Cross section PR141A was established in 1979 in a cutoff channel that had formed during the 1978 flood across the neck of a large meander bend in Powder River near the mouth of Bloom Creek. The 1978 cutoff channel began by following the course of a pre-flood headcut gully that had been sporadically active for decades, and had nearly cut through the neck of the bend by early 1978 (Gay et al.,1998, *their* Figure 7; Meade and Moody, 2013, *their* Figures 9 &10). Because the actual cutoff at PR141A happened during the early stages of the flood of 1978, we infer that this left enough time for the flood waters to erode the adjacent flood plain across the neck, and to widen the new cutoff channel sufficiently so that new sand could be deposited therein. This new channel had a gentle downstream slope (0.00061, as compared with Powder River's average overall slope of 0.001) and a nominal radius of channel curvature of 125 m.

The record at PR141A provides the most complete narrative, so far, of any cross section of Powder River. Early aerial photographs show the pre-flood gully that was to become the initial course of the cutoff channel. Local ranchers actually observed the moment of transition in May 1978 when waters went slack in the old meander channel and began to flow rapidly across the meander neck (Gay *et al.*, 1998, p. 657). During the years since the birth of this cutoff channel, we have been able to observe the deposition and maturation of a large point bar and the formation of three scroll bars (Moody and Meade, 2014). Also recorded are the first 34 years (1979-2012) of concave-left-bank erosion, which has removed a width of 80 m (~160 m^3 per meter of bank) of old sand and gravel from the Lightning terrace. Leveling surveys of cross section PR141A were made in 1979, 1980, and 1982, annually during the 19-year period 1984-2002, in 2006, and annually during the 5-year period 2009-2013.

Early large changes at cross section PR141A were: erosion of about 14 m of the left bank, recorded in 1984, and the erosion of the right bank in 1986. Between 1987 and 1995 there were a series of overbank deposits on top of the right bank landward of station 80. Evidence of the first scroll bar in section PR141A appears in the cross-channel profile surveyed in 1992 between stations 70 and 90. Successive higher deposition after 1992 built up the first scroll bar, which consisted of mostly very fine sand and silt. Sometime during these depositional and erosional events, a cottonwood tree sprouted and grew on the crest (near station 80) of this scroll bar within 1 m of the line of section, and thus the scroll bar has slowly evolved into what Nanson (1980) defined as a flood-plain ridge, which "is vegetated and flooded only near bankfull flow".

Substantial thicknesses of new sediment (0.20-0.50 m) were deposited in 1994 during an ice-break-up flood that jammed downstream from the section causing the water to back up and overtop both banks at PR141A. This water carried ice floes that grounded on top of the bank with coarse sand and gravel frozen to the bottom, and it carried a large suspended-sediment load caused by the extreme turbulence of the tumbling ice floes striking the bed of the river and by ice flows ramming and eroding the river's banks.

The foundation of the second scroll bar was laid down in 1994 between stations 26 and 46. In 1995, an additional ~14-m width of old Lightning terrace was eroded from the left bank (39.6 m^3 per meter of bank), which was nearly balanced by 10.5 m^3/m of new floodplain deposition and 26.9 m^3/m of new point-bar deposition between stations 18 and 48 (Moody et al., 2002). The scroll bar may have formed by the process of rapid channel expansion and subsequent deposition of sediment near a separation zone along the opposite bank (a process

described by Nansen, 1980). The scroll bar was further increased in height by sediment deposition in 1996.

