County	Richland	**Upstream River Mile**	49.9
Classification	PCA: Partially confined anabranching	**Downstream River Mile**	36.3
General Location	Seven Sisters	**Length**	13.60 mi (21.89 km)
General Comments	Secondary channel on valley wall; Sinuous; long abandoned secondary channel		

Narrative Summary

Reach D12 is located in Richland County at Seven Sisters. The Seven Sisters Fishing Access Site is located in the lower portion of the reach. The reach is a 13.6 mile long Partially Confined Anabranching reach type, indicating some influence of the valley wall along with extensive forested islands. This reach supports over 20 miles of side channels, and islands that are miles long and over ½ mile wide.

There are almost 7,000 feet of bank armor in the reach, and about one third of that was built since 2001. Most of the armor (3,250 feet) is rock riprap, and there are about 2,000 feet each of concrete riprap and flow deflectors. A total of 5 percent of the bank is armored, which is a relatively low concentration of bank armor for the Yellowstone River. All of the armor is protecting agricultural land, most of it against a flood irrigated field on the left bank in the lower end of the reach at RM 37.

Since 1950, a side channel that is almost three miles long was blocked at RM 45.3L. There have also been some gains in side channel length in the reach, such that the net change in length is a loss of approximately one mile. As of 2001, this reach supported almost 21 miles of anabranching channel.

Land use is dominated by agriculture, with 583 acres of pivot irrigation development since 1950. Physical features such as bank armor, dikes, and levees have isolated 3 percent of the Channel Migration Zone in Reach D12, and as of 2011 there were 224 acres of land in the CMZ under pivot irrigation, and 900 acres under flood.

Reach D12 shows, like most other reaches below the Bighorn River, a shrinking channel with reduced rates of erosion and floodplain turnover. For example, the bankfull channel area in the reach dropped by 480 acres since 1950, and there was almost 600 acres of riparian encroachment into old channel areas. Floodplain turnover rates have dropped from 2.1 acres/valley mile/year from 1950-1976 to 1.3 acres/valley mile/year from 1976-2001. This equates to 330 fewer acres of floodplain turnover since 1976. There has also been a net loss of 159 acres of open bar area as the channel has become smaller and more forested. On the floodplain, riparian acreage has decreased; about 350 acres or 9 percent of the total riparian area was cleared for irrigation since 1950.

There are 75 acres of Russian olive in the reach.

The 100-year floodplain has been isolated in this reach, but compared to other reaches the isolation has been fairly minor. About 300 acres of 100-year floodplain has been isolated by human development, which is 5 percent of the total 100-year floodplain. Although only about 5 percent of the 100-year floodplain has been isolated, the impact of flow alterations on the smaller 5-year floodplain has been much more severe; 42 percent of the historic 5-year floodplain is no longer inundated at that frequency. The isolation of the historic 5-year floodplain, which is due primarily to flow alterations, has been associated with increased development in these areas; currently there are about 300 acres of flood irrigated land and within the historic 5-year floodplain footprint.

There is an animal feeding facility on the right bank at RM 46.8.

Reach D12 was sampled as part of the fisheries study. A total of 37 fish species were sampled in the reach. Three species collected in the reach have been identified by the Montana Natural Heritage Program as Species of Concern (SOC): Pallid Sturgeon, Sauger, and Sturgeon Chub.

Reach D12 was also sampled as part of the avian study. A total of 59 bird species were identified in the reach. All five bird species identified by the Montana Natural Heritage Program as Potential Species of Concern (PSOC) on the Yellowstone River were also found, the Black and White Warbler, the Chimney Swift, the Dickscissel, the Ovenbird, and the Plumbeous Vireo. Similarly, all three bird species identified as Species of Concern (SOC) were identified: the Black-billed Cuckoo, Bobolink, and Red-headed Woodpecker. In contrast to most other reaches, Reach D12 has seen an increase in the forested area that is at low risk of cowbird parasitism since 1950. At that time, there were 103 acres per valley mile of such forest, and that number increased to 115 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 2-year flood, which strongly influences overall channel form, has dropped by 22 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 4,310 cfs to 2,410 cfs with human development, a reduction of 50 percent. More typical summer low flows, described as the summer 95% flow duration, have dropped from 6,470 cfs under unregulated conditions to 2,680 cfs under regulated conditions, a reduction of 59 percent.

CEA-Related observations in Reach D12 include:
•Increase in area at low risk of cowbird parasitism with riparian encroachment

Recommended Practices (may include Yellowstone River Recommended Practices--YRRPs) for Reach D12 include:
•Nutrient management at animal handling facility at RM 46.8R
•Side channel reactivation at RM 45.3R
•Russian olive removal

PHYSICAL FEATURES MAP (2011)

HYDROLOGIC SUMMARY

Hydrologic data available for the Reach Narratives include data from representative gaging stations, modeling from the COE from the Big Horn river upstream, and modeling by the USGS for the Big Horn River to the Missouri River confluence. Gaging stations that best represent the watershed area within any reach are used to describe the flood history within the reach. Hydrology modeling results generated for all reaches provides unregulated and regulated flow values. Seasonal and annual flow duration data generated by the USGS are available for reaches C10 through D13.

