County	Yellowstone	**Upstream River Mile**	318
Classification	PCM: Partially confined meandering	**Downstream River Mile**	310.8
General Location	Waco	**Length**	7.20 mi (11.59 km)

Narrative Summary

Reach B10 is located in lower Yellowstone County and contains the Captain Clark Fishing Access Site. The Reach is 7.2 miles long and is a Partially Confined Meandering reach type, (PCM), indicating the presence of a primary meandering channel thread with substantial valley wall influence on the river. The Captain Clark Fishing Access Site is located in the middle of the reach.

There are about 1,150 feet of rock riprap and 800 feet of flow deflectors in the reach, which collectively armor about 3 percent of the total bankline. About one half of the armor is protecting the active railroad, and the other half is protecting agricultural land. High resolution 2011 imagery shows the complete flanking of the mapped flow deflectors since 2001. The river has since eroded over 100 feet of bank behind the flanked barbs, eroding into a series of old corrals. The barbs are readily visible in the river.

One abandoned side channel that is about 3,300 feet long at RM 315R appears to be very old, however has several crossings that currently form plugs along its course. The channel is still within the 5-year floodplain, so the plugs have likely affected its function as a flood channel, and perhaps historically as a seasonal channel. This historic side channel is located landward (south) of the Fishing Access Site, which is on an old island. The lower end of this old channel supports a high density of Russian olive.

Reach B10 has lost almost 5.5 miles of side channel length since 1950. In the uppermost portion of the reach, the main river channel flipped from the south side of the corridor to the north sometime between 1976 and 2001, progressively abandoning a mile long channel and focusing the river into a single thread that flows along the north valley bluff line. This is where the flow deflectors described above have been flanked. This pattern has been common all through the reach; major secondary channels from the 1950s have been abandoned and the river has shifted to much more of a single thread meandering river. Some of the 1950's channels have potentially been blocked, and others appear to have been passively abandoned.

On the south side of the river at RM 312.5, the rail line currently isolates about 42 acres of historic 100-year floodplain. The river is currently against the rail line at this location, so that the separation between the river and the isolated remnant is only about 200 feet. This area is also adjacent to about 20 acres of mapped emergent wetland.

Overall, land uses in reach B10 are primarily agricultural, with about 860 acres of flood irrigated land mapped as of 2011. About one third of that irrigated acreage is within the CMZ. The railroad has encroached into 19 acres of the CMZ. In total, just under 7 percent of the CMZ has been restricted, and all of that restriction is due to bank armor protecting the rail line.

The modern 5-year floodplain contains about 72acres of flood-irrigated ground. Reach B10 also supports almost 40 acres of mapped wetlands per valley mile, which is a relatively high density for the corridor.

A hydrologic evaluation of flow depletions indicates that flow alterations over the last century have been major in this reach. The mean annual flood is estimated to have dropped from 30,200 cfs to 24,500 cfs, a drop of about 19 percent. The 2-year flood, which strongly influences overall channel form, has dropped by 11 percent. Low flows have also been impacted; severe low flows described as 7Q10 (the lowest average 7-day flow anticipated every ten years) for summer months has dropped from an estimated 3,070 cfs to 2,090 cfs with human development, a reduction of 32 percent. More typical summer low flows, described as the summer 95% flow duration, have dropped from 3,846 cfs under unregulated conditions to 2,227 cfs under regulated conditions at the Billings gage, a reduction of 42 percent.

CEA-Related observations in Reach B10 include:
- Active and passive abandonment of over five miles of anabranching channel length since 1950
- Bank armor flanking associated with flow consolidation into single thread.

Recommended Practices (may include Yellowstone River Recommended Practices--YRRPs) for Reach B10 include:
- Removal of flanked flow deflectors at RM 318
- Side channel reactivation throughout reach
- Floodplain reconnection at Rm 312.5R
- Russian olive removal

Yellowstone River Reach Narratives — Reach B10

The following table summarizes some key CEA results that have been used to describe overall condition and types of human influences affecting the river. The values are specific to this single reach. Blanks indicate that a particular value was not available for this area. This information is consolidated from a large dataset that is presented in more detail in the full reach narrative report.