The base for the third scroll bar (between stations 0 and 20) was deposited by floods in 1995, 1996, and 1997, but did not become discernible in the cross-channel profile until after the 1999 flood. Later, in year 2000, pebbles, coal particles, and coarse sand were added atop the third scroll bar and also filled the gap between the second and third scroll bar. This third scroll bar increased in height in three stages: (1) medium-fine suspended sand was deposited by a small flash flood in August 2002 (73 $m^3 s^{-1}$), (2) coarse sediment was deposited during the snowmelt flood in June 2005 (82 $m^3 s^{-1}$), and (3) silt and fine sand were probably deposited during the flood of June 2008 (329 $m^3 s^{-1}$; the largest since May 1978). Accompanying the scroll-bar deposition in 2008 was a corresponding ~12 m of lateral erosion of the left bank, again suggesting the rapid bank erosion-point bar deposition process proposed by Nanson (1980). A secondary chute channel was started during the 2008 flood as a headcut gully along the joint interface (stations 24-30) between the second and third scroll bars. Thus by 2009 three distinct scroll bars had developed on the point bar at PR141A.

An extensive topographic survey was done around this bend in 2009 and 2010. The survey started about 450 m upstream along the left bank from PR141A and extended downstream along the left bank about 350 m. The survey along the left bank was limited to 2-4 m landward from the cutbank, but included the entire point bar formed by the right bank. The data are in file PR141ATopog.xlsx

In 2013, there was a substantial flood in tributary Bloom Creek probably as a consequence of wildfires in 2011 and 2012 along Bloom Creek in the hills to the west of Powder River. This flood cut through the left bank of Powder River along the section from station -86 to -58 such that the end of the section PR141A on the left bank is now (2014) an embayment.

Gay, G.R., Gay, H.H., Gay, W.H., Martinson, H.A., Meade, R.H., and Moody, J.A., 1998, Evolution of cutoffs across meander necks in Powder River, Montana, USA. *Earth Surface Processes and Landforms*, v. 23, p. 651-662.

Meade, R.H., and Moody, J.A., 2013, Erosional and depositional changes wrought by the flood of 1978 in the channels of Powder River, southeastern Montana: *U.S. Geological Survey Scientific Investigations Report* 2013-5035, 28 p., 1 pl.

Moody, J.A., Meade, R.H., and Martinson, H.A., 2002. Erosion and deposition of sediment at channel cross sections on Powder River between Moorhead and Broadus, Montana, 1980-98, *U.S. Geological Survey Water-Resources Investigations Report* 02-4219, 310 p.