Gage Representation (Gage-Based): Sidney

	Downstream Gage	Upstream Gage
Gage No	6329500	6309000
Location	Sidney	Miles City
Period of Record	1911-2015	1929-2015
Distance To (miles)	5.5	134.1

Flood History

Year	Date	Flow on Date	Return Interval
1978	May 23	111,000	10-25 yr
1912	Mar 29	114,000	10-25 yr
1944	Jun 21	120,000	10-25 yr
2011	May 24	124,000	10-25 yr
1918	Jun 20	126,000	25-50 yr
1943	Mar 29	132,000	25-50 yr
1923	Oct 3	134,000	25-50 yr
1952	Mar 31	138,000	25-50 yr
1921	Jun 21	159,000	100-yr

Discharge

	1.01 Yr	2 Yr	5 Yr	10 Yr	50 Yr	100 Yr	500 Yr	7Q10 Summer	95% Sum. Duration
Unregulated		69,800	90,300	103,000	132,000	144,000	172,000	4,310	6,470
Regulated		54,300	74,900	88,600	119,000	132,000	163,000	2,140	2,680
% Change		-22.21%	-17.05%	-13.98%	-9.85%	-8.33%	-5.23%	-50.35%	-58.58%

Flow Duration

Streamflow, in ft3/s, which was equaled or exceeded for indicated percent of time

Note that these statistics are only available from Reach C10 downstream. See the USGS report for detailed information.

Season		5%	50%	95%
Spring	Unregulated	67,400	24,700	7,180
	Regulated	52,000	14,400	5,190
	% Change	**-23%**	**-42%**	**-28%**
Summer	Unregulated	47,700	14,700	6,470
	Regulated	35,300	8,370	2,680
	% Change	**-26%**	**-43%**	**-59%**
Fall	Unregulated	9,910	5,830	1,940
	Regulated	11,300	7,330	3,510
	% Change	**14%**	**26%**	**81%**
Winter	Unregulated	16,100	5,580	2,140
	Regulated	16,600	6,750	3,490
	% Change	**3%**	**21%**	**63%**
Annual	Unregulated	49,700	8,830	2,830
	Regulated	37,000	8,000	3,480
	% Change	**-26%**	**-9%**	**23%**

AERIAL PHOTOGRAPHY

A variety of aerial photographic sources provide the basis for much of the Cumulative Effects Assessment analysis. The table below lists the air photos compiled for the reach and the associated discharge at the most representative USGS gaging station.

	Source	Acquisition Date	Type	Scale	Gage	Discharge
1950	USGS-EROS	26-Aug-49	B/W	1:14,800	6329500	2750
1957	USDA	???	B/W	1:20,000	6329500	
1976	MDT	28-Oct-77	B/W	1:12,000	6329500	5800
1995	USGS DOQQ	8/3/97 - 8/22/97	B/W		6329500	23000
2001	NRCS	August 2-8, 2001	CIR	1:24,000	6329500	4000
2005	NAIP	07/14/2005	color	1-meter pixels	6329500	15900
2007	Woolpert	10/15/2007 - 11/2/0007	Color		6329500	
2009	NAIP	7/11/2009	Color	1-meter pixels	6329500	32600
2011	USCOE	October 2012	color	1-ft pixel	6329500	9030
2011	NAIP	7/21/2011	Color	1-meter pixels	6329500	46600
2011	NAIP	7/15/2011	Color	1-meter pixels	6329500	57900
2013	NAIP	07/19/2013	color	1-meter pixels	6329500	

PHYSICAL FEATURES

Several efforts to capture the types and extents of physical features in the corridor have been generated by the CEA study. The 2001 Physical Features Inventory was performed through helicopter/video Rapid Aerial Assessment by the NRCS (NRCS, 2001) and did not include Park County. This inventory includes point and linear features that represent bank armor, irrigation structures, transportation encroachments, and areas of accelerated erosion. Bank armor mapped in the 2001 inventory only reflects features on the active channel margin, and thus excludes off-channel features on historic side channels. Some floodplain restriction features such as dikes and levees in the 2001 Physical Features Inventory may extend well beyond the active channel. In 2013, the 2001 inventory was revised to include Park County. At that time, some attribute inconsistencies in the original data were addressed. This dataset was then updated to reflect conditions in the 2011 NAIP imagery.

