

County	Stillwater	Upstream River Mile	430.3
Classification	PCB: Partially confined braided	Downstream River Mile	423.3
General Location	I-90 bridge crossing	Length	7.00 mi (11.27 km)

Narrative Summary

Reach A11 is seven miles long and is located at the I-90 Bridge crossing below Reed Point. The reach is a Partially Confined Braided (PCB) reach type, indicating valley wall influences and relatively extensive open gravel bars and small islands. The valley is relatively narrow in this reach, and the river swings from the north valley wall upstream of the bridge to the south valley wall downstream. The valley wall consists of erosion-resistant sandstone cliffs of the Hell Creek Formation. The river has been extremely dynamic in this reach, and over a thousand feet of bank armor has been flanked since 2001. Since 1950, numerous areas have experienced over 500 feet of bank movement.

Similar to other reaches in Region A, the overall footprint of the river channel has increased in size since 1950. In 1950, the channel footprint was 451 acres but by 2001 it had expanded to 567 acres.

About 13 percent of the banks in Reach A11 are armored, with the majority of that armor being rock riprap. Between 2001 and 2011, there was a loss of about 1,200 feet of armor in the reach. Rock riprap was eroded out from the left (north) bank at RM 424.5, where the river flanked about a thousand feet of rock between 2005 and 2011. Since that time, the river has migrated at least 250 feet behind the armor. At least one flow deflector was lost on the same bankline just upstream. About 320 feet of the lost bank protection was flow deflectors.

Over a mile of side channels have been physically blocked in Reach A11 since 1950. The loss has occurred at RM 424, where a road/field dike crosses the old side channel at two locations.

Land use in Reach A11 is predominantly agricultural, although there several hundred acres of transportation-related use associated with I-90 and the rail line. All of the irrigated land is in under flood irrigation. A total of 210 acres of developed land are in the Channel Migration Zone. Almost all of that ground is in flood irrigation, and about 50 acres of the transportation corridor are within the CMZ. About 17 percent of the CMZ is isolated by physical features.

There is one diversion structure on the right bank at RM 428.3 that feeds the Merrill Columbus Ditch. The diversion is located just downstream of the railroad and county road bridges, which are about 2,100 feet upstream of the I-90 Bridge.

There is one dump site mapped in Reach A11 at RM 425.8.

Riparian mapping in Reach A11 shows a reduction in total acreage of closed timber from 400 acres in 1950 to 230 acres in 2001. Similarly, the extent of mapped shrubs dropped from 170 acres to 82 acres for the same timeframe.

Reach A11 was sampled as part of the avian study. The average species richness in Reach A11 was 9.6, which indicates the average number of species observed during site visits to the reach in cottonwood habitats. The average species richness for all sites evaluated is 8. One bird Species of Concern (SOC), the Bobolink, was identified in the reach. One bird species identified by the Montana Natural Heritage Program as a Potential Species of Concern (PSOC), the Ovenbird, was also found.

Since 1950, Reach A11 has lost most of its forest that would be considered at low risk of cowbird infestation due to its separation from agricultural infrastructure. In 1950, about 35 acres of forest per valley mile were identified as low risk and by 2001 that forest area had been reduced to 13 acres due to development within the reach.

Reach A11 marks a distinct jump in the extent of Russian olive present in the river corridor. The reach has approximately 2.3 acres of mapped Russian olive, which is most concentrated in the vicinity of the bridges.

A hydrologic evaluation of flow depletions indicates that flow alterations over the last century have been moderate in this reach. The mean annual flood is estimated to have dropped from 14,200 cfs to 13,400 cfs, a drop of about 6 percent. 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 2,070 cfs to 1,690 cfs with human development, a reduction of 18 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 A11 include:

- Accelerated erosion behind 1,000 feet of flanked rock riprap.
- Blockage of several thousand feet of side channel
- At least one flanked barb
- Expansion of Russian olive infestation relative to upstream.
- Reduction in both closed timber and shrub riparian extent.

Recommended Practices (may include Yellowstone River Recommended Practices--YRRPs) for Reach A11 include:

