County	Sweet Grass	**Upstream River Mile**	475.4
Classification	UB: Unconfined braided	**Downstream River Mile**	468.5
General Location	Grey Bear fishing access	**Length**	6.90 mi (11.10 km)

Narrative Summary

Reach A2 is 6.9 miles long and extends from about one mile below the Prather Mayborn Westfall Ditch Diversion to about a mile below the Grey Bear fishing access. Reach A2 is classified as Unconfined Braided (UB), indicating a relatively small influence of the valley wall on reach geomorphology as well as a preponderance of open gravel bars in the channel. Reach A2 has changed markedly since the 1950s due to loss of riparian forest and side channel length.

As a consequence of its unconfined and dynamic nature, there are over two miles of rock riprap in the reach that cover almost 18 percent of the total bankline. Of those 10,633 feet of rock riprap, 1,673 feet was constructed since 2001. The physical features mapping also indicated 945 feet of tree revetments in the reach in 2001, however these were not identified in the 2011 mapping. This is the most upstream-reach with mapped concrete rubble riprap; there are over 1,000 feet of concrete riprap on the left bank at RM 474.6.

Sometime prior to 1950, one 3,125 foot long channel was blocked at RM 473. In 1950, there were still over 6 miles of active anabranching channels, but by 2011 that side channel length had dropped to 4 miles, resulting in a 15 percent reduction of braiding parameter in the reach.

There is also intermittent transportation encroachment by the railroad on the south side of the river. The transportation encroachment, which is due to the rail line, extends over two miles along the south bank and isolates 23 acres of historic floodplain. Similarly, 140 acres of the natural Channel Migration Zone (CMZ) area has been restricted by bank armor and the railroad prism.

Floodplain turnover values show that turnover rates have dropped from 4.5 acres per year to 3.7 acres per year since 1976. The channel has also enlarged by over 30 acres as anabranching channels have consolidated into a larger single thread. About 23 acres of 100-year floodplain area has been isolated by dikes.

Land uses in Reach A2 are primarily agriculture, with about ½ of the total agricultural land in some form of irrigation. About 26 acres of the existing 5-year floodplain are currently under irrigation, most of which is in flood.

Over 300 acres of wetland have mapped in the reach, most of which is emergent marsh-type areas. About 40 acres of emergent wetland are in an area of historic floodplain isolated by the railroad at RM 471.2. Approximately ½ of an acre of Russian olive was mapped in Reach A2.

Reach A2 has had extensive riparian clearing over the last century. In 1950, there were 431 acres of closed timber in the reach, and that footprint had contracted to 275 acres by 2001. Almost 12 acres of riparian forest in the reach per valley mile have been identified as being at low risk of cowbird parasitism due to the distance of those areas from agricultural infrastructure.

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 moderate 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 1,760 cfs to 1,580 cfs with human development, a reduction of 10.2 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 A2 include:
- Blockage of over 3,000 feet of side channel prior to 1950
- Passive abandonment of over two additional miles of side channel since 1950.
- Loss of over 150 acres of closed timber since 1950, most of which is in the 5-year floodplain.

Recommended Practices (may include Yellowstone River Recommended Practices--YRRPs) for Reach A2 include:
- Side Channel Restoration (RM 473)
- CMZ management due to extent of encroachment (140acres restricted)

Yellowstone River Reach Narratives — Reach A2

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)	23,300	22,900	-1.7%
100 Year (cfs)	43,400	43,200	-0.5%

"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
442.3	474.7	464.9	480.2	37.9

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	12,305	16.9%	1,673
Concrete Riprap	1,015	1.4%	1,015
Flow Deflectors	154	0.2%	154
Total	**13,475**	**18.5%**	**2,842**

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
3,125	0

Numerous side channels have been blocked by small dikes.

Floodplain Turnover

	1950 - 1976	1976 - 2001
Total Acres	117.5	93.0
Acres/Year	4.5	3.7
Acres/Year/Valley Mile	0.7	0.6

1950-2001 In-channel riparian encroachment (negative number indicates retreat)

-30.58 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)				

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	16.1	4%
100 Year	23.4	3%

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
140.5	11%

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)	3,713.3	3,548.8
Ag. Infrastructure (Ac)	141.0	217.9
Exurban (Ac)	0.0	13.4
Urban (Ac)	0.0	0.0
Transportation (Ac)	91.6	150.5

	1950	2011
Flood (Ac)	2,014.7	1,213.3
Sprinkler (Ac)	0.0	93.9
Pivot (Ac)	0.0	737.0