For Stillwater, Yellowstone and Dawson Counties, a Physical Features Timeline was generated that includes additional mapping based on aerial photography and assigns approximate dates of feature construction based on observed presence/absence in historic imagery between the 1950s and 2005 (DTM and AGI, 2008). The Physical Features Timeline contains features that were not mapped in the 2001 inventory (e.g. bank armor abandoned in floodplain areas by 2001). As such the total bank armor extent in the 2005 data is commonly greater than that identified in 2001 or 2013.

Note: As the goal for each physical features mapping effort were different, with differing mapping extents, there will be descrepancies between total feature lengths (e.g. length of rock riprap) in each data set.

2001 and 2011 Physical Features Bankline Inventories

Feature Class	Feature Type	2001 Length (ft)	% of Bankline	2011 Length (ft)	% of Bankline	2001-2011 Change
Stream Stabilization						
	Tree Revetments	531	0.4%	404	0.3%	-127
	Rock RipRap	595	0.4%	3,251	2.3%	2,656
	Flow Deflectors	356	0.2%	474	0.3%	118
	Concrete RipRap	1,945	1.4%	1,945	1.4%	0
	Between Flow Deflectors	1,328	0.9%	1,328	0.9%	0
	Feature Type Totals	**4,755**	**3.3%**	**7,402**	**5.2%**	**2,647**
Floodplain Control						
	Floodplain Dike/Levee	350	0.2%	350	0.2%	0
	Feature Type Totals	**350**	**0.2%**	**350**	**0.2%**	**0**
	Reach Totals	**5,106**	**3.6%**	**7,752**	**5.4%**	**2,647**

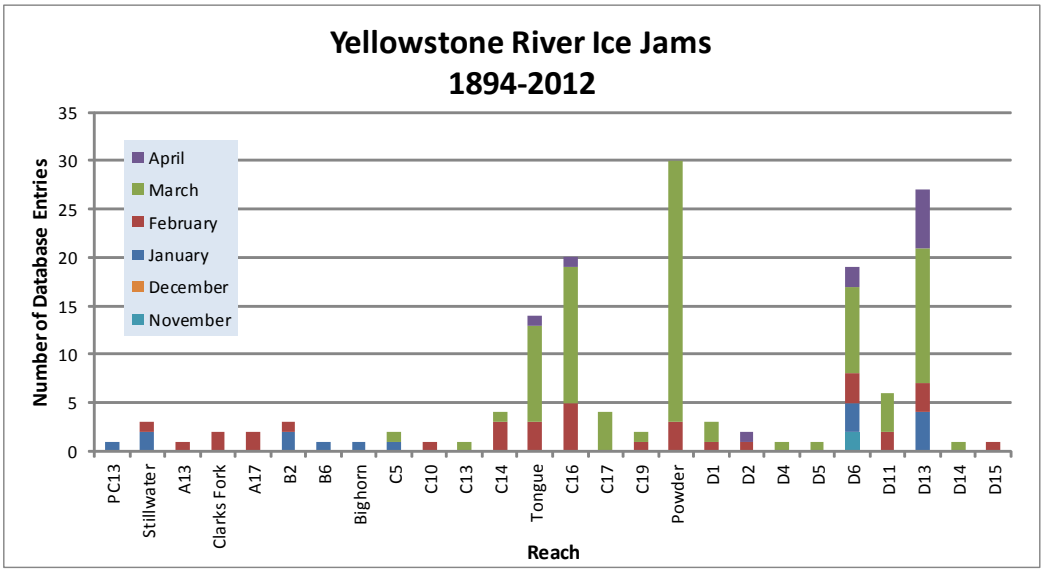
Intent of Bank Protection: 2001

The 2001 bank protection features were assessed for the 'intent' of what they protect.

Feature Type	Irrigated	Non-Irrig.	Ag. Infrastr.	Road	Interstate	Railroad	Urban	Exurban
Concrete RipRap	1,289	0	656	0	0	0	0	0
Flow Deflectors/Between FDs	1,683	0	0	0	0	0	0	0
Rock RipRap	0	423	171	0	0	0	0	0
Tree Revetments	531	0	0	0	0	0	0	0
Totals	**3,503**	**423**	**827**	**0**	**0**	**0**	**0**	**0**

ICE JAMS

Ice jam data were obtained from the National Ice Jam Database maintained by the Ice Engineering Group at Army Corps of Engineers Cold Regions Research and Engineering Laboratory (https://rsgis.crrel.usace.army.mil/icejam/). From this database, Yellowstone River ice jams are summarized by reach in the Yellowstone River Historic Events Timeline (DTM and AGI, 2008b). The basic information for each ice jam is presented as a list of events. The graph represents the number of database entries for a reach. Note that a single jam event may have multiple entries.



GEOMORPHIC

The geomorphology data presented below consist of measured changes in Braiding Parameter since 1950 and blocked side channels. Braiding parameter is a measure of the total length of side channels relative to that of the main channel. The braiding parameter is calculated as the sum of anabranching and primary channel lengths divided by the primary channel length. Secondary channels within the bankfull margins are a function of flow stage and hence were not included in the braiding parameter calculation. If a reach has a braiding parameter of 3, then the total bankfull channel length is three times that of the main channel. The mean braiding parameter measured for all 88 reaches is 1.8.

