

# The Oxbow

FROM THE NORTH DAKOTA STATE WATER COMMISSION

## The Pembina River: Jewel of the Northeast

By James T. Fay

### Introduction

North Dakota is blessed with many natural wonders. Everybody knows about the Badlands, the Peace Gardens, and the Missouri River. There are other places, however, that present comparable delights, but just don't seem to get the attention they deserve. One of those places is the beautiful Pembina River area.

This magnificent resource is the result of a unique combination of factors that produce a landscape radically different than any other in our state. From whatever direction you approach, it presents a beautiful view. Come north on Highway 32 and you can see the great escarpment to the west. Drive east from Langdon on Highway 5 and as you cross the Pembina Escarpment, the whole Red River Valley unfolds before your eyes. The route east from Mount Carmel Dam (better have your map ready for this) takes you right through the valley of the Little South Pembina and the Pembina Gorge. Hardwood forests, steep valley walls, wildlife, and of course the Pembina River itself, present an ever-changing spectacle.

The area is steeped in history as well. The city of Pembina is the oldest in the state. It was founded in the earliest days of our nation, when it wasn't even considered part of the United States. It was a thriving community when Lewis and Clark came up the Missouri. It was the hub of the fur trading caravans to St. Paul,

and a center of the Metis communities which settled in the area.

I walked through the woods along the river banks accompanied by a landowner one day. We came to a little clearing which was obviously once a yard. The landowner pointed to it and said "This is where Louis Riel (the leader of the Metis rebellions) hid when the English were after him."

### Origin

The Pembina is one of those rivers that formed as the glacier was melting and runoff was flowing into

Lake Agassiz. Its headwaters are in the lakes of the Turtle Mountains. Draining to the north, it arcs through southern Manitoba. Like similar rivers, (the Mouse, James, Sheyenne, and many smaller ones) its valley was cut by the enormous flows of glacial meltwater, making it vast compared to the river.

However, the spot where the Pembina discharged into the lake was very different. The shores of Lake Agassiz, at that point, were formed by the steep slopes of the Pembina Escarpment, hundreds of feet above the lake bottom. A large delta formed at that spot, and as the lake receded, the river began cutting into the escarpment, forming the Pembina Gorge. This is a steep, heavily wooded and very sparsely populated valley extending from the Manitoba boundary to Walhalla. The major tributaries, the Little South Pembina, and the Tongue have their own valleys, equally beautiful, only smaller. After the lake receded, the river meandered from the delta area across the lake bottom.



The Pembina River at Leroy (in the o)

Over the centuries it left its oxbow tracks across a band one to two miles on either side of its present course. The river is still very active, having formed and cut off numerous oxbows within the memory of local residents.

### Characteristics

The drainage basin of the Pembina River is quite large. Its total gross drainage area above its confluence with the Red is 3,950 square miles. The outer fringes of the basin, however, are composed of relatively flat areas dotted with depressions. Many of these areas do not contribute or do so only under very large flood events. When the Corps of Engineers did their hydrology studies for the Pembilier Dam, they determined that this "secondary drainage area" comprised 1,540 square miles. The remaining directly contributing area includes

It also formed another unusual feature. When the river floods, the water level exceeds the bank elevations and flows overland. As it does this, its velocity diminishes, which causes sediments to fall out. Since this occurs right at the river's banks, the sediments collect there, forming natural dikes. In most locations, the channel banks are the highest ground around. Because of this, flood waters can't re-enter the channel at many places, and a complex system of over-bank drainage has developed.

### Problems

Since the Pembina River channel doesn't have to handle large flows, it hasn't had a chance to "grow up." The maximum capacity varies from 4,000 to 6,000 cubic feet per second (cfs). The 10 percent chance flood is greater than that. Most of the

Water Resources Board resulted in a finding that most of these levees were illegal. The finding was appealed, and ended up in North Dakota's Supreme Court, which found that they were under the permitting authority of the Water Resources Board, and if they weren't permitted they must be removed. Most of the levees were removed in 2001 and 2002.

Another controversy is related to the northeastward gradient. Because of this, overflowing water attempts to flow into Manitoba. In the mid-1940s, landowners in Manitoba began building a structure along the international boundary. Its north side is called a road and its south side a dike. This structure interrupts the northeastward traveling water and contains it on the North Dakota side. The controversy has grown intense over the years to the point that Pembina County and the affected townships have brought a lawsuit in Canadian Federal Court to have it removed.

