

County	Park	Upstream River Mile	508.7
Classification	PCM: Partially confined meandering	Downstream River Mile	506.7
General Location	To Carters Bridge	Length	2.00 mi (3.22 km)

Narrative Summary

Reach PC12 is located in the northernmost portion of the Paradise Valley, consisting of the two miles of river channel upstream of Carters Bridge. The reach is somewhat confined between terraces, Highway 89, and bedrock hillslopes. Carter’s Bridge hosts a fishing access site and boat ramp.

Over its two mile length, the banks of Reach PC12 are armored by 7,267 feet of rock riprap and 4,106 feet of flow deflectors. Over 50 percent of the banks are armored. There are also about 8,700 feet of floodplain levees in Reach PC12. About 2,600 feet of this levee extent is the Highway 89 embankment which also forms the bankline as the river approaches the Livingston Ditch Diversion structure. A total of 39 percent of the Channel Migration Zone in this reach has been restricted by physical features such as bank armor and levees.

In 1950, there were 343 acres of land under flood irrigation in the reach. By 2000, that had dropped to about 90 acres, and sprinklers and pivots had expanded to 201 and 16 acres, respectfully. There was also about 51 acres of exurban development in the reach, all of which is just above Carter’s Bridge on the west side of the river.

Over 100 acres of wetlands have been mapped in Reach PC12. These wetlands are located in isolated relic channels in the southwest floodplain, and in perched historic meander features in the northeast.

Reach PC12 is located right next to the Livingston gage which is at Carters Bridge. This area of the upper Yellowstone River has seen three severe floods in the last 20 years. The 1996 and 1997 floods were very damaging, early-June events that peaked at 37,100 and 38,000 cfs, respectively. At the time, these were considered to be sequential 100-year floods. Then in late June of 2011, the river peaked at 40,600 cfs, which is currently the flood of record at Livingston. This flood exceeded a 100-year event, with both the 1996/1997 events considered to have exceeded a 75-year flood.

A hydrologic evaluation of flow depletions indicates that flow alterations over the last century have been relatively small in this reach. The biggest influence has been on low flows: severe low flows described as 7Q10 (the lowest average 7-day flow anticipated every ten years) for summer months has dropped from an estimated 1,550 cfs to 1,500 cfs with human development, a reduction of 3.2 percent. More typical summer low flows, described as the summer 95% flow duration, have dropped from 1,760 cfs under unregulated conditions to 1,680 cfs under regulated conditions at the Livingston gage, a reduction of 4.6 percent.

CEA-Related observations in Reach PC12 include:

- Narrowing of the CMZ to less than half of its natural width, mainly due to long levees that run parallel to the river to protect spring creeks.
- Loss of side channel connectivity due to floodplain dikes and bank armor causing simplification