Blocked side channels that were either plugged with a small dike or cutoff by larger features such as a levee or road prism were identified for the pre and post-1950s eras.

Additional geomorphic parameters are discussed in more detail in the study report and appendices.

Braiding (Bankfull)

	Primary Chan. Length (ft)	Anab. Ch. Length (ft)	Bankfull Braiding Parameter		% Change in Braiding
1950	75,467	116,193	2.54	1950 to 1976:	-2.36%
1976	72,988	107,995	2.48	1976 to 1995:	9.36%
1995	70,922	121,394	2.71	1995 to 2001:	-6.48%
2001	71,860	110,374	2.54	1950 to 2001:	-0.15%
Change 1950 - 2001	**-3,607**	**-5,818**	**0.00**		

Length of Side Channels Blocked

Pre-1950s (ft)	0
Post-1950s (ft)	14,624

HYDRAULICS

Available hydraulic information includes county-based HEC-RAS modeling efforts by the Army Corps of Engineers with the exclusion of Park County. Floodplain modeling was performed for four conditions representing a developed and undeveloped floodplain, and unregulated and regulated flows for the 1.5, 2, 5, 10, 20, 50, 100, 200, and 500-year events. Park County has limited FEMA hydraulic modeling and was not included in the analysis.

The results of HEC-RAS modeling for the 5 and 100-year flood events were assessed to compare the extents of inundated area for the pristine (undeveloped floodplain, unregulated flows) and developed (developed floodplain, regulated flows) conditions. The data sets provided for each flow condition were unioned in the GIS to identify areas where the inundated extent differed. These area areas of human-caused floodplain isolation due to either flow alterations or physical features such as levees. For the 100-year flood event, isolated areas greater than 5 acres were attributed with the interpreted reason for isolation (railroad, levee, etc.). The resulting values are presented as acres and percent of the pristine floodplain that has been isolated. The pristine floodplain is defined as the total floodplain footprint minus the area of the mapped 2001 bankfull channel (mapped islands were included in the floodplain area).

Floodplain Isolation

	100-Year		5-Year	
	Isolated Acres	% of Floodplain	Isolated Acres	% of Floodplain
Non-Structural (hydrology, geomorphic, etc.)	11	0.2%		
Agriculture (generally relates to field boundaries)	0	0.0%		
Agriculture (isloated by canal or large ditch)	0	0.0%		
Levee/Riprap (protecting agricultural lands)	285	3.9%		
Levee/Riprap (protecting urban, industrial, etc.)	0	0.0%		
Railroad	49	0.7%		
Abandoned Railroad	0	0.0%		
Transportation (Interstate and other roads)	0	0.0%		
Total Not Isolated (Ac)	6965		4622	
Total Floodplain Area (Ac)	7310		6736	
Total Isolated (Ac)	**345**	**4.7%**	**2113**	**42.4%**

The 5-year floodplain is a good allegory for the extent of the riparian zone. Thus, irrigated areas within the 5-year floodplain tend to represent riparian zones that have been converted to agrigulture and may result in additional bank protection to protect the agricultural production and irrigation infrastructure.

	Flood	Sprinkler	Pivot	Total
Irrigated Acres within the 5 Year Flooplain:	300	0	27	**328**

CHANNEL MIGRATION ZONE

A series of Channel Migration Maps were developed for the Yellowstone River from Gardiner to its mouth in McKenzie County, North Dakota (Thatcher, Swindell, and Boyd, 2009). These maps and their accompanying report can be accessed from the YRCDC Website. The channel migration zone (CMZ) developed for the Yellowstone River is defined as a composite area made up of the existing channel, the historic channel since 1950 (Historic Migration Zone, or HMZ), and an Erosion Buffer that encompasses areas prone to channel erosion over the next 100 years. Areas within this CMZ that have been isolated by constructed features such as armor or floodplain dikes are attributed as "Restricted Migration Areas" (RMA). Beyond the CMZ boundaries, outlying areas that pose risks of channel avulsion are identified as "Avulsion Potential Zones".

Mean 50-Yr Migration Distance (ft)	Erosion Buffer (ft)	Total CMZ Acreage	Restricted CMZ Acreage	% Restricted Migration Area	Total AHZ Acreage	Restricted AHZ Acreage	% Restricted Avulsion Area
556	1,113	7,034	126	2%	639	0	0%

2011 Restricted Migration Area Summary

Note that these data reflect the observed conditions in the 2011 aerial photography (NAIP for Park and Sweet Grass Counties, COE for the rest of the river).

