

## The study site



The South Saskatchewan River originates in the Rocky Mountains, Alberta, Canada, and flows eastwards into Lake Diefenbaker, 25 km upstream of the study reach at Outlook.

The river is incised by up to 30m into Cretaceous shales and sandstones and Quaternary deposits. At Outlook, the channel belt is ~0.6 km wide, has an average bed slope of 0.0003 and a braided planform. The braiding index (the number of active main channels per cross-stream transect at low-flow stage) within the 10 km long study reach is 2.2. Fifty-two grain size samples taken from bar surfaces and cutbanks in the study reach show the D50 grain size ranges from 0.22mm to 0.44mm, with a mean of 0.30mm. Clay is rarely found within the sediments (less than 1 % by weight). Gravel is also rare but can be found in channel thalwegs, with cobbles and boulders near some cutbanks where the river has eroded into Quaternary sediments. Scrub grass vegetation, willow bushes and small trees stabilise bars within the channel and on the floodplain.



The main (or first-order) channels are 2-5m deep and 50-150m wide. Channel bars in the river range in size from 50m long and 30m wide up to 700m long and 350m wide with migration rates up to 150m yr<sup>-1</sup>.

The deepest channels are dominated by dunes that may be up to 1.5m high during floods, but are more commonly 0.3 to 0.5m high.

Ripples are ubiquitous in shallow areas and on bartops, whilst aeolian reworking of bartop surfaces commonly creates both aeolian ripples and barchanoid dunes.

Winter conditions result in bar surfaces and smaller channels being covered in ice. However, flow continues beneath the ice cover and the major channels remain ice free.

In 1967, the South Saskatchewan River was impounded by the Gardiner Dam, creating Lake Diefenbaker, which subsequently caused incision of 0.5m up to 5km downstream of the dam. A series of permanent benchmarks and cross-sections were established by Environment Canada downstream from the dam and have been surveyed pre-dam (1964) and up to 16 times since.

The town of Outlook is located between benchmarks 17.4 and 21.0, which are 27 and 32 km downstream of the dam respectively. The most recent resurveys in the summer of 2002 by Phillips (2003), conclude that the study reach reported herein has not experienced any statistically significant change in mean bed elevation since building of the dam. The Gardiner dam has reduced some of the very largest flood events, with mean annual peak discharge pre - and post - dam being 1536 m<sup>3</sup>s<sup>-1</sup> and 595 m<sup>3</sup>s<sup>-1</sup> respectively. The mean annual discharge pre- and post-dam is 280 m<sup>3</sup>s<sup>-1</sup> and 203 m<sup>3</sup>s<sup>-1</sup> respectively, and most bars become overtopped at approximately 230 m<sup>3</sup>s<sup>-1</sup>. Thus, although the very highest discharges do not occur anymore, the flow regime still causes bedload transport over the entire braidplain during floods and many of the channels are active for large parts of the year. Thus, the more moderate and frequently occurring flow events continue to shape the channel, and ensure the South Saskatchewan River near Outlook remains an active braided system.

