

County	Yellowstone	Upstream River Mile	310.8
Classification	PCA: Partially confined anabranching	Downstream River Mile	302.7
General Location	To Custer Bridge	Length	8.10 mi (13.04 km)

Narrative Summary

Reach B11 is located in lower Yellowstone County. The Reach is 8.1 miles long and is a Partially Confined Anabranching reach type, (PCA), indicating the presence of forested islands with substantial valley wall influence on the river. Custer Bridge and the town of Bighorn are at the lower end of the reach.

There are about 2,600 feet of rock riprap and 1,200 feet of flow deflectors in the reach, which collectively armors about 4 percent of the total bankline. All of the armor is protecting agricultural land, both irrigated and non-irrigated. Most of the rock riprap was built between 1950 and 1976, whereas the flow deflectors were built between 1995 and 2001.

One side channel that is about 1,000 feet long at RM 305R appears to have been blocked as a seasonal channel by three different plugs that were all in place in 1950. Hydraulic modeling results show that under undeveloped conditions, the channel conveyed water at a 2-year discharge, but now it doesn't convey flow at the 5-year discharge. The blocked channel now has dense stands of Russian olive on its lower end.

Since 1950, the bankfull area of the channel has increased by about 60 acres in Reach B11 indicating some enlargement of the main channel between 1950 and 2001. This is interesting because there was also a net increase in riparian area due to erosional processes of about 75 acres, which may appear contradictory. In reviewing the GIS data, it is apparent that much of the channel migration in Reach B11 was through unvegetated farm fields such that the channel was able to enlarge, and the area created by the migration was then colonized by riparian vegetation, resulting in a net gain in riparian area, along with an increase in overall channel size. The total riparian recruitment acreage in the reach was 483 acres; 334 of those acres of recruitment were in 1950s channel areas, and 149 acres of eroded floodplain have been colonized by woody riparian species. The increase in riparian area is most evidenced by riparian shrub, which increased from 219 acres in 1950 to 462 acres in 2001. Reach B11 consequently has a robust riparian corridor with active recruitment associated with channel migration.

Reach B11 experienced a major avulsion between 1976 and 1002, when the river jumped about 1,600 feet to the northwest between RM 305 and RM 306, relocating into a relatively small developing side channel. The avulsed channel has since been migrating back to the southeast, creating a large sediment deposit downstream at RM 305 where the river corridor is tightly confined by the valley wall to the northwest and bank armored fields to the southeast. This section of river appears quite unstable.

Most of the floodplain isolation has been related to more frequent flooding; whereas 2 percent of the 100-year floodplain has become isolated due to human development, about 17 percent of the 5-year floodplain is no longer inundated at that frequency. Much of the loss of 5-year floodplain was in the blocked channel at RM 305R described above. The 100-year isolated floodplain is behind the active rail line and Interstate about 1,000 feet south of the river at RM 308.5R. Emergent wetlands have been mapped in this isolated floodplain area, which is about 21 acres in size. Hydraulic modeling indicates that this area would also be inundated at a 5-year event, making it a good potential candidate for restoring floodplain connectivity through the rail line and frontage road, or for simple wetland restoration.

The mapped land uses in Reach B11 indicate that flood irrigation is the dominant land use, with about 1,500 acres of ground in flood irrigation and 100 in pivot. The town of Bighorn contributes to about 70 acres of urban/exurban development, and the proximity of the rail line to the river corridor is evidenced by 191 acres of transportation footprint. The most common developed land use in the Channel Migration Zone (CMZ) is flood irrigation (431 acres). About 17 percent of the CMZ has been isolated due to physical features such as bank armor and floodplain dikes, and most of that is riprap protection against irrigated lands (11 percent of CMZ). Most of these restrictions are in the lower reach near the town of Bighorn.

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 3,080 cfs to 2,100 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 B11 include:

- Side channel blockage prior to 1950
- Channel instability caused by avulsion at RM 305