Reason for Restriction	Land Use Protected	RMA Acres	Percent of CMZ
RipRap			
	Non-Irrigated	46	0.6%
	Irrigated	23	0.3%
Flow Deflectors			
	Irrigated	122	1.6%
Dike/Levee			
	Railroad	7	0.1%
	Totals	**198**	**2.6%**

Land Uses within the CMZ (Acres)

Flood Irrigation	Sprinkler Irrigation	Pivot Irrigation	Urban/ ExUrban	Trans-portation
896.1	0.0	244.1	4.1	6.4

LAND USE

Land uses were mapped from aerial photography Gardiner to the confluence of the Missouri River in North Dakota for four time periods: 1950s, 1976, 2001, and 2011. Mapping was performed at approximately 1:6,000 to ensure consistent mapping across all data sets. Typically, if a feature could not be easily mapped at the target mapping scale, it was not separated out from the adjacent land use.

A four-tiered system was used to allow analysis at a variety of levels. Tier 1 breaks land use into Agricultural and Non-Agricultural uses. Tier two subdivided uses into productive Agricultural Land and Infrastructure for the Agricultural land, and Urban, Exurban and Transportation categories for the Non-Agricultural land. Tier three further breaks down land uses into more refined categories such as Irrigated or Non-Irrigated and Residential, Commercial, or Industrial. Finally, Tier 4 focuses primarily on the productive agricultural lands, identifying the type of irrigation (Pivot, Sprinkler or Flood).

Land Use Timeline - Tiers 2 and 3

		Acres				% of Reach Area			
Feature Class	Feature Type	1950	1976	2001	2011	1950	1976	2001	2011
Agricultural Infrastructure									
	Canal	0	0	0	0	0.0%	0.0%	0.0%	0.0%
	Agricultural Roads	0	0	0	0	0.0%	0.0%	0.0%	0.0%
	Other Infrastructure	60	109	166	155	0.6%	1.0%	1.6%	1.5%
	Totals	**60**	**109**	**166**	**155**	**0.6%**	**1.0%**	**1.6%**	**1.5%**
Agricultural Land									
	Non-Irrigated	3,778	3,965	3,128	3,139	36.2%	38.0%	29.9%	30.0%
	Irrigated	2,108	2,241	3,003	2,947	20.2%	21.4%	28.7%	28.2%
	Totals	**5,886**	**6,206**	**6,131**	**6,087**	**56.3%**	**59.4%**	**58.7%**	**58.3%**
Channel									
	Channel	4,458	4,074	4,091	4,146	42.7%	39.0%	39.2%	39.7%
	Totals	**4,458**	**4,074**	**4,091**	**4,146**	**42.7%**	**39.0%**	**39.2%**	**39.7%**
ExUrban									
	ExUrban Other	0	0	0	0	0.0%	0.0%	0.0%	0.0%
	ExUrban Undeveloped	0	0	0	0	0.0%	0.0%	0.0%	0.0%
	ExUrban Industrial	0	0	2	2	0.0%	0.0%	0.0%	0.0%
	ExUrban Commercial	0	0	0	0	0.0%	0.0%	0.0%	0.0%
	ExUrban Residential	0	0	0	0	0.0%	0.0%	0.0%	0.0%
	Totals	**0**	**0**	**2**	**2**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
Transportation									
	Public Road	26	42	41	41	0.3%	0.4%	0.4%	0.4%
	Interstate	0	0	0	0	0.0%	0.0%	0.0%	0.0%
	Railroad	17	17	17	17	0.2%	0.2%	0.2%	0.2%
	Totals	**44**	**59**	**59**	**59**	**0.4%**	**0.6%**	**0.6%**	**0.6%**
Urban									
	Urban Other	0	0	0	0	0.0%	0.0%	0.0%	0.0%
	Urban Residential	0	0	0	0	0.0%	0.0%	0.0%	0.0%
	Urban Commercial	0	0	0	0	0.0%	0.0%	0.0%	0.0%
	Urban Undeveloped	0	0	0	0	0.0%	0.0%	0.0%	0.0%
	Urban Industrial	0	0	0	0	0.0%	0.0%	0.0%	0.0%
	Totals	**0**	**0**	**0**	**0**	**0.0%**	**0.0%**	**0.0%**	**0.0%**

Land Use Timeline - Tiers 3 and 4

		Acres				% of Reach Area				Change Between Years (% of Agricultural Land)			
Feature Class	Feature Type	1950	1976	2001	2011	1950	1976	2001	2011	'50-76	'76-01	'01-11	'50-11
Irr													
	Sprinkler	0	0	0	0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Pivot	0	0	360	583	0.0%	0.0%	5.9%	9.6%	0.0%	5.9%	3.7%	9.6%
	Flood	2,108	2,241	2,643	2,365	35.8%	36.1%	43.1%	38.9%	0.3%	7.0%	-4.3%	3.0%
	Totals	**2,108**	**2,241**	**3,003**	**2,947**	**35.8%**	**36.1%**	**49.0%**	**48.4%**	**0.3%**	**12.9%**	**-0.6%**	**12.6%**

