

County	Treasure	Upstream River Mile	282
Classification	PCB: Partially confined braided	Downstream River Mile	278.2
General Location	Below Yellowstone Diversion	Length	3.80 mi (6.12 km)

Narrative Summary

Reach C4 is located in Treasure County, below Yellowstone Diversion Dam. Amelia Island Fishing Access Site is located in the middle of the reach. The reach is a 3.8 mile long Partially Confined Braided reach type, indicating some influence of the valley wall along with fairly common mid-channel bars. Within this reach the river trends toward and along the north valley wall near Hysham.

There are almost 5,000 feet of bank armor in the reach, all of which is rock riprap protecting flood irrigated fields at RM 279. Channel migration at the upstream end of this armor will pose risk of flanking as the bankline continues to erode to the south. A total of 13 percent of the bank is armored. Land use is dominated by agriculture, with 371 acres of pivot irrigation development since 1950. Physical features such as bank armor, dikes, and levees have isolated 9 percent of the Channel Migration Zone in Reach C4. All of the armor is protecting agricultural land. There are 22 acres of land in the CMZ under pivot irrigation.

Reach C4 has lost 8,200 feet of side channel length since 1950; however none of those lost channels were mapped as intentionally blocked.

Reach C4 shows a reduction in floodplain turnover rates from 3.4 acres/valley mile/year from 1950-1976 to 1.8 acres/valley mile/year from 1976-2001. There has also been a net loss of 15.5 acres of mid-channel bars since 1950, and a 10 acre increase in bank-attached bars, indicating a loss in overall low flow channel complexity. About 120 acres of riparian area has been cleared for irrigation, which is 18 percent of the total mapped 1950 riparian zone. There are 34 acres of Russian olive in the reach.

Over 300 acres of 100-year floodplain has been isolated by human development, and all of that isolation is due to agricultural development on the south side of the river. The isolation reflects 20 percent of the total 100-year floodplain. The 5-year floodplain is even more affected; 35 percent of the historic 5-year floodplain is no longer inundated at that frequency. The isolation of the historic 5-year floodplain, which is due primarily to flow alterations, has been associated with increased development in these areas; currently there are about 160 acres of flood irrigated land and 40 acres of pivot within the historic 5-year floodplain.

Reach C4 was sampled as part of the avian study. A total of 39 bird species were identified in the reach. Two bird species identified by the Montana Natural Heritage Program as Potential Species of Concern (PSOC) were also found, the Chimney Swift, and the Ovenbird. In contrast to most other reaches, Reach C4 has seen an increase in the forested area that is at low risk of cowbird parasitism since 1950. At that time, there were 43 acres per valley mile of such forest, and that number increased to 138 acres per valley mile by 2001.

A hydrologic evaluation of flow depletions indicates that flow alterations over the last century have been major in this reach. The 2-year flood, which strongly influences overall channel form, has dropped by 23 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 4,620 cfs to 2,960 cfs with human development, a reduction of 36 percent. More typical summer low flows, described as the summer 95% flow duration, have dropped from 6,150 cfs under unregulated conditions to 3,320 cfs under regulated conditions at Reach C10 downstream where the analysis begins, a reduction of 46 percent.

CEA-Related observations in Reach C4 include:

- Influence of flow alterations on floodplain inundation and riparian extent
- Increase in area at low risk of cowbird parasitism with riparian encroachment