Discharge

	Undev.	Developed	% Change
2 Year (cfs)	55,500	49,400	-11.0%
100 Year (cfs)	97,200	93,600	-3.7%

"Undeveloped" flows represent conditions prior to significant human development, whereas "developed" flows reflect the current condition of both consumptive and non-consumptive water use.

Bankfull Channel Area (Ac)

1950	1976	1995	2001	1950-2001
703.2	814.4	728.5	769.4	66.2

Bankful channel area is the total footprint of the river inundated at approx. the 2-year flood.

Physical Features

	2011 Length (ft)	% of Bankline	2001-2011 Change
Rock RipRap	1,153	1.5%	0
Concrete Riprap	0	0.0%	0
Flow Deflectors	807	1.1%	0
Total	**1,960**	**2.6%**	**0**

There are additional types of bank armor such as car bodies and steel retaining walls, but they are relatively minor.

Length of Side Channels Blocked (ft)

Pre-1950s	Post-1950s
3,344	0

Numerous side channels have been blocked by small dikes.

Floodplain Turnover

	1950 - 1976	1976 - 2001
Total Acres	293.6	154.2
Acres/Year	11.3	6.2
Acres/Year/Valley Mile	1.9	1.0

1950-2001 In-channel riparian encroachment (negative number indicates retreat)

6.66 acres

The rate of floodplain turnover reflects how many acres of land are eroded by the river. Tunover is associated with the creation of riparian habitat.

Open Bar Area

	Point Bars	Bank Attached	Mid-Channel	Total
Change in Area '50 - '01 (Ac)				

The type and extent of open sand and gravel bars reflect in-stream habitat conditions that can be important to fish, amphibians, and ground-nesting birds such as least terns.

Floodplain Isolation

	Acres	% of FP
5 Year	202.4	19%
100 Year	111.7	7%

Floodplain isolation refers to area that historically was flooded, but has become isolated do to flow alterations or physical features such as levees.

Restricted Migration Area

Acres	% of CMZ
163.7	7%

Channel Migration Zone restrictions refer to the area and percent of the CMZ that has been isolated by features such as bank armor, dikes, levees, and transportation embankments.

Land Use

	1950	2011
Agricultural Land (Ac)	4,202.4	4,263.9
Ag. Infrastructure (Ac)	43.9	58.2
Exurban (Ac)	0.0	8.2
Urban (Ac)	0.0	0.0
Transportation (Ac)	54.7	169.9

	1950	2011
Flood (Ac)	637.0	858.1
Sprinkler (Ac)	0.0	0.0
Pivot (Ac)	0.0	0.0

Changes in land use reflect the development of the river corridor through time. The irrigated agricultural are is a sub-set of the mapped agricultural land.

1950s Riparian Vegetation Converted to a Developed Land Use (ac)

To Irrigated	To Other Use	Total Rip. Converted	% of 1950s Rip.
24.9	3.7	28.5	3.0%

Changes in the extents of riparian vegetation are influenced by land use changes within the corridor.

National Wetlands Inventory

	Acres	Acres per Valley Mi
Riverine	19.7	3.3
Emergent	113.2	18.9
Scrub/Shrub	106.4	17.8

Total Wetland Acres: **239.3**

Wetlands units summarized from National Wetlands Inventory Mapping include Riverine (typically open water sloughs), Emergent (marshes and wet meadows) and Shrub-Scrub (open bar areas with colonizing woody vegetation).

