

County	Yellowstone	Upstream River Mile	346.7
Classification	PCB: Partially confined braided	Downstream River Mile	340.6
General Location	Ballantine	Length	6.10 mi (9.82 km)

Narrative Summary

Reach B6 is 6.1 miles long and is located Ballantine. The reach is a Partially Confined Braided (PCB) reach type, which indicates some valley wall influence coupled with relatively extensive unvegetated bars and low flow islands. Within Reach B6, the river flows closely along the north valley wall. The Gritty Stone fishing access site is located in the downstream end of the reach.

About 6.3 percent of the bankline in Reach B6 is armored, and the majority of that armor (2,300 feet) is concrete riprap. Since 2001, riprap has expanded by about 430 feet. Reach B6 also hosts almost 1,500 feet of car body riprap, which is fairly unusual in terms of extent on the Yellowstone River. The car bodies were put in place between 1950 and 1995, and their mapped location is at RM 341.7R, although they are difficult to see on the imagery.

Prior to 1950, a side channel that was about 1,350 feet long was blocked by a small dike at RM 343. Even though this side channel was blocked, there has been a net gain of over three miles of side channel since 1950.

Land uses in the reach are primarily agricultural, with about 1,862 acres of flood irrigated land mapped as of 2011. The Channel Migration Zone (CMZ) has been developed for primarily flood irrigation; as of 2011, there were 237 acres of flood irrigated land in the CMZ, and about 9 percent of the total CMZ footprint has become restricted by bank armor and road prisms. The modern 5-year floodplain contains over 200 acres of flood-irrigated ground.

There is one mapped animal handling facility in the reach at RM 345.5R. It is within 800 feet of the active river bank.

The 100-year floodplain has also been restricted; about 210 acres or 11.4 percent of the historic 100-year floodplain area has become isolated from the river by agricultural infrastructure.

Since 1950, there has been almost 250 acres of riparian recruitment in the reach, and most of that was in the 1950s channels that were abandoned.

One ice jam has been recorded in Reach B6. On January 3, 1997, an ice jam occurred at RM 345 that caused severe flooding and resulted in evacuations.

There are 49 acres of mapped Russian olive in the reach, and the mapping indicates that it has expanded on islands and in side channels. Riparian recruitment in the reach has exceeded 500 acres since 1950; about half of that recruitment occurred in areas that were 1950s channel and the other half in areas that were eroded between 1950 and 2001.

Reach B6 was sampled as part of the avian study. The average species richness in this reach was 8.25, which indicates the average number of species observed during site visits to the reach in cottonwood habitats. The average species richness for sites evaluated is 8.

A hydrologic evaluation of flow depletions indicates that flow alterations over the last century have been substantial in this reach. The mean annual flood is estimated to have dropped from 26,000 cfs to 21,100 cfs, a drop of about 19 percent. The 2-year flood, which strongly influences overall channel form, has dropped from 48,300 cfs to 43,000 cfs, which is a reduction of 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 3,000 cfs to 2,050 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.

Because of the flow alterations, about 25 percent of the 5-year floodplain has become isolated in Reach B6. Much of that 5-year floodplain isolation is within old swales on the south side of the river. The 5-year flood discharge has dropped by 8.25 percent in this reach due to human influences, primarily irrigation.

CEA-Related observations in Reach B6 include:

- Gain in anabranching channel length
- Ice jamming
- Side channel blockage at RM 343.