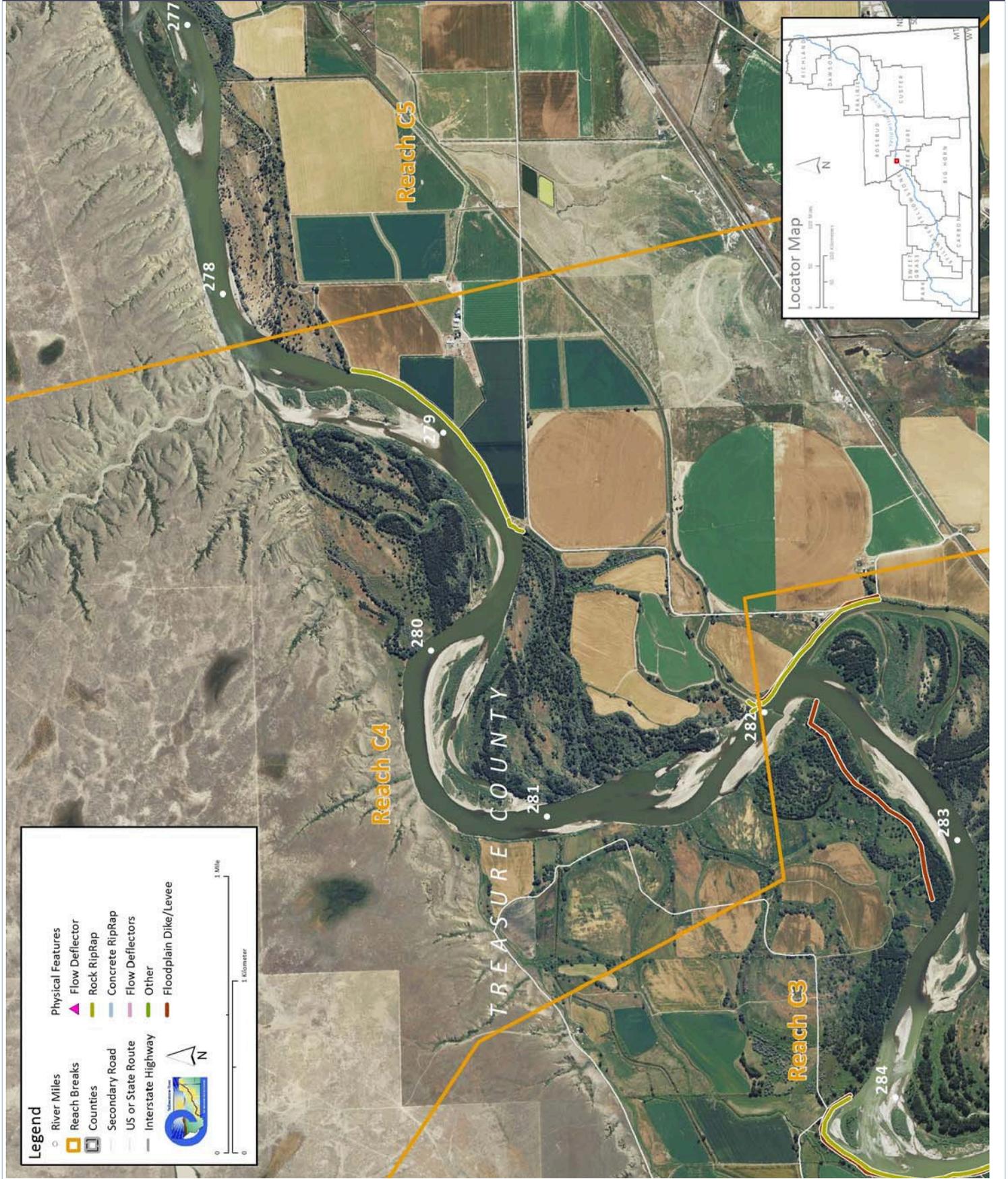
Recommended Practices (may include Yellowstone River Recommended Practices--YRRPs) for Reach C4 include:

- Russian olive removal

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)	60,900	47,100	-22.7%			
100 Year (cfs)	120,000	100,000	-16.7%			
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.
	341.3	398.9	397.1	391.2	49.9	
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	4,971	12.5%	595			
Concrete Riprap	0	0.0%	0			
Flow Deflectors	0	0.0%	0			
Total	4,971	12.5%	595			
Length of Side Channels Blocked (ft)	Pre-1950s	Post-1950s	Numerous side channels have been blocked by small dikes.			
	0	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	88.4	46.0				
Acres/Year	3.4	1.8				
Acres/Year/Valley Mile	1.4	0.8	12.38 acres			
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)	0	10.1	-15.5	-5.4		
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	363.6	35%				
100 Year	324.1	20%				
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.			
	114.4	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)	2,756.2	2,680.3	Flood (Ac)	1,279.5	807.6	
Ag. Infrastructure (Ac)	66.2	36.7	Sprinkler (Ac)	0.0	0.0	
Exurban (Ac)	0.0	0.0	Pivot (Ac)	0.0	370.8	
Urban (Ac)	0.0	0.0				
Transportation (Ac)	30.9	30.9				
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.	
	116.0	3.3	119.3	18.0%		
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	1.8	0.8	57.5			
Emergent	30.7	12.9				
Scrub/Shrub	25.1	10.6				
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.			
	33.9	1.6%				
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.	
	43.3	53.7	138.1	94.8		

PHYSICAL FEATURES MAP (2011)



CHANNEL MIGRATION ZONE MAP

