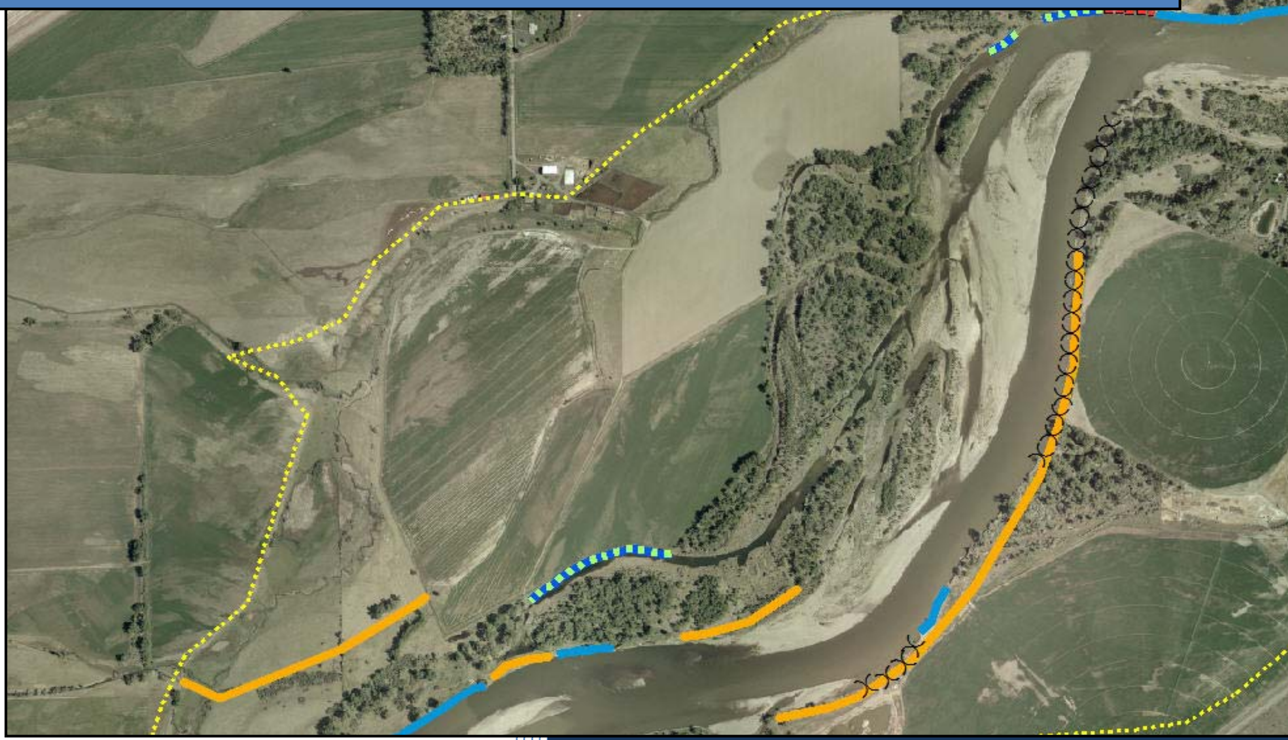
FINAL Report

November 6, 2008

Yellowstone River Human Impacts Timeline



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1 Introduction

This report describes the results of a Human Impacts Timeline assessment of the Yellowstone River corridor within three counties (Stillwater, Yellowstone and Dawson). The focus of the timeline is the determination of approximate construction dates of physical features within the corridor such as dikes, levees, armor, and transportation encroachments. The report describes the procedures utilized and provides a preliminary summary of results. This study is intended to be a Pilot Study for assessing the practicality of the mapping process and for reviewing the types of analysis that may be possible from the mapping. The study supports the Yellowstone River Conservation Districts Council's (YRCDC) ongoing efforts to prepare a Cumulative Effects Study for the Yellowstone River Corridor.

This work was performed for the Custer County Conservation District and the Yellowstone River Conservation Districts Council.

The physical features mapping consists of the following primary tasks:

- For Stillwater, Yellowstone and Dawson Counties, review the 1950s, 1976-77, 1995 and 2004 photography for evidence of physical features within the river corridor;
- Map the extent of each feature as lines within the project Geographic Information System (GIS);
- Attribute each feature with information describing the feature type, function, and presence/absence at the time of photography;
- Perform a preliminary analysis of the resulting data;
- Review the results for evidence of temporal and spatial trends; and
- Make recommendations for continued mapping.

The Human Impacts Timeline contract also contains a second task, which is to compile a series of tables that describe Relevant Historical Occurrences. This task involves reviewing available information for the three counties describing the timing and location of other noteworthy events within the corridor, including ice jams, historic floods, and bridge construction. The results of this task will be provided in a separate document.

The methodology and results used for the Physical Features Mapping are discussed in detail in the following sections.

2 Methodology

Mapping physical features as a function of time of construction within the Yellowstone River Corridor is a multistep process. The steps include: compiling available feature mapping, reviewing imagery, attributing and analysis. Even with this process of integrating multiple data sources and reviewing imagery, it is difficult to capture all the features existing on the ground. Additionally, attributing each feature properly can be challenging due to variable image quality, vegetation cover, and other factors. In all cases, every attempt was made to ensure the resulting GIS data accurately captures the conditions on the ground.

It should be noted that the goal of this project is a *timeline* of physical features. This implies that features have a temporal aspect to them. Features may be present in early photography, but not visible in later photography. This change may be due either to removal of the feature by human or natural events, or the feature may not be visible in later photography due to changes in vegetation. In these cases, visual clues such as the lack of bank migration or the expression of a linear feature on the LiDAR imagery were used to assess whether a feature is present or absent. In other cases, a feature may be included in the dataset that is not visible in any photography. These features were most likely mapped as part of the original Rapid Aerial Assessment (RAA) and were assumed to be present, even though they were not clearly evident in the photography.