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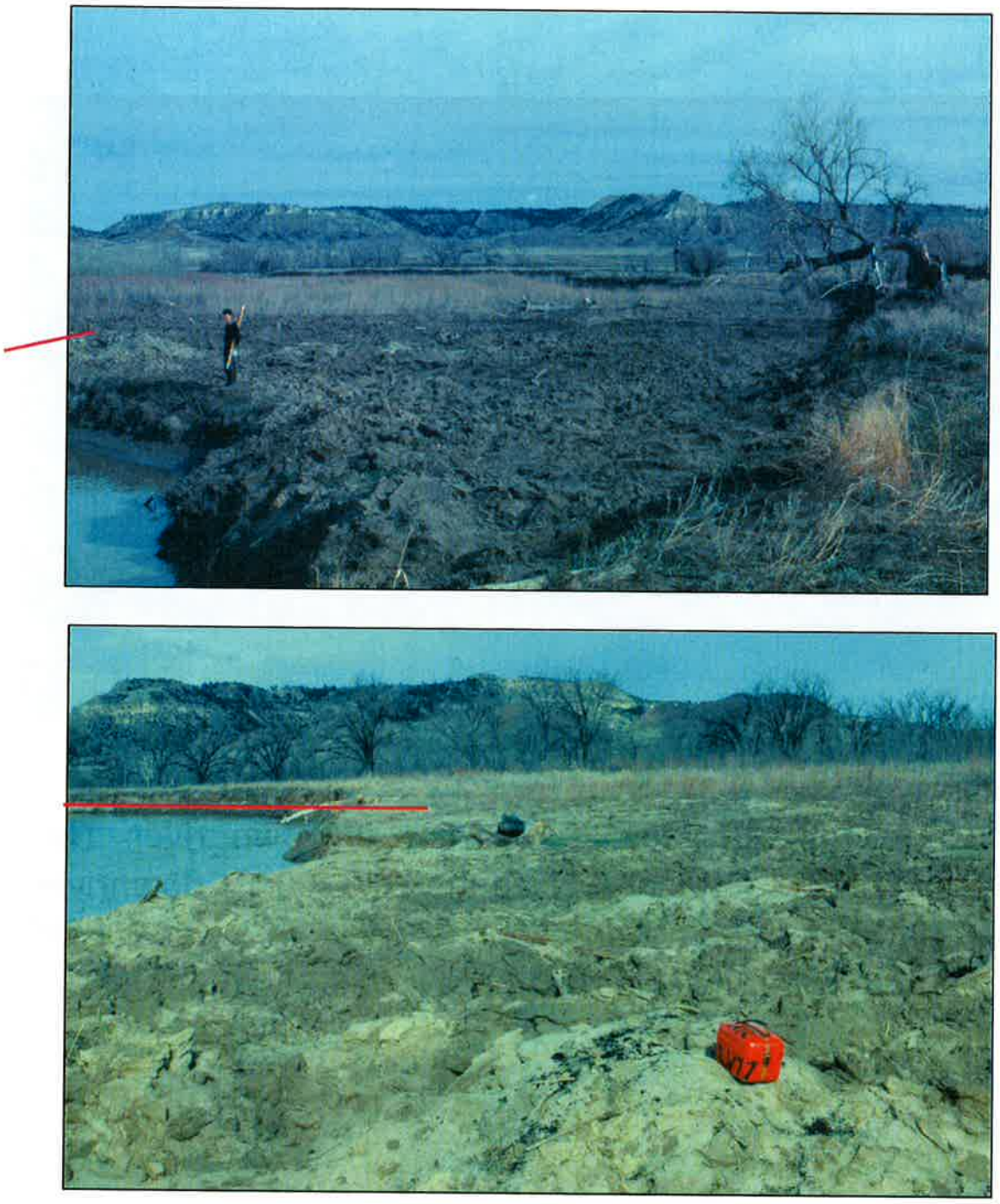
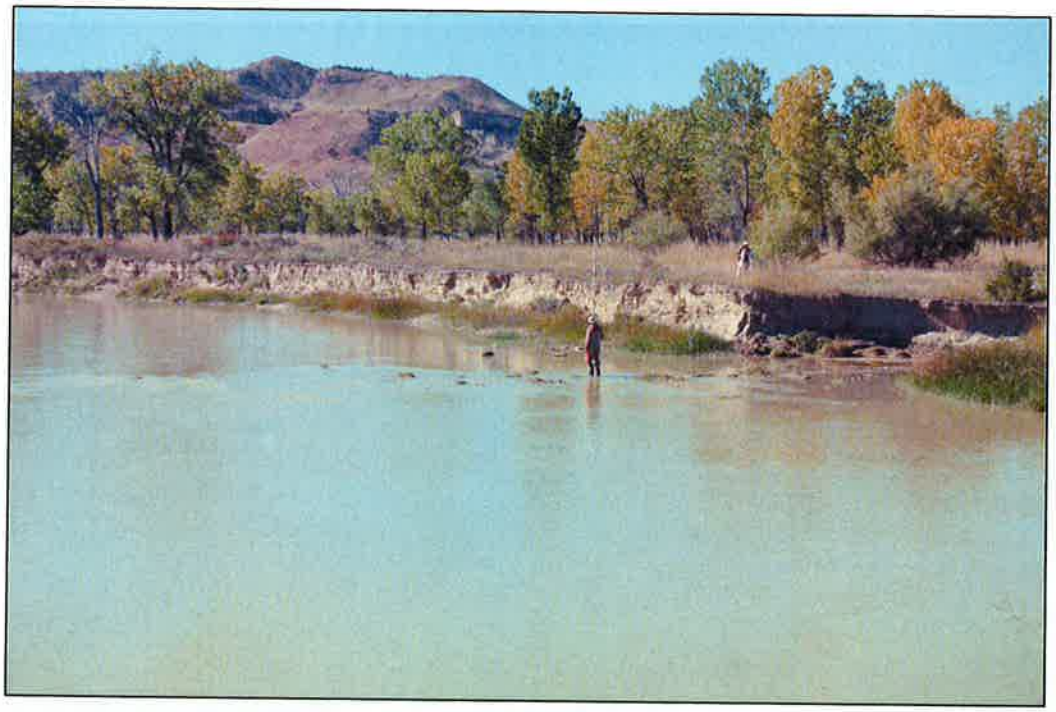
Nanson, G.C., 1980. Point bar and floodplain formation of the meandering Beatton River, northeastern British Columbia, Canada: *Sedimentology*, v. 27, p. 3-29.