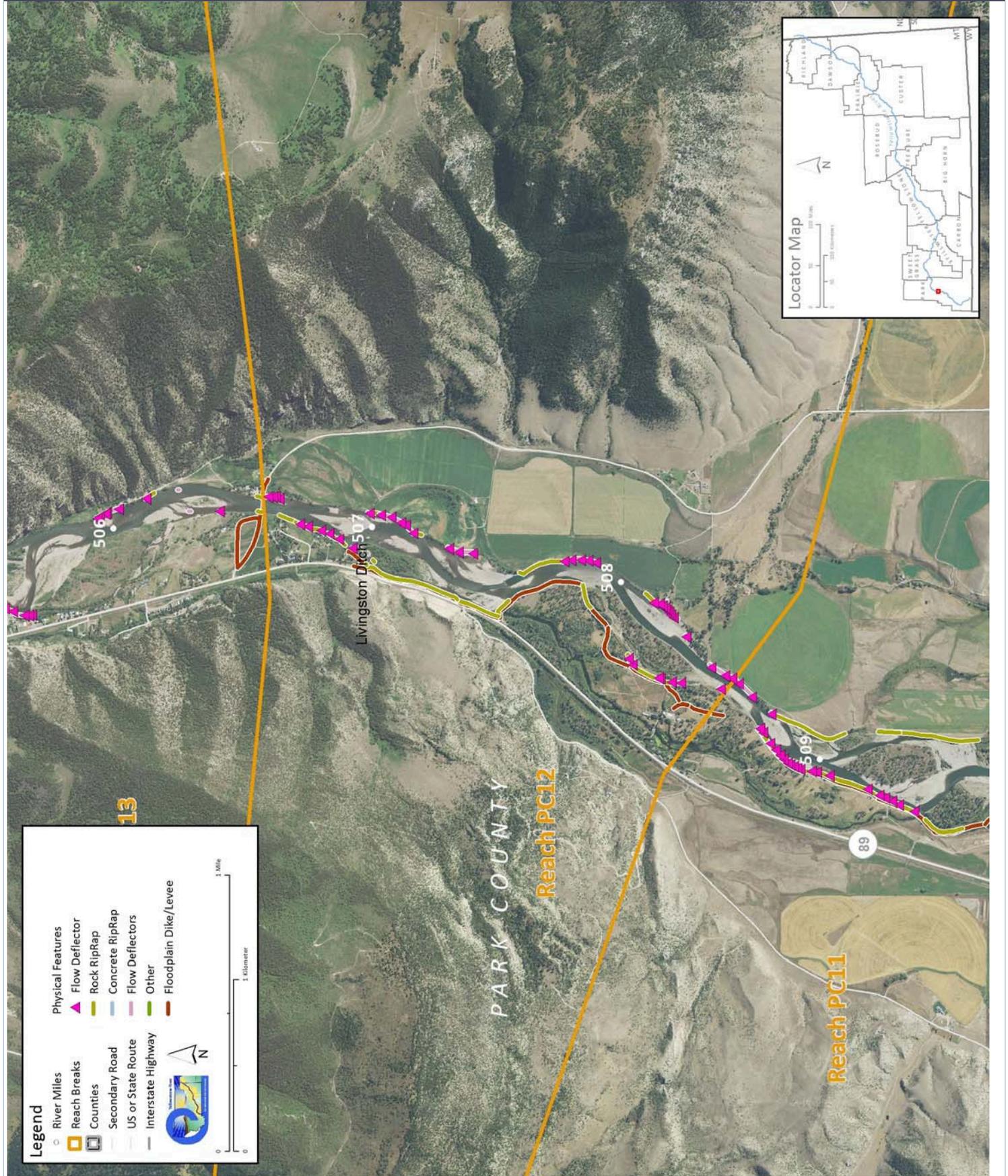
Recommended Practices (may include Yellowstone River Recommended Practices--YRRPs) for Reach PC12 include:

- Side channel restoration at RM 508L
- CMZ Management due to current restriction of 39 percent of the Channel Migration Zone
- Bank Stabilization Recommended Practices due to 55 percent of banks being armored in reach
- Irrigation diversion management at Livingston Ditch Diversion

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)	20,300	20,200	-0.5%			
100 Year (cfs)	38,200	38,100	-0.3%			
Bankfull Channel Area (Ac)	1950	1976	1995	2001	1950-2001	Bankful channel area is the total footprint of the river inundated at approx. the 2-year flood.
	129.5			125.0	-4.5	
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	7,267	35.1%	109			
Concrete Riprap	0	0.0%	0			
Flow Deflectors	4,106	19.9%	-73			
Total	11,373	55.0%	36			
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 Acres/Year Acres/Year/Valley Mile			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)						
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						
100 Year						
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.			
	155.2	39%				
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)	825.0	749.2	Flood (Ac)	343.0	89.4	
Ag. Infrastructure (Ac)	39.0	57.1	Sprinkler (Ac)	0.0	201.3	
Exurban (Ac)	0.0	50.8	Pivot (Ac)	0.0	16.1	
Urban (Ac)	0.0	0.0				
Transportation (Ac)	19.3	19.0				
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.	
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	19.8	10.8	115.8			
Emergent	67.5	36.8				
Scrub/Shrub	28.5	15.6				
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.			
	0.2	0.1%				
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.	

PHYSICAL FEATURES MAP (2011)



CHANNEL MIGRATION ZONE MAP

