County	Stillwater		**Upstream River Mile**	423.3
Classification	PCB: Partially confined braided		**Downstream River Mile**	417.3
General Location	To Stillwater confluence		**Length**	6.00 mi (9.66 km)

Narrative Summary

Reach A12 is seven miles long and is located just upstream of the mouth of the Stillwater River. 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 wall consists of erosion-resistant sandstone cliffs of the Hell Creek Formation. The river is confined by the valley wall to the south and by transportation infrastructure to the north. The river has been extremely dynamic in this reach; in some places the banks have migrated over a thousand feet since 1950.

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 434 acres but by 2001 it had expanded to 570 acres.

About 13 percent of the banks in Reach A12 are armored, with the majority of that armor being rock riprap. Between 2001 and 2011, there was a gain of about 1,182 feet of rock riprap and 560 feet of flow deflectors in the reach.   At least one flow deflector has been flanked on the right bank just upstream of the Stillwater confluence at RM 418.5. About two miles of transportation encroachments were mapped in Reach A12.

On side channel that is almost four thousand feet long at RM 421 was physically blocked in Reach A12 since 1950. More recently, however, the river has migrated back into the side channel such that the majority of it is now active.

Land use in Reach A12 is predominantly agricultural, although there are several hundred acres of exurban development in the reach. Almost a thousand acres of land is under flood irrigation. A total of 293 acres of developed land are in the Channel Migration Zone. Almost all of that ground is in flood irrigation, although 14 acres are in exurban development and 16 acres are in transportation. About 6 percent of the CMZ is isolated by physical features.

Riparian mapping in Reach A12 shows a reduction in total acreage of open timber from 43 acres in 1950 to 23 acres in 2001.

Reach A12 was sampled as part of the avian study. The average species richness in Reach A12 was 7.6, 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 identified by the Montana Natural Heritage Program as Potential Species of Concern (PSOC), the Dickscissel, was identified in the reach.

Since 1950, Reach A12 has lost all of its forest that would be considered at low risk of cowbird infestation due to its separation from agricultural infrastructure. In 1950, about 4 acres of forest per valley mile were identified as low risk and by 2001 that forest area had been reduced to zero.

Reach A12 has approximately 3 acres of mapped Russian olive, which is most concentrated on the north side of the river on the banks of the main channel, side channels, and sloughs.

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 14,400 cfs to 13,600 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 2,080 cfs to 1,690 cfs with human development, a reduction of 19 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 A12 include:
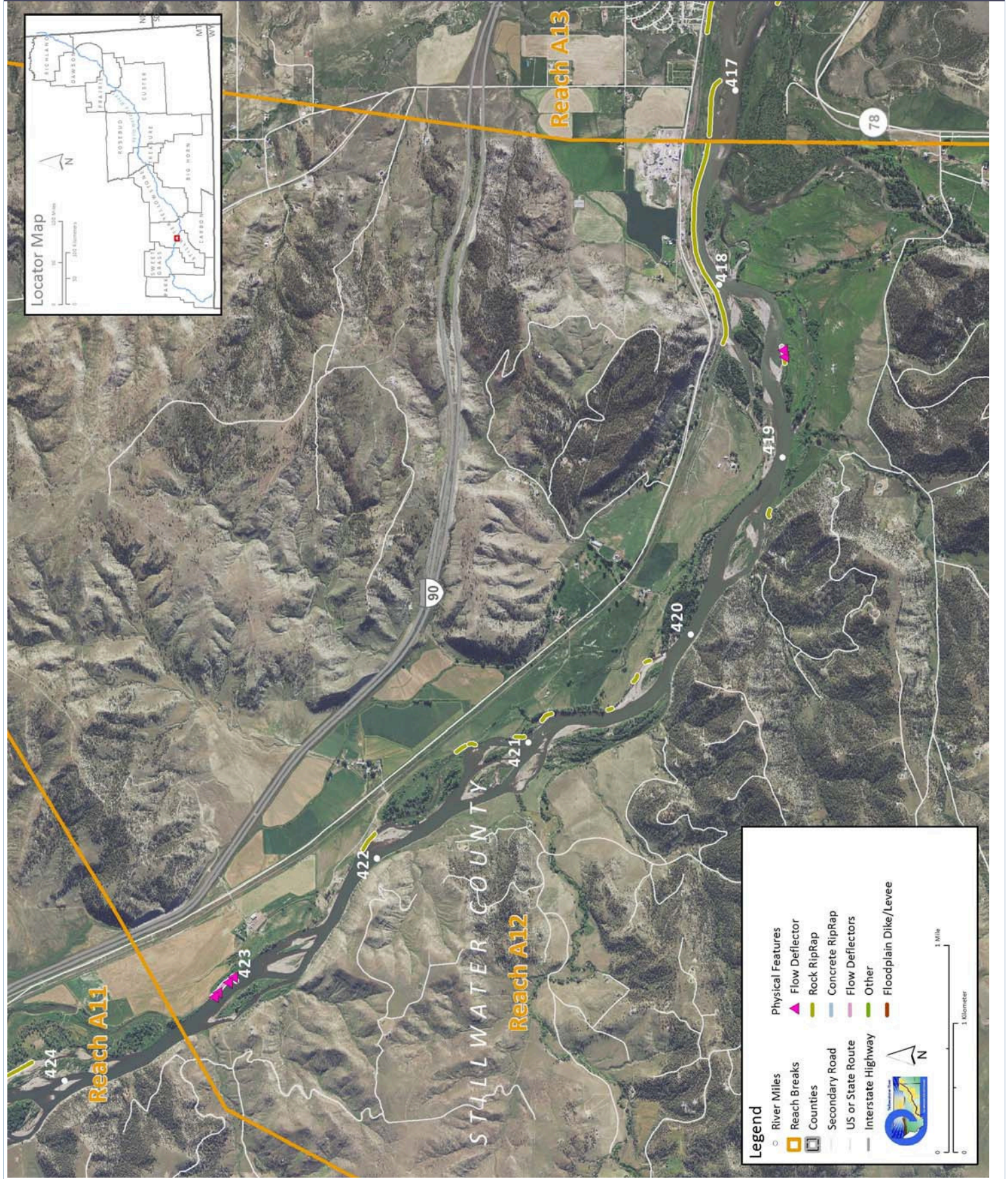•Recapture of previously blocked side channel
•Flanking of barbs