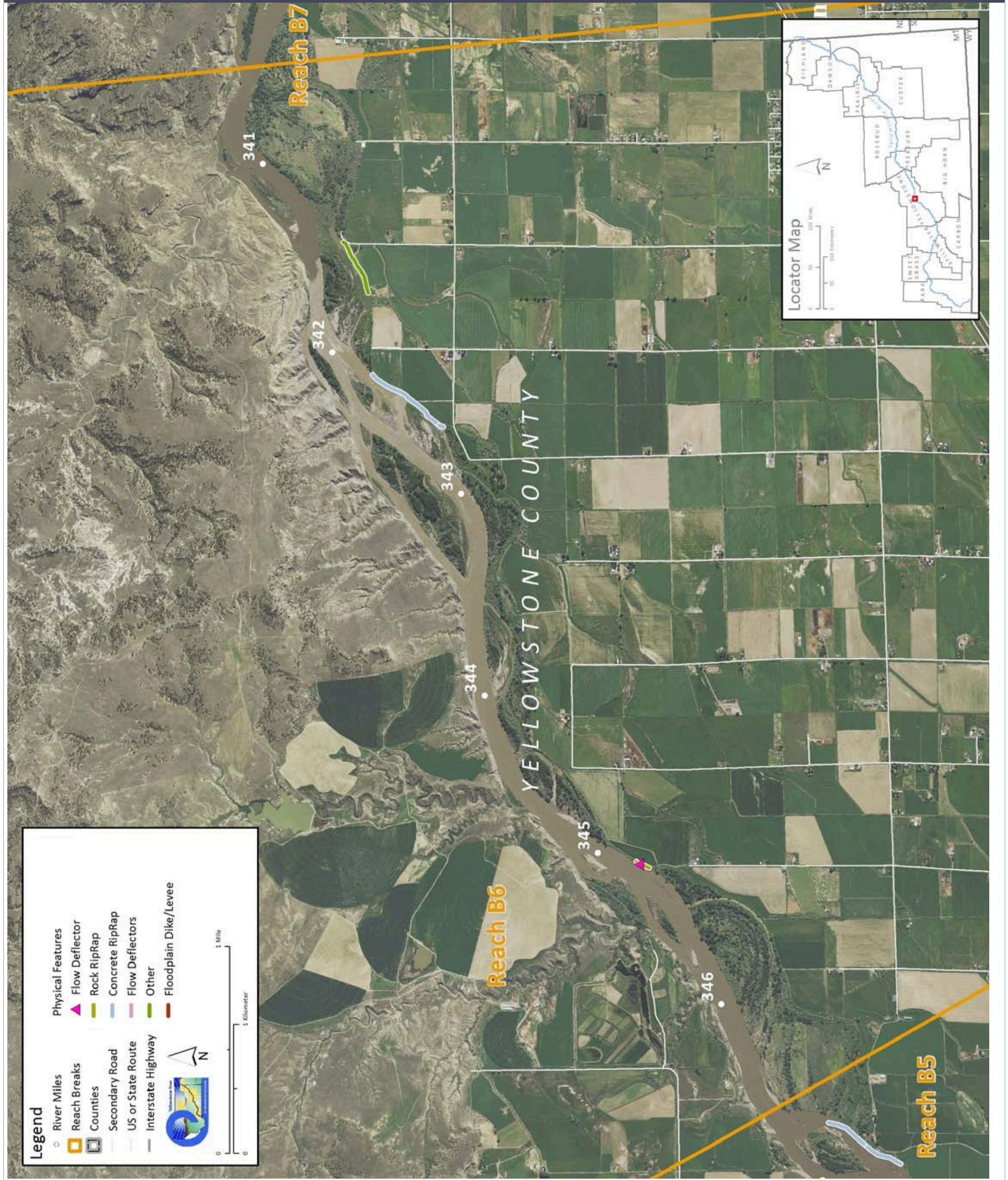
Recommended Practices (may include Yellowstone River Recommended Practices--YRRPs) for Reach B6 include:

- Russian olive removal
- Nutrient management at corrals associated with animal handling facility at RM 534.5R

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)	48,300	43,000	-11.0%			
100 Year (cfs)	85,300	82,200	-3.6%			
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.
	583.2	616.6	578.5	617.8	34.6	
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	304	0.5%	304			
Concrete Riprap	2,275	3.5%	106			
Flow Deflectors	23	0.0%	23			
Total	2,602	4.0%	433			
Length of Side Channels Blocked (ft)	Pre-1950s	Post-1950s	Numerous side channels have been blocked by small dikes.			
	1,352	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	141.8	120.5	-36.52 acres			
Acres/Year	5.5	4.8				
Acres/Year/Valley Mile	1.0	0.9				
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	343.9	25%				
100 Year	209.2	11%				
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.			
	141.6	9%				
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)	3,682.8	3,694.9	Flood (Ac)	1,317.8	1,862.1	
Ag. Infrastructure (Ac)	51.6	136.7	Sprinkler (Ac)	0.0	0.0	
Exurban (Ac)	0.0	0.0	Pivot (Ac)	0.0	96.2	
Urban (Ac)	0.0	3.5				
Transportation (Ac)	16.6	17.1				
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.	
	1.9	1.0	2.8	0.0%		
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	2.9	0.5	112.4			
Emergent	71.5	12.7				
Scrub/Shrub	38.0	6.7				
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.			
	48.7	2.8%				
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.	
	1.8	2.0	0.4	-1.4		

PHYSICAL FEATURES MAP (2011)



CHANNEL MIGRATION ZONE MAP

