County	Park	**Upstream River Mile**	495.6
Classification	PCB: Partially confined braided	**Downstream River Mile**	493.6
General Location	Through Hwy 89 bridge crossing to Shields River	**Length**	2.00 mi (3.22 km)

Narrative Summary

Reach PC17 is 2.0 miles long, extending from just above the Highway 89 Bridge to just below the mouth of the Shields River. The reach is highly impacted by the two bridges that cross the river in the middle of the reach. One is the Highway 89 Bridge and the other is an abandoned railroad bridge that runs parallel to it just upstream.

There is over a mile of bank armor in Reach PC17, about 5,700 feet of which is rock riprap and another 130 feet is flow deflectors. About 28 percent of the total bankline, including those of side channels, is armored. Most of the armor is associated with the bridges.

About 25 percent of the Channel Migration Zone in Reach PC17 has been restricted by physical features. Much of this restriction takes place near the upper end of the reach, where the Highway 89 Bridge has restricted the natural CMZ from a width of 1800 feet down to 300 feet, isolating about 90 acres of ground downstream of the bridge approach. This constriction at the bridge has also caused extensive deposition upstream, and as a result the river currently flows parallel to the highway before “doglegging” through the bridge opening.

There are also 7,300 feet of mapped floodplain dikes in the reach. These dikes are all associated with the transportation prisms at the bridges. Construction of the bridges also resulted in the blockage of about 3,950 feet of side channel prior to 1950 on the north floodplain just downstream.

Land uses in Reach PC17 are almost entirely agricultural, with historic flood irrigation converting to sprinkler and pivot, and some exurban development. The major land use in the reach, however, is non-irrigated agriculture.

About 85 acres of wetlands have been mapped in Reach PC17, most of which are emergent marshes and wet meadows. Most of these wetlands are in non-irrigated hay pastures or multi-use riparian bottoms.

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 1,720 cfs to 1,560 cfs with human development, a reduction of 9.3 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 PC17 include:
- Constriction of CMZ at bridge and poor river alignment to structure.
- Side channel blockage by transportation embankment.

Recommended Practices (may include Yellowstone River Recommended Practices--YRRPs) for Reach PC17 include:
- Floodplain restoration/connectivity below transportation embankment at RM 494.5
- Side channel restoration below transportation embankment at RM 494.5
- CMZ Management due to current restriction of 25 percent of the Channel Migration Zone
- Bank Stabilization Recommended Practices due to the extent of armoring in the reach (28 percent armored banks)

Yellowstone River Reach Narratives — Reach PC17

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)	20,600	20,500	-0.5%
100 Year (cfs)	38,700	38,600	-0.3%

"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
92.4			118.1	25.7

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	5,704	27.3%	-56
Concrete Riprap	0	0.0%	0
Flow Deflectors	134	0.6%	56
Total	**5,838**	**28.0%**	**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
3,948	0

Numerous side channels have been blocked by small dikes.

Floodplain Turnover

	1950 - 1976	1976 - 2001
Total Acres		
Acres/Year		
Acres/Year/Valley Mile		

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

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		
100 Year		

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
106.0	25%

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)	845.9	736.1
Ag. Infrastructure (Ac)	10.9	43.6
Exurban (Ac)	0.0	39.7
Urban (Ac)	0.0	0.0
Transportation (Ac)	18.4	20.0

	1950	2011
Flood (Ac)	383.7	18.3
Sprinkler (Ac)	0.0	60.4
Pivot (Ac)	0.0	46.7

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.