Russian Olive (2001) (Appx. 100-yr Floodplain)

Acres	%
38.8	1.5%

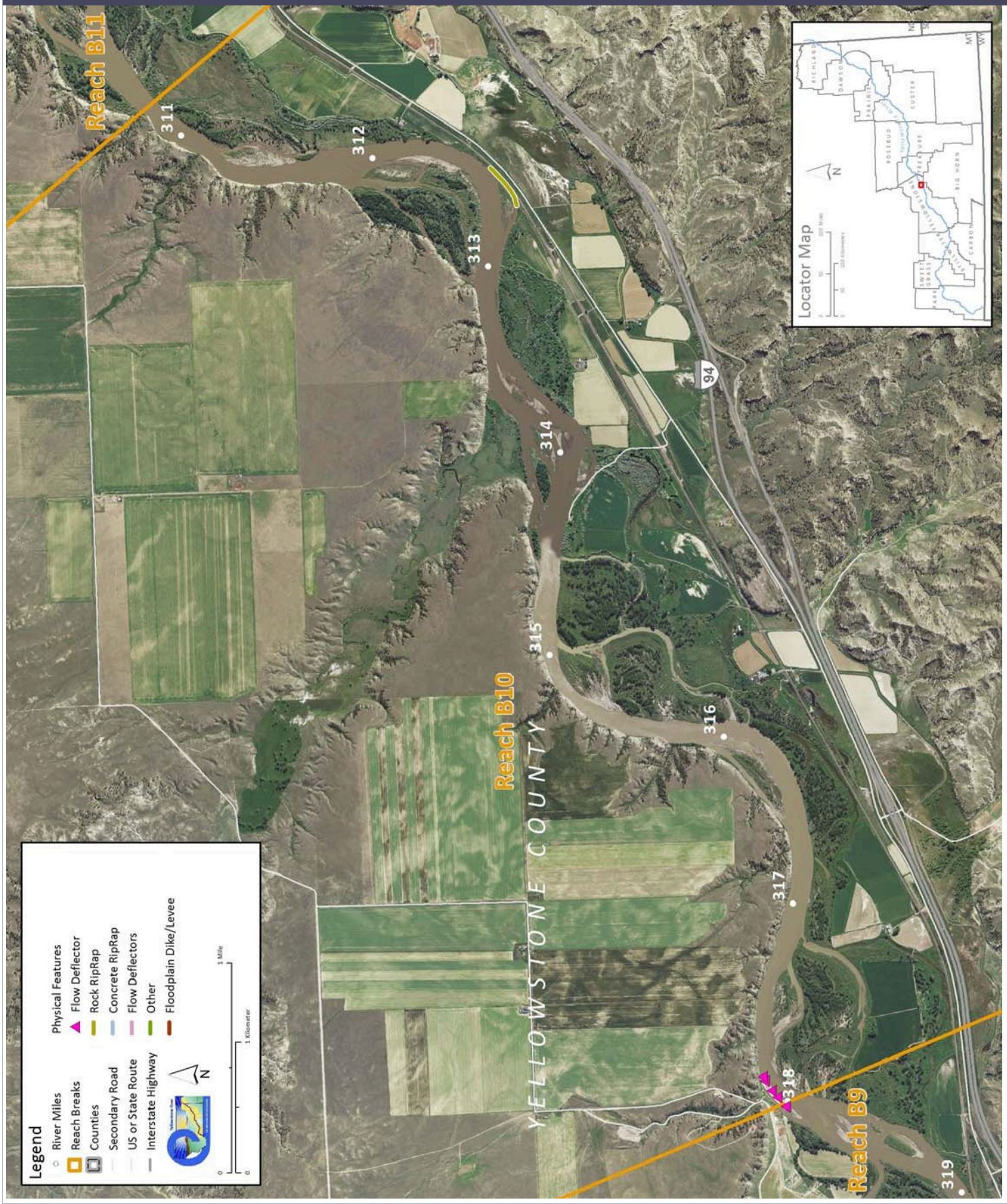
Russian olive is considered an invasive species and its presence in the corridor is fairly recent. Its spread can be used as a general indicator of invasive plants within the corridor.

Riparian Forest at low risk of Cowbird Parasitism (Ac/Valley Mile)

1950	1976	2001	Change 1950-2011
6.3	6.2	8.4	2.2

Cowbirds are associated with agricultural and residential development, displacing native bird species by parasitizing their nests.

PHYSICAL FEATURES MAP (2011)



CHANNEL MIGRATION ZONE MAP