NoIrr

Multi-Use	3,111	3,170	2,961	2,986	52.8%	51.1%	48.3%	49.1%	-1.8%	-2.8%	0.8%	-3.8%
Hay/Pasture	668	795	167	154	11.3%	12.8%	2.7%	2.5%	1.5%	-10.1%	-0.2%	-8.8%
Totals	**3,778**	**3,965**	**3,128**	**3,139**	**64.2%**	**63.9%**	**51.0%**	**51.6%**	**-0.3%**	**-12.9%**	**0.6%**	**-12.6%**

RIPARIAN

Riparian mapping data are derived from the Yellowstone River Riparian Vegetation Mapping study (DTM/AGI 2008). This study coarsely mapped the riparian vegetation communities using 1950's, 1976-1977, and 2001 aerial imagery in a GIS environment. The polygons are digitized at a scale of approximately 1:7,500, with a minimum mapping unit of approximately 10 acres. The goal of the delineation was to capture areas of similar vegetation structure as they appeared on the aerial imagery, while maintaining a consistent scale.

The "Riparian Turnover" values quantify the total area within the active channel area that converted from either woody vegetation to open bar or water, or from open bar or water to woody vegetation. A comparison of these values allows some consideration of overall riparian encroachment into the river corridor from 1950 to 2001.

Riparian Mapping

	Shrub (Acres)			Closed Timber (Acres)			Open Timber (Acres)		
Statistic	1950	1976	2001	1950	1976	2001	1950	1976	2001
Min	0.5	0.2	0.8	3.1	0.6	0.2	4.0	4.4	4.2
Max	247.0	140.2	87.4	235.5	658.4	804.3	78.4	137.8	189.5
Average	21.5	14.0	11.3	64.5	81.6	71.8	27.1	71.1	33.8
Sum	1,611.4	870.4	473.5	2,128.4	2,856.4	3,517.4	379.5	284.3	337.7

Riparian Turnover

Conversion of riparian areas to channel, or from channel to riparian between the 1950's and 2001 data set.

Riparian to Channel (acres)	518.6
Channel to Riparian (acres)	1115.6
Riparian Encroachment (acres)	**597.0**

Riparian Recruitment

Creation of riparian areas between 1950s and 2001.

1950s Channel Mapped as 2011 Riparian (Ac)	1123.2
1950s Floodplain Mapped as 2011 Channel (Ac)	578.0
Total Recruitment (1950s to 2011)(Ac)	**1701.2**

WETLANDS

Wetland areas were mapped to National Wetland Inventory standards by the Montana Natural Heritage Program. Palustrine wetlands within the mapped 100-year inundation boundary were extracted and summarized into four categories: Riverine (Unconsolidated Bottom - UB, Aquatic Bed - AB, and Unconsolidated Shore - US), Emergent - EM, Scrub-Shrub - SS, and Forested - FO.

	Riverine	Emergent	Scrub/Shrub	Forested	Total
Mapped Acres	28.0	117.2	139.8	0.0	**285.0**
Acres/Valley Mile	2.6	10.9	13.0	0.0	

RUSSIAN OLIVE

Russian olive is considered an invasive species and its presence in the Yellowstone River corridor is fairly recent. As such, its spread can be used as a general indicator of invasive plants within the corridor. It has the added benefit of being easily identified in multi-spectral aerial photography, making it possible to inventory large areas using remote techniques.

In 2011, Natural Resources Conservation Service (NRCS) in Bozeman, MT conducted an inventory of Russian olive locations in the Yellowstone River watershed. This study utilized the Feature Analyst extension within ArcGIS to interpret multi-spectral 2008 NAIP imagery for the presence of Russian olive. The resulting analysis was converted from raster format to a polygon ESRI shape file for distribution and further analysis within a GIS environment.

This work scope was tasked with integrating the resulting Russian olive inventory into the Yellowstone River Conservation Districts Council (YRCDC) Cumulative Effects Assessment (CEA) GIS and associated reach-based database. Additionally, analysis of Russian olive within the corridor was conducted to characterize its distribution in throughout the corridor and its association with other corridor data sets.

	Floodplain Area (Ac)	% of Floodplain	Other Area (Ac)	Inside RMA (Ac)	Inside '50s Channel (Ac)	Inside 50s Island (Ac)
Russian Olive in Reach	74.77	1.37%	82.86	0.12	25.02	13.06

FISHERIES SUMMARY

Fisheries data available for the Reach Narratives include low-flow and high-flow habitat mapping of 2001 conditions for 406 miles of river, extending from the mouth upstream to a point approximately 8 miles upstream of Park City. Habitat mapping was performed remotely on the 2001 CIR aerial photography utilizing habitat classifications developed by Montana Fish, Wildlife, and Parks (DTM 2009). Historic habitat mapping using the 1950's imagery is limited to Reach B1 (high-flow) and D9 (low and high-flow).