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	2.0	1.2
Emergent	65.1	37.9
Scrub/Shrub	19.0	11.0

Total Wetland Acres: **86.1**

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	%
0.3	0.1%

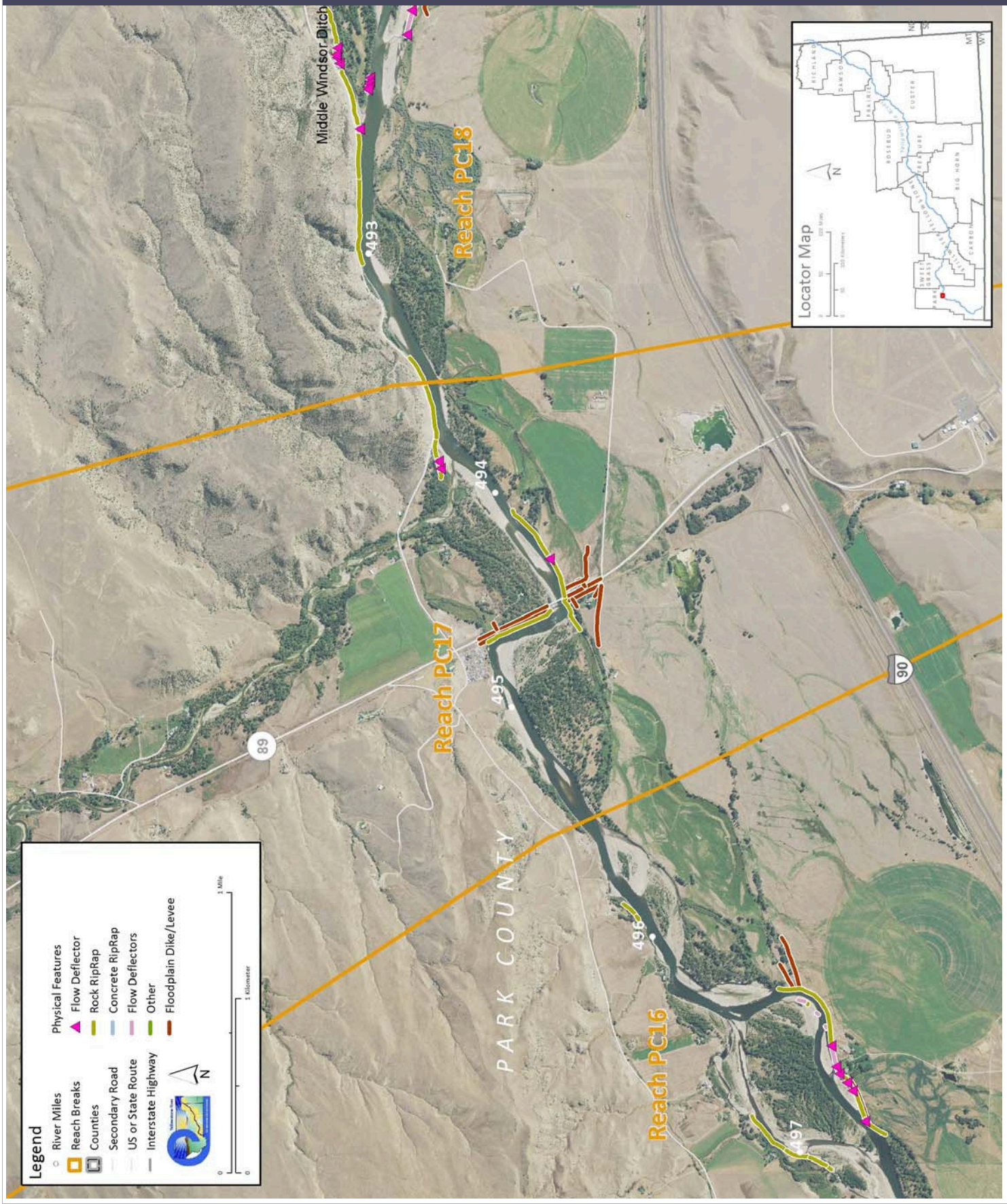
Russian olive is considered an invasive species and its presence in the corridor is fairly recent. Its spread can be used as a general indicator of invasive plants within the corridor.

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

1950	1976	2001	Change 1950-2011

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

PHYSICAL FEATURES MAP (2011)



CHANNEL MIGRATION ZONE MAP