The Pembina River enters the Red River at the City of Pembina. During large floods it has an unusual tendency to reach its peak discharge at about the same time the Red does. With the Red and the Pembina at peak, and the Tongue coming in a short distance upstream, the City of Pembina often finds itself an island in a huge shallow sea. The City of Neche is also at risk in flood conditions. Both cities have protected themselves with ring dikes, but it is still frightening to watch the water rise.

Most flood damages in the area are agricultural. And, overland flows have caused serious erosion damages, frequently delaying planting. The worst case is in years like 2005, when June and July rains flooded crops.

In spite of the damages it can cause, the Pembina River is a part of the lives of the people who live near it. Whenever they talk about it, you can sense that they're proud of their river. They have reason to be.



The Little South Pembina River.

the wide floor and steep flanks of the valley as well as the numerous coulees draining the nearby uplands.

These discharges exit the gorge near the City of Walhalla. The water then travels through the delta, an area marked by a well-defined valley with a broad floor. At the City of Leroy, the river exits the delta and flows onto the lake bottom plain. Although this area appears flat, it has a considerable gradient to the north and east. In the centuries of flowing across this plain, the river has formed its highly meandered course.

people living in the affected area have learned to live with it, but the really big floods can cause serious problems. The 1997 flood was the grand-daddy at 16,000 cfs, but serious flooding also occurred in 1996, 2005, 2006, and many other years.

Historically, farmers protected their lands with levees. This practice became widespread, and an extensive levee system developed. Unfortunately, levees can cause problems elsewhere, and eventually can become controversial. A complaint brought to the Pembina County

## Bureau of Reclamation Completes Devils Lake Basin Crossing Study



A culvert in Calio Coulee in the Devils Lake basin.

By Michael Noone

In October, the Devils Lake Basin Joint Water Resource Board was presented with the final report on the tenth of several major coulees in the Devils Lake basin. Over the years, the coulees surveyed have included Mauvais, Big, Edmore, Nekoma, East Branch, Calio, St. Joe, Starkweather, Little, and Stump Lake.

Culvert-sizing across watershed and county lines has long been an issue in the basin, with cases of smaller culverts being downstream of bigger ones, leading to potential flooding. What was needed, was information on all of the culverts and bridge crossings along the major coulees in the basin, so that water boards in adjoining counties could size their structures appropriately.

Fortunately, the U.S. Bureau of Reclamation was interested in fund-

ing the entire project, and provided the technical expertise of its staff.

In 1999, work began on a survey of the major coulees through a cooperative agreement between the Bureau of Reclamation, the State Water Commission, and the Devils Lake Joint Board. The purpose was to provide an inventory of the crossings and culverts along the major coulees, providing information on culvert and bridge sizes, elevations on the upstream and downstream side of the structures, coordinates, materials used in their construction, and the condition of the structure.

In 2005, the Joint Board found the data to be of use when the Water Commission began a cooperative effort to look at the Billings Lake interbasin water transfer area. Information taken from the Bureau studies proved a valuable supplement to the survey work done by the Water

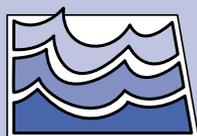
Commission, reducing the cost of the project.

Joint Board Chairman Robert Shirek of Walsh County stated that the “The BOR inventories of the Devils Lake basin are an invaluable aid to local water boards, county officials and others in helping to maintain good water management practices in the local county and basin wide.”

The new Devils Lake Basin Water Management Plan states that “It is the goal of the Joint Board to develop a comprehensive, coordinated, water management plan for the basin that will protect the economic and biological values of the basin while providing optimum benefits for agriculture, wildlife and fisheries, outdoor recreation, economic development, and its citizens.”

In pursuit of that goal, the Joint Board is currently examining taking the information gathered through the Bureau studies, and applying it to a pilot management project in one of the smaller watersheds in the basin. The hope is that the Bureau study, along with further survey work to be done on coulee tributaries could be an integral part of designing a cross-county watershed management project.

The Water Commission is in the process of making the information available to the public via the easy to use Water Commission website mapserver at (<http://mapservice.swc.state.nd.us/index.html>).



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