| | | | |
|---|---|---|---|
| **County** | Treasure | **Upstream River Mile** | 292.3 |
| **Classification** | PCB: Partially confined braided | **Downstream River Mile** | 286.8 |
| **General Location** | To Myers Bridge | **Length** | 5.50 mi (8.85 km) |

## Narrative Summary

Reach C2 is located just upstream of Myers Bridge. The Reach is 5.5 miles long and is a Partially Confined Braided (PCB) reach type indicating some valley wall influence on a channel with fairly extensive low flow channels and open gravel bars. The reach follows the southern bluff line along the entire reach, which is almost entirely armored to protect the railroad.

There are over five miles of bank armor in the reach, most of which is rock riprap protecting the rail line. A total of 46 percent of the bank is armored. Since 2001, 1,200 feet of flow deflectors have been built on the right bank just above Myers Bridge.

About two miles of side channel have recently been blocked in Reach C2. In the upper end of the reach, two large side channels were blocked by a several thousand foot long floodplain dike sometime after 1976, and the old island in between these side channels is now cleared and farmed. The heads of these channels are at RM 293, and removal of the plugs at their heads could potentially reactivate over a mile of side channel connectivity. A second channel on the north side of the river at RM 289 appears relatively old, but has access roads crossing it that appear to block seasonal access. Similar to upstream, the isolation of this ~9,000 foot-long side channel has prompted clearing and farming of the old island area that is currently accessible. In total, about 18 percent (162 acres) of the mapped 1950s riparian vegetation in the reach has been cleared and converted to irrigation.

Land use is dominated by agriculture, with 137 acres of pivot irrigation development since 1950. There are several corrals associated with an animal handling facility at RM 289.5L. The corrals are on the edge of a blocked historic side channel that drains to the river. Dikes, levees, and irrigation-related riprap have collectively isolated just over 10 percent of the Channel Migration Zone in Reach C2.

Over 600 acres of 100-year floodplain has been isolated by human development, and all of that isolation is due to agricultural development on the north side of the river. The isolation reflects 23 percent of the total 100-year floodplain. The 5-year floodplain is even more affected; 59 percent of the historic 5-year floodplain is no longer inundated at that frequency. The loss of 5-year floodplain shows the strong imprint of flow alterations below the mouth of the Bighorn River and consequent development of those areas that are less frequently inundated; about 550 acres of currently flood irrigated areas are in the historic 5-year floodplain footprint.

Since 1950, Reach C2 has experienced about 190 acres of new riparian recruitment, with most of that colonization occurring in old 1950s channel area. There has been a net gain of 40 acres of riparian area in the reach associated with channel movement. This reflects encroachment of vegetation into the channel that has experienced a 20 percent reduction in channel forming (2-year) flow. There are about 46 acres of Russian olive in the reach.

Reach C2 was sampled as part of the fisheries study. A total of 32 fish species were sampled in the reach and one of those species was Sauger, which has been identified by the Montana Natural Heritage Program as a Species of Concern (SOC).

Reach C2 has seen a substantial loss in forested area that is at low risk of cowbird parasitism since 1950. At that time, there were 37 acres per valley mile of such forest, and that number decreased to 6 acres per valley mile by 2001.

A hydrologic evaluation of flow depletions indicates that flow alterations over the last century have been major in this reach. The mean annual flood is estimated to have dropped from 60,900 cfs to 47,100 cfs, a drop of about 23 percent. The 2-year flood, which strongly influences overall channel form, has dropped by 20 percent. Low flows have also been impacted; severe low flows described as 7Q10 (the lowest average 7-day flow anticipated every ten years) for summer months has dropped from an estimated 4,610 cfs to 2,950 cfs with human development, a reduction of 36 percent. More typical summer low flows, described as the summer 95% flow duration, have dropped from 6,150 cfs under unregulated conditions to 3,320 cfs under regulated conditions at Reach C10 downstream where the analysis begins, a reduction of 46 percent.

CEA-Related observations in Reach C2 include:
- Blocking of over a mile of side channel by floodplain dikes
- Riparian clearing and irrigation development in isolated 5-year floodplain
- Loss of area at low risk of cowbird parasitism with riparian clearing

Recommended Practices (may include Yellowstone River Recommended Practices--YRRPs) for Reach C2 include:
- Side channel reactivation at RM 293
- Side channel reactivation at RM 289
- Nutrient management at corrals associated with an animal handling facility at RM 288.8L
- Russian olive removal

# Yellowstone River Reach Narratives — Reach C2

**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) | 60,900 | 47,100 | -22.7% |
| 100 Year (cfs) | 119,000 | 100,000 | -16.0% |

"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 |
|---|---|---|---|---|
| 596.8 | 631.0 | 578.5 | 590.0 | -6.8 |

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 | 25,536 | 43.9% | 10 |
| Concrete Riprap | 0 | 0.0% | 0 |
| Flow Deflectors | 1,256 | 2.2% | 1,256 |
| Total | **26,792** | **46.0%** | **1,266** |

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 |
|---|---|
| 1,014 | 10,614 |

Numerous side channels have been blocked by small dikes.