Fisheries field sampling data have been provided by Ann Marie Reinhold (MSU). In this study, the Yellowstone River from Park City to Sidney was divided into five segments. Within each segment, fish were sampled in reaches modified by riprap ("treatment reaches") and relatively unmodified reaches ("control reaches"). Fish sampling was conducted during summer and autumn of 2009, 2010, and 2011. Boat electrofishing, trammel nets, mini-fyke nets and bag seines were used to collect data from river bends.

Fish presence data is only presented for those reaches that were sampled.

The Low Flow Habitat Mapping followed schema deveoped by Montana Fish Wildlife and Parks to identify key habitat units for certain aquatic species.

Fish Species Observed in Reach/Region

Species of Concern

Reach	Region		Reach	Region		Reach	Region		Reach	Region	
☑	☑	Bigmouth buffalo	☑	☑	Flathead chub	☑	☑	Northern redbelly dace	☑	☑	Stonecat
☑	☑	Black bullhead	☑	☑	Freshwater drum	☑	☑	Pallid sturgeon	☑	☑	Sturgeon chub
☑	☑	Black crappie	☑	☑	Goldeye	☐	☑	Pumpkinseed	☑	☑	Sucker species
☐	☑	Blue sucker	☑	☑	Green sunfish	☐	☐	Rainbow trout	☑	☑	Sunfish species
☑	☑	Bluegill	☐	☑	Lake chub	☑	☑	River carpsucker	☑	☑	Walleye
☑	☑	Brook stickleback	☐	☐	Largemouth bass	☐	☐	Rock bass	☑	☑	Western silvery minnow
☐	☐	Brown trout	☑	☑	Longnose dace	☑	☑	Sand shiner	☑	☑	White bass
☑	☑	Burbot	☑	☑	Longnose sucker	☑	☑	Sauger	☑	☑	White crappie
☐	☑	Catfish species	☑	☑	Minnow species	☑	☑	Shorthead redhorse	☑	☑	White sucker
☑	☑	Channel catfish	☐	☐	Mottled sculpin	☐	☑	Shortnose gar	☐	☐	Yellow bullhead
☑	☑	Common carp	☐	☐	Mountain sucker	☑	☑	Shovelnose sturgeon	☐	☐	Yellow perch
☑	☑	Creek chub	☐	☐	Mountain whitefish	☐	☑	Sicklefin chub			
☑	☑	Emerald shiner	☑	☑	Northern pike	☐	☑	Smallmouth bass			
☑	☑	Fathead minnow	☑	☑	Northern plains killifish	☑	☑	Smallmouth buffalo			

Low Flow Fisheries Habitat Mapping

Habitat	2001 (Acres) Bankfull	Low Flow	% of Low Flow
Scour Pool	608.4	334.5	8.2%
Rip Rap Bottom	23.1	16.6	0.4%
Rip Rap Margin	24.4	21.9	0.5%
Bluff Pool	16.3	16.9	0.4%
Terrace Pool	40.1	30.7	0.8%
Secondary Channel	122.7	110.7	2.7%
Secondary Channel (Seasonal)	479.7	402.0	9.8%
Channel Crossover	439.8	269.4	6.6%
Point Bar		247.3	6.0%
Side Bar		107.7	2.6%
Mid-channel Bar		69.6	1.7%
Island	2,336.7	2,336.7	57.1%
Dry Channel		127.5	3.1%

AVIAN

Birds were sampled in 2006 and 2007 by Danielle Jones of Montana State University. Point count methods were used at 304 randomly chosen sites in 21 braided or anabranching reaches. Each site was visited multiple times within a season, and sites were visited in both years. Birds were sampled in grassland, shrubland, and cottonwood forest habitats. Additional bird data was collected by Amy Cilimburg of Montana Audubon in summer 2012. High priority areas for data collection were identified with the assistance of the YRCDC Technical Advisory Committee. The Audubon methodology recorded data for a wider variety of bird species relative to the MSU study, including raptors and waterfowl.

