County	Park	**Upstream River Mile**	488.3
Classification	CS: Confined straight	**Downstream River Mile**	485.4
General Location	To near Locke Cr	**Length**	2.90 mi (4.67 km)

Narrative Summary

Reach PC19 is located in Park County, downstream of Livingston near Locke Creek. It is 2.9 miles long, and is a Confined Straight (CS) reach type indicating that it is highly confined between the valley wall to the north, and by the railroad/Interstate corridor to the south. The transportation corridor has isolated on the order of 40acres of historic floodplain from the river. These broad fields south of the river that are historic floodplain areas are now irrigated. The primary land use in the reach is agriculture, with about 200 acres each of flood, pivot, and sprinkler irrigation. More than half of the agricultural land is non-irrigated (~750 acres). In 1950, the transportation corridor footprint consumed about 50 acres in the reach, and that area was doubled with the construction of the Interstate in the late 1960s.

The stability of the reach is indicated by the fact that less than 3 percent of the bankline is armored. That 805 feet of armor was all constructed on the right bank sometime since 2001 where the river flows within a few hundred feet of the rail line. There are no side channels in the reach and the CMZ is relatively narrow.

Although the corridor confined and relatively narrow, there are about 50 acres of wetlands mapped in Reach PC19. These wetlands are consistently along low areas of the active riverbanks that support emergent and scrub/shrub wetland types. Only 0.03 acres of Russian olive was mapped in the reach.

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 now 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 1,730 cfs to 1,560 cfs with human development, a reduction of 9.8 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 PC19 include:
- Corridor confinement by transportation infrastructure.
- Agricultural development and irrigation of historic floodplain area that has become isolated from the river by transportation infrastructure.

No reach-specific Practices were identified for Reach PC19.

Yellowstone River Reach Narratives — Reach PC19

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)	22,400	22,000	-1.8%
100 Year (cfs)	41,800	41,600	-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
115.7			119.3	3.6

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	805	2.8%	805
Concrete Riprap	0	0.0%	0
Flow Deflectors	0	0.0%	
Total	**805**	**2.8%**	

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
0	0

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)
Total Acres			acres
Acres/Year			
Acres/Year/Valley Mile			

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
2.2	1%

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)	1,522.4	1,450.2
Ag. Infrastructure (Ac)	9.0	22.2
Exurban (Ac)	0.0	0.0
Urban (Ac)	0.0	0.0
Transportation (Ac)	47.0	102.8

	1950	2011
Flood (Ac)	685.8	211.3
Sprinkler (Ac)	0.0	201.4
Pivot (Ac)	0.0	240.9

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	2.2	0.8
Emergent	40.7	15.2
Scrub/Shrub	8.9	3.3

Total Wetland Acres: **51.9**

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	%
0.0	0.1%

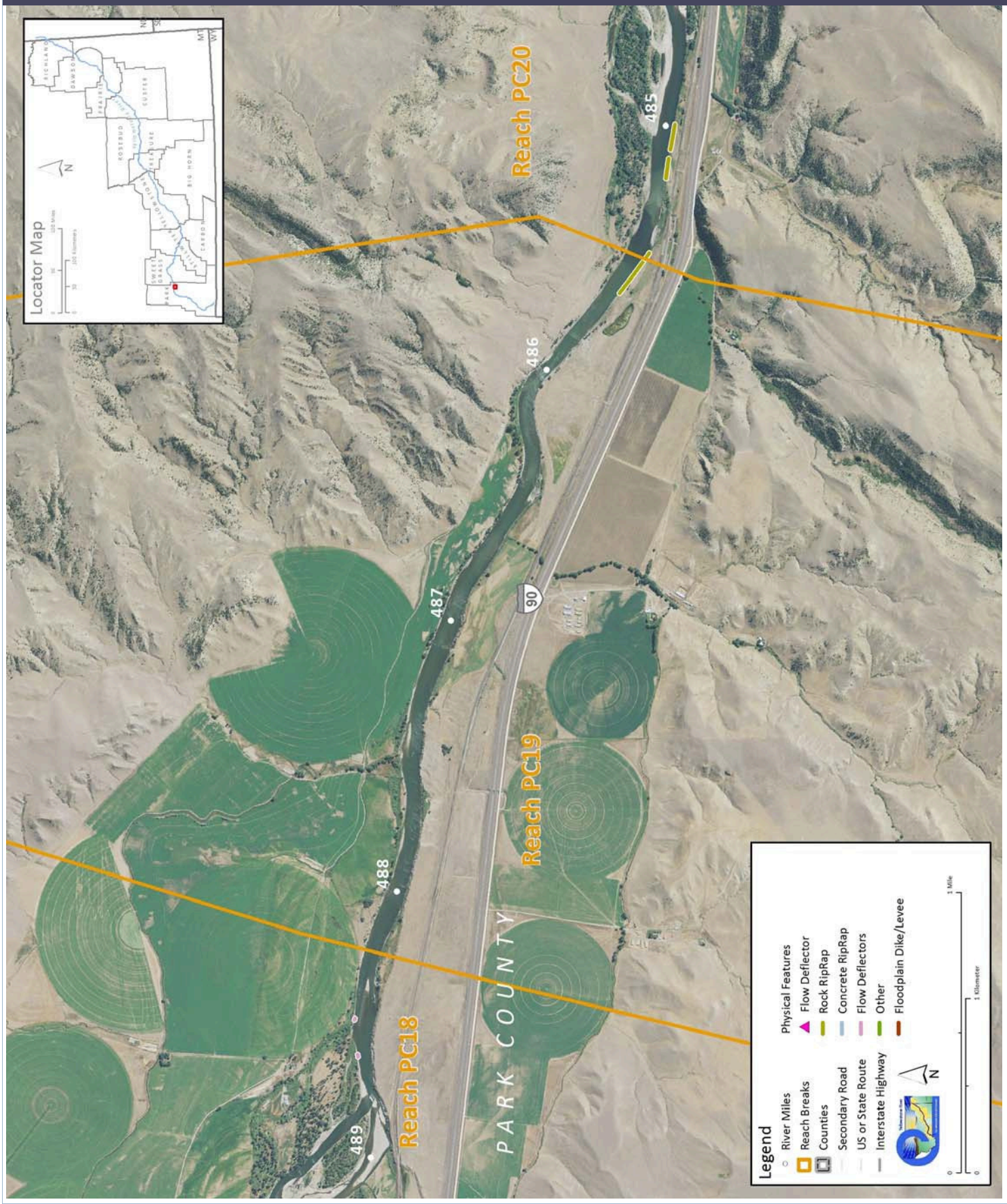
Russian olive is considered an invasive species and its presence in the corridor is fairly recent. Its spread can be used as a general indicator of invasive plants within the corridor.

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