Recommended Practices (may include Yellowstone River Recommended Practices--YRRPs) for Reach A12 include:
•Bank armor removal at RM 418.5
•Russian olive removal (3 acres)

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)	27,900	27,000	-3.2%	"Undeveloped" flows represent conditions prior to significant human development, whereas "developed" flows reflect the current condition of both consumptive and non-consumptive water use.
100 Year (cfs)	51,300	50,800	-1.0%	

Bankfull Channel Area (Ac)	1950	1976	1995	2001	1950-2001	
	434.2	466.7	457.0	569.8	135.6	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	7,315	11.4%	1,182	There are additional types of bank armor such as car bodies and steel retaining walls, but they are relatively minor.
Concrete Riprap	0	0.0%	0	
Flow Deflectors	855	1.3%	556	
Total	8,170	12.7%	1,739	

Length of Side Channels Blocked (ft)	Pre-1950s	Post-1950s	
	0	3,771	Numerous side channels have been blocked by small dikes.

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. Tunover is associated with the creation of riparian habitat.
Total Acres	134.0	158.7		
Acres/Year	5.2	6.3		
Acres/Year/Valley Mile	0.9	1.1	-12.71 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	
5 Year	14.0	14%	Floodplain isolation refers to area that historically was flooded, but has become isolated do to flow alterations or physical features such as levees.
100 Year	0.0	0%	

Restricted Migration Area	Acres	% of CMZ	
	91.1	6%	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		1950	2011	
Agricultural Land (Ac)	3,331.1	2,990.0	Flood (Ac)	1,201.2	979.6	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.
Ag. Infrastructure (Ac)	60.8	79.4	Sprinkler (Ac)	0.0	0.0	
Exurban (Ac)	6.5	143.3	Pivot (Ac)	0.0	1.4	
Urban (Ac)	0.0	0.0				
Transportation (Ac)	70.2	96.2				

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.
	5.3	0.0	5.3	2.0%	

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	5.7	1.0		
Emergent	55.5	9.9	130.4	
Scrub/Shrub	69.1	12.3		

Russian Olive (2001) (Appx. 100-yr Floodplain)	Acres	%	
	2.9	0.2%	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	Cowbirds are associated with agricultural and residential development, displacing native bird species by parasitizing their nests.
	4.1	0.0	0.0	-4.1	

Locator Map

Reach A13

Reach A12

Reach A11

STILLWATER COUNTY

417

418

419

420

421

422

423

424

90

78

Legend

- River Miles
- Reach Breaks
- Counties
- Secondary Road
- US or State Route
- Interstate Highway

Physical Features
- Flow Deflector
- Rock RipRap
- Concrete RipRap
- Flow Deflectors
- Other
- Floodplain Dike/Levee

1 Mile

1 Kilometer

Locator Map

Reach A13

Reach A12

Reach A11

STILLWATER COUNTY

417
418
419
420
421
422
423
424

78

90

Legend

- River Miles
- Reach Breaks
- Counties
- Channel Migration Zone
- 5 Year Floodplain
- Secondary Road
- US or State Route
- Interstate Highway