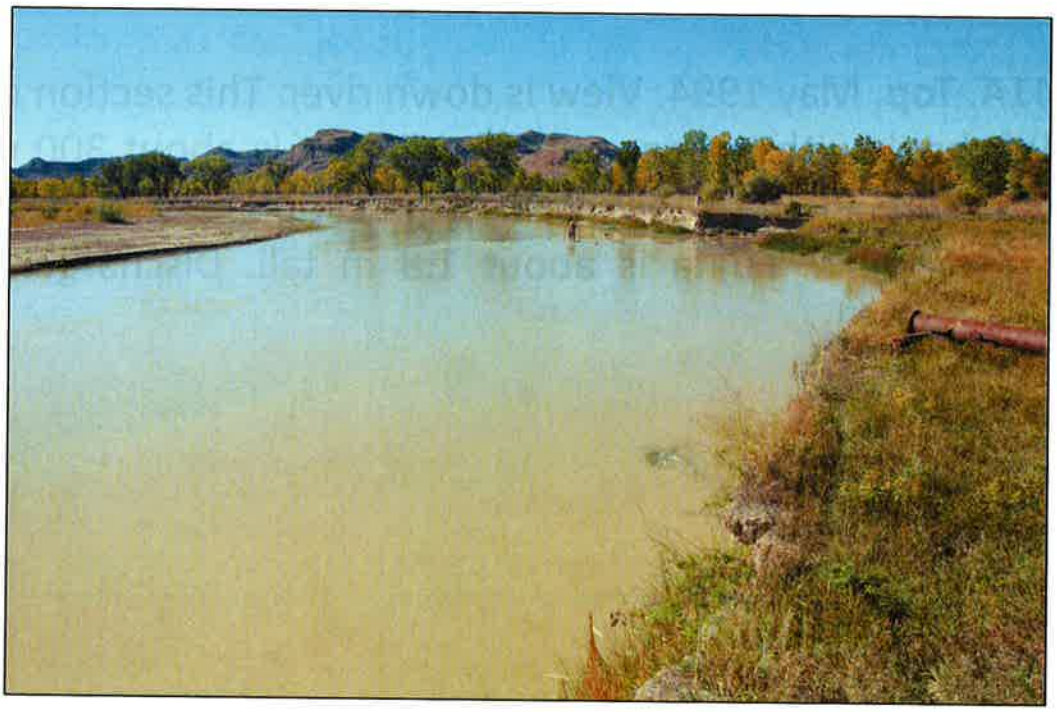
PR141A. **Top**. 10 May 1993. View is down river. This section of the left bank is about 100-200 m downriver from PR141A. High water level on 8 May 1993 was 987.06 m and the water level in the photo is 986.26 m.