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.
4.3	0.8	5.1	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	17.0	2.6
Emergent	257.8	39.9
Scrub/Shrub	80.9	12.5

Total Wetland Acres: **355.7**

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	%
0.4	0.1%

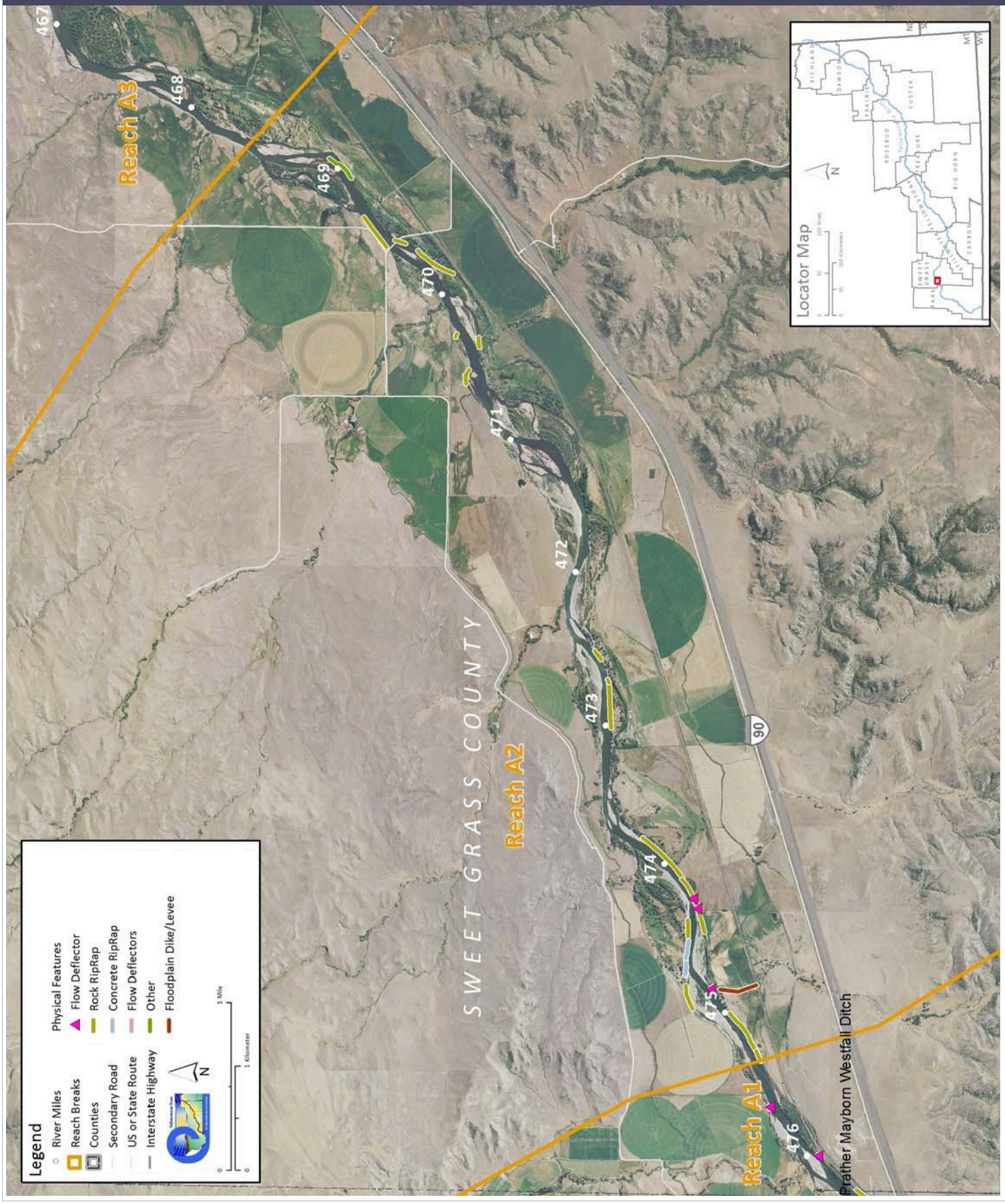
Russian olive is considered an invasive species and its presence in the corridor is fairly recent. Its spread can be used as a general indicator of invasive plants within the corridor.

Riparian Forest at low risk of Cowbird Parasitism (Ac/Valley Mile)

1950	1976	2001	Change 1950-2011
11.6	11.4	6.9	-4.8

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

PHYSICAL FEATURES MAP (2011)



CHANNEL MIGRATION ZONE MAP