example of the Resdeln McMurray “D” Pool.

Petro-Canada points out that the Board might reconsider its interpretation referenced above and recognize from these examples at Meadow Creek that lateral communication between gas in McMurray “A” regional sand and gas in offsetting channel sediments can occur.

⁴ 2003, EUB Decision 2003-023, Chard Area and Leismer Field Athabasca Oil Sands Area, pp. 27.

MEADOW CREEK CROSS SECTIONS TECHNICAL DISCUSSION

Gordon Stabb
November 12/03

FIGURE 2

This cross section addresses lateral communication within the Resdeln McMurray “D” Pool. Lateral communication in this discussion refers to the potential for lateral pressure communication of gas pools and top water zones in regional sands with gas pools and top water zones in channel sands as a result of sand on sand contact between the two facies. The Resdeln McMurray “D” Pool includes the wells 00/08-07-82-7W4 and 00/15-01-82-8W4. The “A” and “B” regional mudstones are correlated to those in the EUB type well 00/12-16-80-9W4/0⁵.

This cross section also contains interpretation of other nearby wells including 00/14-11-82-8W4 that is exempt from the GB-2003-28 shut in order. However at this time, objection to exemption of 00/14-11-82-8W4 is outside of the purpose of this discussion.

The 00/08-07-82-7W4 well of the Resdeln McMurray “D” Pool contains 5.0 metres of gas (447-453m) in regional sand above the “A” mudstone. The base of gas in 00/08-07-82-7W4 is at 453m measured depth (MD), +273.8m above sea level (ASL). The sand above the “A” mudstone has a blocky gamma ray character and is interpreted to be either a distributary channel of bayfill delta origin or alternatively a tributary channel related to nearby post “A” mudstone channel incisement. Adjacent post “A” mudstone channel incisement is recognized in 00/15-01-82-8W4.

In its Decision 2003-23: *“The Board interprets the McMurray A and B mudstones as having been removed by channeling where they are not clearly identifiable on logs or in core”*.⁶

The 00/15-01-82-8W4 well of the Resdeln McMurray “D” Pool contains 7.5 metres of gas (444-452.5m) in post “A” mudstone channel sands. The base of gas at 00/15-01-82-8W4 is at 452.5m MD, +273.2m ASL. In addition the 00/15-01-82-8W4 well contains 4.5 metres of top water (452.5-457m) in direct contact with overlying gas and an underlying 43 metres of gross bitumen (457-500m) in channel sands. Resistivity in the gross bitumen interval ranges from 25 to 150 ohm metres and includes a 14 metre interval with greater than 40 ohm metres (481-495m).

The “A” and “B” regional mudstones are not preserved in 00/15-01-82-8W4 and have been removed by channel incisement and replaced by channel sediments. The gamma ray response at 458-470m is a mudstone related to channel abandonment and is not regionally correlative.

⁵ 2003, EUB Decision 2003-023, Chard Area and Leismer Field Athabasca Oil Sands Area, Fig. 11, pp. 61.

⁶ 2003, EUB Decision 2003-023, Chard Area and Leismer Field Athabasca Oil Sands Area, pp. 17.

The McMurray in 00/15-01-82-8W4 is a channel deposit from the top of the McMurray to the Devonian with no preserved correlative regional mudstones present.

The structural difference in the base of gas between 00/08-07-82-7W4 (+273.8m ASL) and 00/15-01-82-8W4 (+273.2m ASL) is 0.6 metres.

By definition of the EUB Pool Order 1228 328004 2001-02-01, the McMurray gas in wells 00/08-07-82-7W4 and 00/15-01-82-8W4 is in pressure communication. It follows that McMurray gas above the “A” mudstone in 00/08-07-82-7W4 is in lateral pressure communication with gas in channel sands at 00/15-01-82-8W4 where the “A” and “B” mudstones are not preserved.

In its Decision 2003-23 *“the Board concludes that all McMurray channel gas in the Chard-Leismer area is or has the potential to be associated with underlying bitumen, either through direct vertical continuity or indirectly through lateral continuity of the gas and water zones.”*⁷

At 00/15-01-82-8W4 the 43 metres of gross bitumen (457-500m) in channel sands is observed to be in direct communication with 7.5 metres of overlying McMurray gas (444-452.5m) through the 4.5 metres of top water (452.5-457), in post “A” mudstone channel sands. Therefore it follows that in 00/15-01-82-8W4 the 14 metre interval (481-495m) with greater than 40 ohm metres resistivity is at risk of lateral pressure communication since by the pool definition the gas in 00/08-07-82-7W4 above the “A” mudstone is in pressure communication with the gas in 00/15-01-82-8W4. Risk to the bitumen arises from lateral communication between the gas zone in post “A” mudstone channel sand at 00/15-01-82-8W4 and gas zones in regional sands above the “A” mudstone at 00/08-07-82-7W4.

It is evident that gas production from either of these wells endangers the bitumen resource because of lateral pressure communication between gas in sands above the regional mudstones and gas in the laterally offsetting channel sediments that is associated with prospective oil sand.

It was stated in Decision 2003-23 that *“The Board does not interpret the McMurray A regional sand gas pools to be connected with gas within laterally offsetting channel sediments,”*⁸.

In light of:

- The Board’s recognition of pressure communication between the Resdeln McMurray “D” Pool wells 00/08-07-82-7W4, and 00/15-01-82-8W4,

⁷ 2003, EUB Decision 2003-023, Chard Area and Leismer Field Athabasca Oil Sands Area, pp. 29.

⁸ 2003, EUB Decision 2003-023, Chard Area and Leismer Field Athabasca Oil Sands Area, pp. 27.

- And pending the Board's agreement that the presence of gas occurs within sands above regional mudstones and in adjacent channel sediments in the Resdeln McMurray "D" Pool in addition to the previous example of the Hangingstone McMurray "A" Pool.

Petro-Canada points out that the Board might reconsider its interpretation referenced above and recognize from these Meadow Creek examples that lateral communication between gas in McMurray "A" regional sand and gas in offsetting channel sediments can occur.