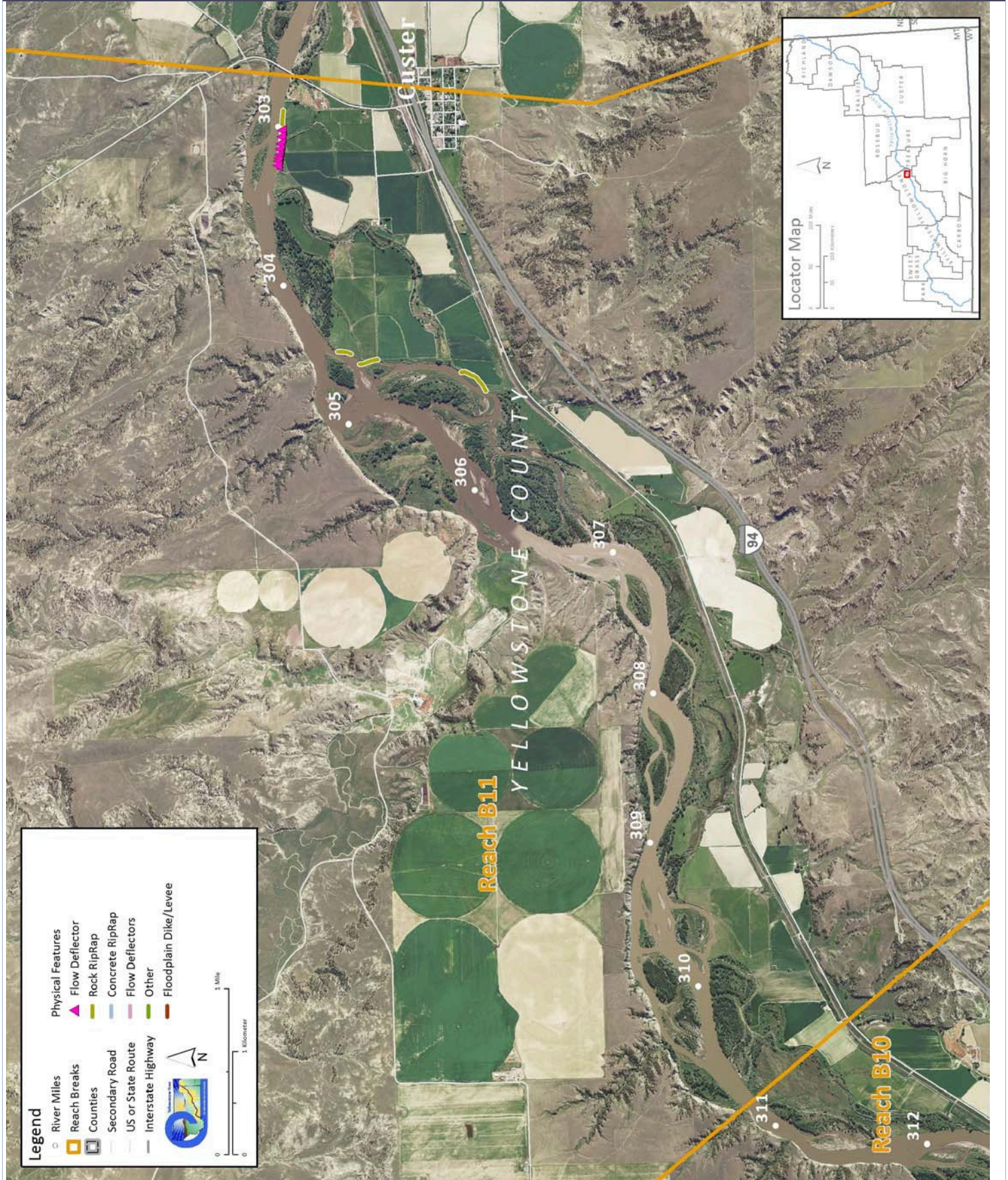
Recommended Practices (may include Yellowstone River Recommended Practices--YRRPs) for Reach B11 include:

- Side channel reactivation at RM 305R
- Floodplain reconnection at Rm 308.5R
- Russian olive removal
- Channel Migration Zone (CMZ) management due to extent of CMZ restricted (17 percent)

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	"Undeveloped" flows represent conditions prior to significant human development, whereas "developed" flows reflect the current condition of both consumptive and non-consumptive water use.		
2 Year (cfs)	55,500	49,400	-11.0%			
100 Year (cfs)	97,200	93,600	-3.7%			
Bankfull Channel Area (Ac)	1950	1976	1995	2001	1950-2001	Bankfull channel area is the total footprint of the river inundated at approx. the 2-year flood.
	916.2	948.6	928.3	976.4	60.2	
Physical Features	2011 Length (ft)	% of Bankline	2001-2011 Change	There are additional types of bank armor such as car bodies and steel retaining walls, but they are relatively minor.		
Rock RipRap	2,570	3.0%	0			
Concrete Riprap	0	0.0%	0			
Flow Deflectors	1,169	1.4%	0			
Total	3,739	4.4%	0			
Length of Side Channels Blocked (ft)	Pre-1950s	Post-1950s	Numerous side channels have been blocked by small dikes.			
	1,002	0				
Floodplain Turnover	1950 - 1976	1976 - 2001	1950-2001 In-channel riparian encroachment (negative number indicates retreat)		The rate of floodplain turnover reflects how many acres of land are eroded by the river. Turnover is associated with the creation of riparian habitat.	
Total Acres	252.0	259.1	74.5 acres			
Acres/Year	9.7	10.4				
Acres/Year/Valley Mile	1.3	1.4				
Open Bar Area	Point Bars	Bank Attached	Mid-Channel	Total	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.	
Change in Area '50 - '01 (Ac)						
Floodplain Isolation	Acres	% of FP	Floodplain isolation refers to area that historically was flooded, but has become isolated do to flow alterations or physical features such as levees.			
5 Year	206.3	17%				
100 Year	33.3	2%				
Restricted Migration Area	Acres	% of CMZ	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.			
	511.3	17%				
Land Use	1950	2011	1950	2011	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.	
Agricultural Land (Ac)	5,117.4	4,940.7	Flood (Ac)	1,189.9	1,490.7	
Ag. Infrastructure (Ac)	54.3	74.4	Sprinkler (Ac)	0.0	0.0	
Exurban (Ac)	2.2	24.7	Pivot (Ac)	0.0	101.8	
Urban (Ac)	68.1	45.0				
Transportation (Ac)	88.0	191.3				
1950s Riparian Vegetation Converted to a Developed Land Use (ac)	To Irrigated	To Other Use	Total Rip. Converted	% of 1950s Rip.	Changes in the extents of riparian vegetation are influenced by land use changes within the corridor.	
	9.9	0.2	10.1	1.0%		
National Wetlands Inventory	Acres	Acres per Valley Mi	Total Wetland Acres	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).		
Riverine	17.6	2.4	221.4			
Emergent	160.7	21.8				
Scrub/Shrub	43.0	5.8				
Russian Olive (2001) (Appx. 100-yr Floodplain)	Acres	%	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.			
	30.6	0.8%				
Riparian Forest at low risk of Cowbird Parasitism (Ac/Valley Mile)	1950	1976	2001	Change 1950-2011	Cowbirds are associated with agricultural and residential development, displacing native bird species by parasitizing their nests.	
	14.7	11.1	9.9	-4.8		

PHYSICAL FEATURES MAP (2011)



CHANNEL MIGRATION ZONE MAP