Bird Species Observed in Reach/Region

Species of Concern | Potential Species of Concern

Reach	Region		Reach	Region		Reach	Region		Reach	Region	
☑	☑	American Robin	☑	☑	Chipping Sparrow	☐	☑	Killdeer	☑	☑	Song Sparrow
☑	☑	American Crow	☑	☑	Clay-collared Sparrow	☐	☐	Lark Bunting	☑	☑	Spotted Sandpiper
☑	☑	American Goldfinch	☐	☐	Cliff Swallow	☑	☑	Lark Sparrow	☑	☑	Spotted Towhee
☑	☑	American Kestrel	☑	☑	Common Grackle	☑	☑	Lazuli Bunting	☐	☐	Sharp-shinned Hawk
☑	☑	American Redstart	☐	☐	Common Merganser	☑	☑	Least Flycatcher	☐	☐	Swainson's Thrush
☑	☑	Bald Eagle	☐	☑	Common Nighthawk	☐	☑	Mallard	☐	☐	Sandhill Crane
☑	☑	Baltimore Oriole	☐	☐	Common Raven	☐	☐	Mountain Bluebird	☑	☑	Tree Swallow
☐	☐	Barn Swallow	☑	☑	Common Yellowthroat	☑	☑	Mourning Dove	☐	☐	Turkey Vulture
☐	☑	Belted Kingfisher	☐	☑	Cooper's Hawk	☑	☑	Northern Flicker	☐	☐	Upland Sandpiper
☑	☑	Black-billed Cuckoo	☑	☑	Dickcissel	☑	☑	Orchard Oriole	☐	☐	Vesper Sparrow
☑	☑	Black-billed Magpie	☑	☑	Downy Woodpecker	☐	☐	Osprey	☐	☐	Violet-green Swallow
☑	☑	Black-capped Chickadee	☐	☑	Eastern Bluebird	☑	☑	Ovenbird	☑	☑	Warbling Vireo
☑	☑	Black-and-white Warbler	☑	☑	Eastern Kingbird	☑	☑	Plumbeous Vireo	☐	☑	Western Kingbird
☑	☑	Black-headed Grosbeak	☐	☐	Eurasian Collared-dove	☑	☑	Red-headed Woodpecker	☑	☑	Western Meadowlark
☑	☑	Blue Jay	☑	☑	European Starling	☐	☐	Red-naped Sapsucker	☑	☑	Western Wood-pewee
☑	☑	Bobolink	☑	☑	Field Sparrow	☐	☑	Red Crossbill	☑	☑	White-breasted Nuthatch
☑	☑	Brewer's Blackbird	☑	☑	Franklin's Gull	☑	☑	Ring-necked Pheasant	☐	☐	White-throated Swift
☑	☑	Brown-headed Cowbird	☑	☑	Grasshopper Sparrow	☑	☑	Red-tailed hawk	☐	☑	Wild Turkey
☐	☐	Brown Creeper	☑	☑	Gray Catbird	☐	☑	Rock Dove	☐	☑	Wood Duck
☑	☑	Brown Thrasher	☑	☑	Great Blue Heron	☑	☑	Red-winged Blackbird	☐	☑	Yellow-bellied Sapsucker
☑	☑	Bullock's Oriole	☐	☑	Great Horned Owl	☑	☑	Red-eyed Vireo	☐	☑	Yellow-billed Cuckoo
☐	☐	Canada Goose	☑	☑	Hairy Woodpecker	☐	☑	Red-breasted Grosbeak	☑	☑	Yellow-breasted Chat
☑	☑	Cedar Waxwing	☐	☐	House Finch	☐	☐	Say's Phoebe	☐	☐	Yellow-headed Blackbird
☑	☑	Chimney Swift	☑	☑	House Wren	☑	☑	Savannah Sparrow	☑	☑	Yellow Warbler

CULTURAL INVENTORY SUMMARY

The Yellowstone River Cultural Inventory - 2006 documents the variety and intensity of different perspectives and values held by people who share the Yellowstone River. Between May and November of 2006, a total of 313 individuals participated in the study. They represented agricultural, civic, recreational, or residential interest groups. Also, individuals from the Crow and the Northern Cheyenne tribes were included.
There are three particular goals associated with the investigation. The first goal is to document how the people of the Yellowstone River describe the physical character of the river and how they think the physical processes, such as floods and erosion, should be managed. Within this goal, efforts have been made to document participants' views regarding the many different bank stabilization techniques employed by landowners. The second goal is to document the degree to which the riparian zone associated with the river is recognized and valued by the participants. The third goal is to document concerns regarding the management of the river's resources. Special attention is given to the ways in which residents from diverse geographical settings and diverse interest groups view river management and uses. The results illustrate the commonalities of thought and the complexities of concerns expressed by those who share the resources of the Yellowstone River.

Summary of Cultural Views in Region D

A review of the interview data for the segment, Missouri River to Powder River, suggests that people in this area engage in four primary discussions when asked about the Yellowstone River. First, the notion of Eastern Montana is not simply a geographic reference. It is a defining concept that captures the agricultural roots and the cultural values of the people living in the study segment, and the river is an essential element within their notion of Eastern Montana. Second, the river is discussed as a wholesome recreational outlet. However, shifting landownership is noted as an important change in the recreational context. Third, even though agricultural practices are viewed as the mainstay of the local economies, many participants discuss the long-term economic viability of their communities as a concern. Industrial and residential developments along the river's edge are seemingly remote possibilities and are generally discussed with references to flood plain restrictions and the stability of nearby dikes. Finally, discussions of managing the river are limited, but a variety of opinions are offered regarding bank erosion and stabilization techniques.