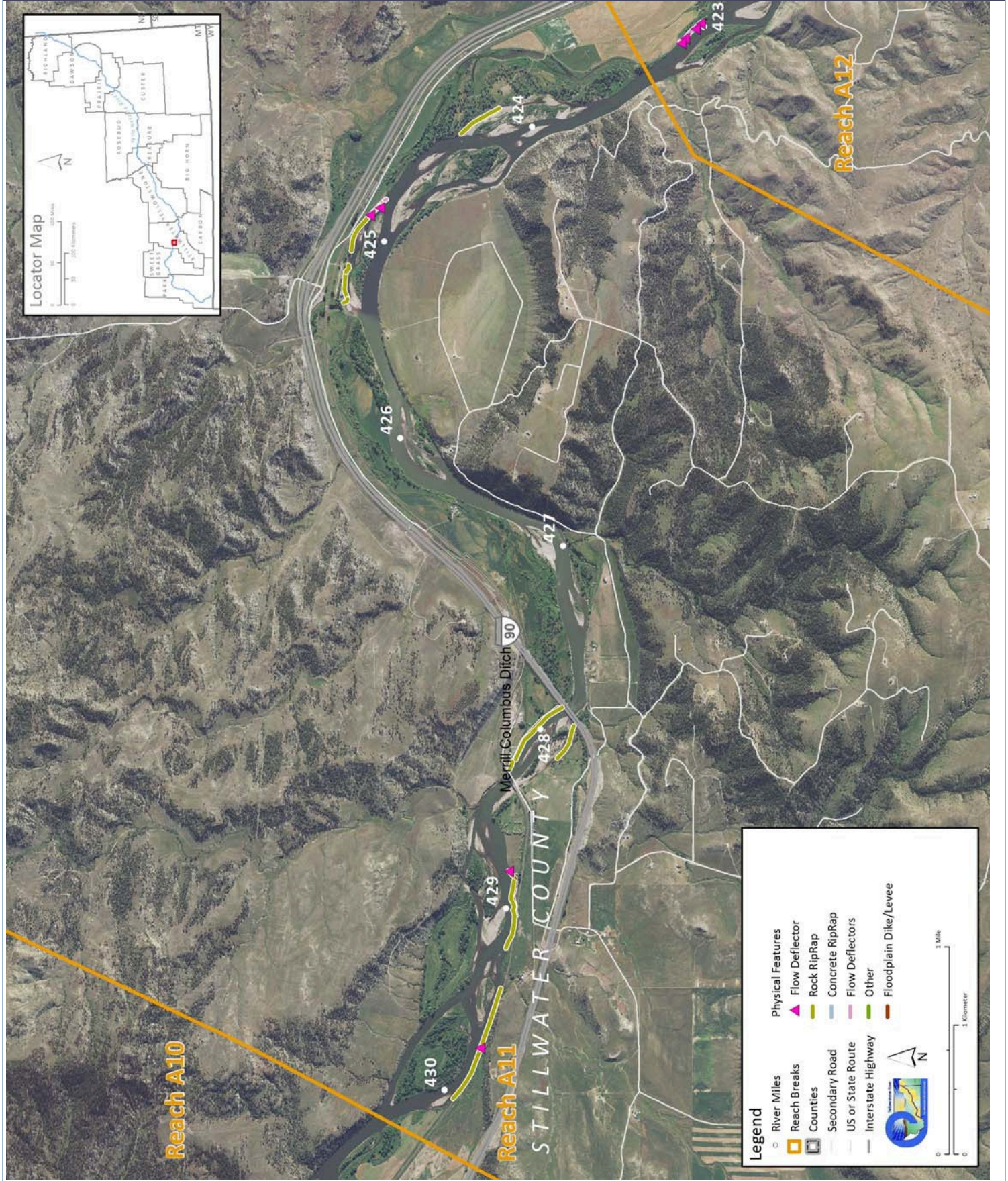
- Floodplain restoration/reconnection behind rail line at RM 430
- Side channel restoration at RM 424

- Bank armor removal at RM 424.5
- CMA management due to extent of CMZ restriction (17 percent)
- Russian olive removal—this is the most upstream reach of major Russian olive colonization
- Solid waste removal from right (south) bank area at RM 425.8
- Irrigation diversion structure management at Merrill Columbus Ditch Diversion at RM 428.3

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)	27,500	26,700	-2.9%			
100 Year (cfs)	50,600	50,100	-1.0%			
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.
	451.0	492.6	532.9	568.8	117.9	
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	9,701	13.2%	-956			
Concrete Riprap	0	0.0%	0			
Flow Deflectors	286	0.4%	-321			
Total	9,987	13.6%	-1,277			
Length of Side Channels Blocked (ft)	Pre-1950s	Post-1950s	Numerous side channels have been blocked by small dikes.			
	0	6,747				
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	135.3	121.7	-65.23 acres			
Acres/Year	5.2	4.9				
Acres/Year/Valley Mile	0.8	0.8				
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	49.7	21%				
100 Year	38.7	5%				
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.			
	235.8	16%				
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)	2,872.2	2,357.0	Flood (Ac)	351.2	530.6	
Ag. Infrastructure (Ac)	49.4	107.7	Sprinkler (Ac)	0.0	0.0	
Exurban (Ac)	0.0	70.6	Pivot (Ac)	0.0	0.0	
Urban (Ac)	0.0	0.0				
Transportation (Ac)	94.4	326.5				
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.	
	26.6	14.9	41.5	7.0%		
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	20.2	3.2	78.7			
Emergent	28.3	4.6				
Scrub/Shrub	30.2	4.9				
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.			
	2.3	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.	
	34.8	21.2	13.4	-21.4		

PHYSICAL FEATURES MAP (2011)



CHANNEL MIGRATION ZONE MAP