### Floodplain Turnover

| | 1950 - 1976 | 1976 - 2001 |
|---|---|---|
| Total Acres | 112.9 | 81.5 |
| Acres/Year | 4.3 | 3.3 |
| Acres/Year/Valley Mile | 0.8 | 0.6 |

1950-2001 In-channel riparian encroachment (negative number indicates retreat): 38.77 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) | -22.4 | 9.7 | 68.5 | 55.8 |

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 | 959.1 | 59% |
| 100 Year | 624.5 | 18% |

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 |
|---|---|
| 167.6 | 10% |

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) | 5,141.4 | 5,310.8 |
| Ag. Infrastructure (Ac) | 68.7 | 189.6 |
| Exurban (Ac) | 0.0 | 4.8 |
| Urban (Ac) | 0.0 | 0.0 |
| Transportation (Ac) | 56.9 | 53.6 |

| | 1950 | 2011 |
|---|---|---|
| Flood (Ac) | 2,464.8 | 2,393.8 |
| Sprinkler (Ac) | 0.0 | 79.1 |
| Pivot (Ac) | 0.0 | 137.6 |

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.

### 1950s Riparian Vegetation Converted to a Developed Land Use (ac)

| To Irrigated | To Other Use | Total Rip. Converted | % of 1950s Rip. |
|---|---|---|---|
| 161.7 | 0.0 | 161.7 | 18.0% |

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 | 2.3 | 0.4 |
| Emergent | 68.1 | 12.7 |
| Scrub/Shrub | 33.6 | 6.3 |

Total Wetland Acres: **104.1**

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 | % |
|---|---|
| 45.8 | 0.9% |

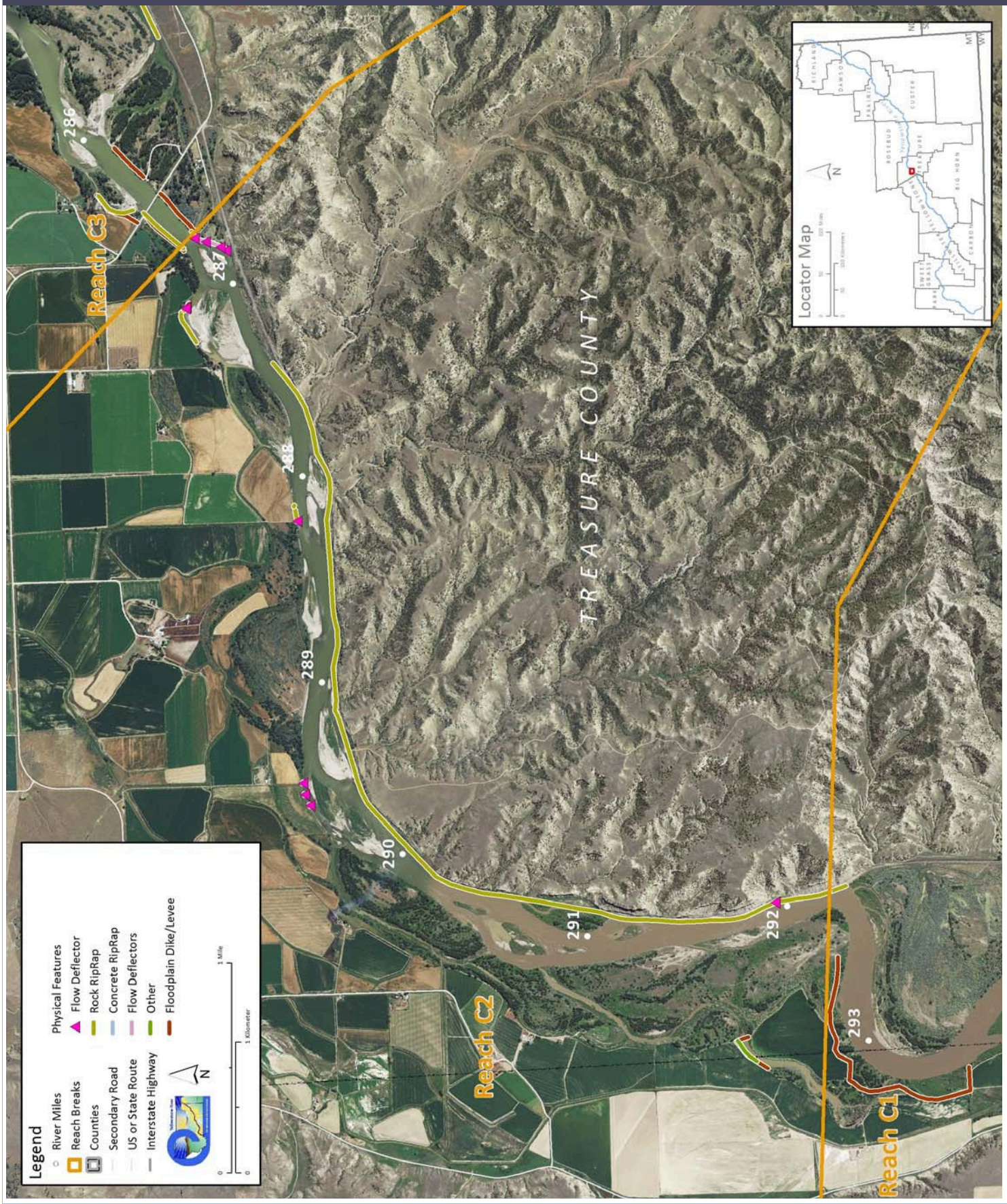
Russian olive is considered an invasive species and its presence in the corridor is fairly recent. Its spread can be used as a general indicator of invasive plants within the corridor.

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

| 1950 | 1976 | 2001 | Change 1950-2011 |
|---|---|---|---|
| 36.8 | 6.5 | 6.0 | -30.8 |

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

## PHYSICAL FEATURES MAP (2011)



## CHANNEL MIGRATION ZONE MAP