County	Treasure	**Upstream River Mile**	269.4
Classification	UA: Unconfined anabranching	**Downstream River Mile**	260.3
General Location	Mission Valley	**Length**	9.10 mi (14.65 km)

Narrative Summary

Reach C7 is 9.1 miles long and is located in the Mission Valley downstream of Hysham. It is an Unconfined Anabranching reach type, which indicates little in the way of valley wall influence coupled with extensive side channels and forested islands. The Mission Valley owes its width to the presence of the Bearpaw Shale in the valley wall. Because this Cretaceous-age shale is relatively erodible and prone to mass failure, over time the river has been able to erode the valley wall more easily than in other reaches, creating the large distinct valleys present today. Because the Mission and Hammond Valleys are so wide, the river developed a complex series of channels and an expansive riparian forest. These reaches are especially rich in terms of aquatic and riparian habitat extent, diversity, and geomorphic complexity.

Just over 2,000 feet of rock riprap lines the banks in Reach C7, protecting 2.3 percent of the bankline.

Prior to 1950 about 4,200 feet of side channel had been blocked in Reach C7, and since then, floodplain dikes have blocked another three miles of side channel. Blocked side channels are located at RM 270.8L, RM 263.5R, and RM 261R. Even with all of the blockages, Reach C7 still has on the order of 17 miles of functional side channel length.

Reach C7 appears to be experiencing an active major avulsion just north of Sanders, where an anabranching channel has been developing into a primary channel over the last decade. As rerouting of the river would shorten the main thread by approximately 1.5 miles, an avulsion is very likely to occur in this area over the next several years. The rate at which the anabranching side channel fully captures the main thread will depend on flood events, as floods will accelerate the avulsion process. This avulsion would take pressure off of the main channel to the south, which is currently threatening the rail line at RM 264.8R and RM 266.2R.

About 9 percent of the total 100-year floodplain has become isolated due to human development in Reach C7. The 5-year floodplain is even more affected; 41 percent of the historic 5-year floodplain is no longer inundated at that frequency. The isolation of the historic 5-year floodplain, due primarily to flow alterations, has been associated with increased development in these areas; currently there are about 95 acres of flood irrigated land and 56 acres of pivot land within the historic 5-year floodplain. Much of the isolated 5-year floodplain area is within the active stream corridor and riparian zone however, exemplifying the potential impacts of flow alterations on frequent floodplain inundation.

Land use is dominated by agriculture, with 277 acres of pivot irrigation development since 1950. There are about 350 acres of flood irrigated land and 31 acres of pivot within the CMZ, but only 4 percent of the CMZ is restricted by physical features.

Riparian mapping data show a net gain of 780 acres of woody vegetation into the active channel corridor since 1950. This has occurred both on migrating point bars that have become vegetated, as well as within abandoned side channels. Reach C7 has about 90 acres of wetland per valley mile, which makes it one of the most concentrated wetland areas in the corridor. There are also 164 acres of Russian olive in the reach.

Reach C7 was sampled as part of the fisheries study. A total of 27 fish species were sampled in the reach, including Sauger, which are recognized by the Montana Natural Heritage Program as a Species of Concern (SOC).

Reach C7 was sampled as part of the avian study. A total of 69 bird species were identified in the reach. Four bird species identified by the Montana Natural Heritage Program as Potential Species of Concern (PSOC) were found, the Black and White Warbler, the Plumbeous Vireo, the Ovenbird, and the Chimney Swift. Two Species of Concern (SOC) were identified, the Black Billed Cuckoo and the Bobolink. Brown Headed Cowbirds were also present. Reach C7 has seen an increase in the forested area that is at low risk of cowbird parasitism since 1950. At that time, there were 86 acres per valley mile of such forest, and that number increased to 102 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 4,680 cfs to 2,990 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 C7 include:
•Active and passive loss of thousands of feet of side channel

Recommended Practices (may include Yellowstone River Recommended Practices--YRRPs) for Reach C7 include:
•Side channel reactivation at RM 270.8L, RM 263.5R, and RM 261R
•Russian olive removal

Yellowstone River Reach Narratives — Reach C7

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)	61,100	47,000	-23.1%
100 Year (cfs)	120,000	100,000	-16.7%

"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
1,264.9	1,329.6	1,230.4	1,217.0	-47.9

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	2,173	2.3%	0
Concrete Riprap	0	0.0%	0
Flow Deflectors	0	0.0%	0
Total	**2,173**	**2.3%**	**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
4,230	15,593

Numerous side channels have been blocked by small dikes.

Floodplain Turnover

	1950 - 1976	1976 - 2001
Total Acres	447.8	278.9
Acres/Year	17.2	11.2
Acres/Year/Valley Mile	2.8	1.8

1950-2001 In-channel riparian encroachment (negative number indicates retreat): 169.5 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)	-116	58.7	-33.6	-91

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	1,107.4	41%
100 Year	378.0	9%

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
172.8	4%

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)	6,777.9	6,695.6
Ag. Infrastructure (Ac)	77.0	128.1
Exurban (Ac)	0.0	7.5
Urban (Ac)	0.0	0.0
Transportation (Ac)	101.9	104.3

	1950	2011
Flood (Ac)	3,276.6	1,951.2
Sprinkler (Ac)	0.0	0.0
Pivot (Ac)	0.0	276.3

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.
29.7	0.4	30.1	1.0%

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	15.7	2.5
Emergent	406.2	65.4
Scrub/Shrub	130.4	21.0

Total Wetland Acres: **552.3**

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	%
164.4	2.1%

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
86.2	76.9	100.3	14.0

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

PHYSICAL FEATURES MAP (2011)

CHANNEL MIGRATION ZONE MAP