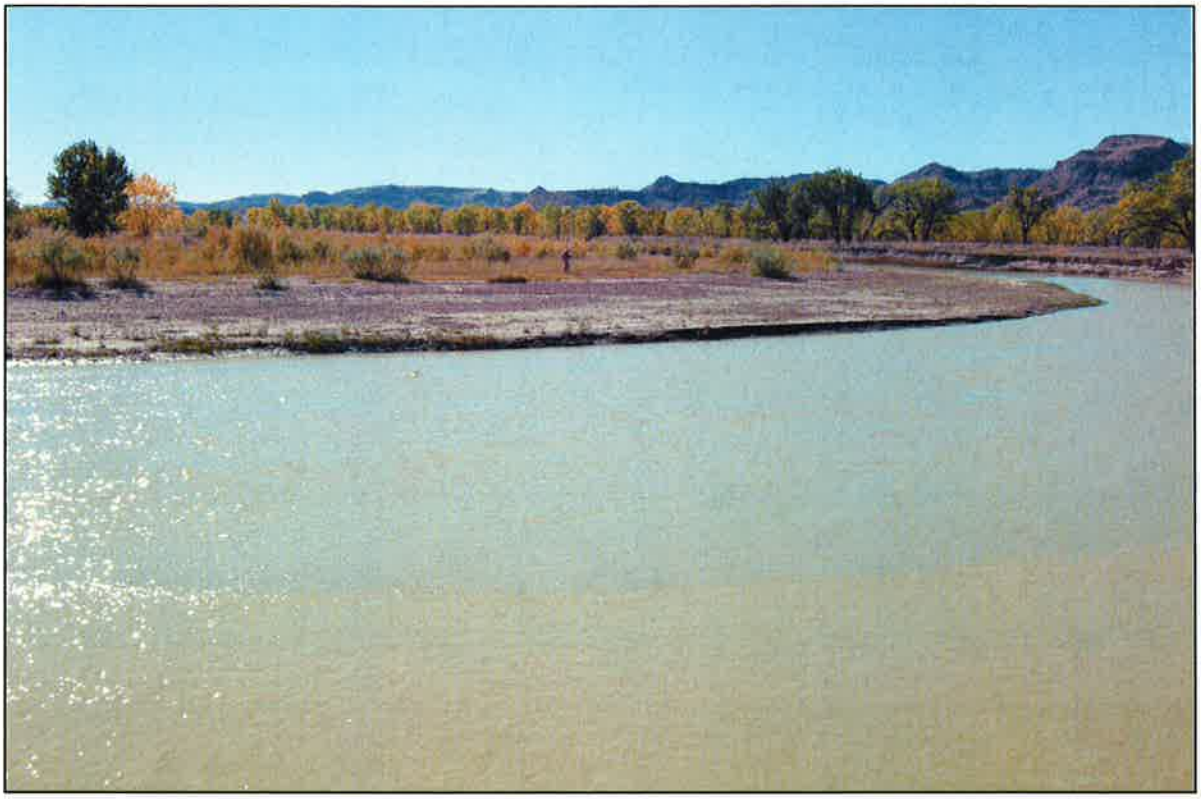
PR141A. **Top**. May 1994. View is upriver showing ice-deposited sand piles in the mouth of Bloom Creek and on PR141A, for which only a short segment (red line) shows in the photo. **Bottom**. May 1994. View is upriver showing a close up of ice-deposited sediment (see detailed survey of these deposits in data files). Orange level case is 0.17 m high.

PR141A. **Top**. May 1994. View is down river. This section of the left bank with ice-deposited sediment is about 300 m upriver from PR141A (approximate location is shown by the red line). K. Fujita is about 1.8 m tall. Discharge is about 17 $m^3 s^{-1}$.





PR141A. **Top**. 1 October 2013. View is upriver. Level, tripod, and D. Martin are about 12 m upriver of station -60. Rodman (J. Moody) is on line of section at station -47. Washout gully at mouth of Bloom Creek is to the right of J. Moody. **Bottom**. As above with J. Moody at station -41.



PR141A. **Top**. 1 October 2013. View is upriver. Dark green tree at left margin of photo is a cottonwood tree near station +80. J. Moody stands on line of section at station +20, which was the location of the left bank in 1979.