One final component to the data that is considered is the functional nature of each feature. For this study, "*functionality*" reflects the level of influence of the feature on the natural channel processes of lateral migration and floodplain inundation. Examples of functional features are riprapped alluvial channel margins, diversion structures, and levees along the river bank. Non-functional features include bank armor that protects a non-alluvial valley wall. As features were developed over time, a feature that was functional in the 50's may become non-functional at a later date as other features take precedence. This is a complex, time-consuming process in the GIS, but important for understanding the influence of human features on the river over time.

Each of these complexities is captured in the attributes assigned to each feature. The actual process for developing the data set, along with the associated attributes are discussed in detail in the following sections.

2.1 Compilation of Existing Mapping

For this project, much of the initial physical feature data compilation was performed by Jim Robinson (DNRC). All available data GIS sources defining physical features for Stillwater, Yellowstone and Dawson counties were integrated into a single data set. These included:

- Physical Features Inventory from the Rapid Aerial Assessment,
- NRCS field mapping, and
- Feature mapping from 2004 LiDAR/high-resolution digital photography.

The resulting data provided the best 'current' (2004) data set of physical features available and formed the starting point for the Human Impacts Timeline mapping effort.

2.2 Base Map Imagery

The project work scope calls for assessing physical features using the 1950, 1976, 1995 and 2004 image data sets. To provide the most complete mapping available, as well as to assist in assessing the features in the core data sets, the imagery from 2001 (color infrared) and 2005 (color NAIP) were also assessed. Additionally, shaded relief LiDAR (2004) data was referenced to help identify hidden or subtle features. By using the complete suite of available imagery there were more clues available to assess the existence, functionality, extent, and timing of each feature.

The ground resolution and image quality of each of the data sets plays a large role in feature recognition. Within the project area, the image quality ranges from excellent (2001) to poor (1950). The general conditions of each image set are described in Table 2-1 below. The reliability of the mapping for each feature is directly related to the quality of the imagery, along with other factors such as vegetation cover and shadows. This variability is captured in the HI_Reliability attribute discussed in Section 2.4.3.

Table 2-1. Summary characteristics of project imagery used in mapping effort.

Year	Quality	Type	Description
1950s	Poor	B/W	Scanned black and white images mosaiced by county. Actual image dates vary from 1948 to 1950. Image quality, contrast, shadows, and resolution varies throughout the data set. Difficult to make out details of features.
1976	Moderate	B/W	Scanned black and white images mosaiced by county. Overall image quality, contrast and resolution is fair. Major features are generally easy to identify.
1995	Good	B/W	1995 Digital Orthophoto Quads. Overall image quality is good. Feature identification is generally good.
2001	Very Good	CIR	Mosaiced color infra-red imagery from 2001. Image quality is very good and detailed feature identification is relatively easy.
2004	Excellent	Color	High-resolution (~1 ft) resolution imagery collected only for Stillwater, Yellowstone, and Dawson Counties. Feature identification is excellent.
2005	Very Good	Color	Statewide NAIP imagery distributed as county-level mosaics. Overall quality allows very good identification of features.

2.3 Digitizing Methodology

To detect temporal changes in the distribution of physical features, the digitizing process involved examining each suite of imagery and assessing each length of riverbank for the presence or absence of physical features. To ensure mapping consistency, features were mapped forwards through time, starting with the 2004 high-resolution orthophotos as a baseline, and moving to successively newer photography. The general workflow sequence is as follows:

1) Assess the 2004 imagery.
    a. Review each feature in the *current* dataset and confirm its existence using visual clues.
    b. Remove or flag suspect features.
    c. Add additional features that were missing in the dataset.
    d. Assign the appropriate attributes to each feature.
2) Review the LiDAR shaded relief to identify any hidden or incorrectly mapped features.

   a. Add any missing features.
   b. Remove or flag suspect features.
   c. Assign the appropriate attributes.
3) Review the 1950 imagery.
   a. Assess whether the mapped features are present. Attribute each feature as necessary to reflect the presence or absence of the feature in the 1950 imagery.
   b. Split existing feature lines to reflect the extent of feature in 1950. For example, a section of bank protection may be shorter in 1950 than it was in 2004. Here the 2004 line is split. One piece shows presence in both 2004 and 1950, while the other piece only shows existence in 2004.
   c. Add any missing features.
   d. Assign the appropriate attributes.
4) Repeat Step 3 for the remaining imagery (1976, 1995, 2001 and 2005).

2.4 Feature Attributes

A variety of attributes were assigned for each feature to reflect the feature class (i.e. irrigation, transportation, etc.), type (riprap, diversion, levee, etc.), existence at time of photography, and functionality at time of photography. These attributes are discussed in detail in the following sections. The goal of the attributes is to allow the analysis of the mapped features and identify trends in physical feature development throughout the period of record as they relate to both river reach and geomorphic channel type.

2.4.1 Feature Classes (FEATURECLASS):

The feature class defines the base function of the feature. Is it an irrigation, transportation, bank protection, or other on/off channel feature? A feature may actually bridge two different feature class categories. For example, riprap bank protection may provide both stream stabilization, as well as irrigation ditch protection. In this case, the feature would be marked as an Irrigation Feature, as it protects irrigation infrastructure.

The range of values in the feature class domain include the following:

1) Irrigation Feature – Dikes, levees and other features associated with irrigation infrastructure:
   a. Ditches
   b. Canal levees
   c. Pump station protection
2) Other Off Channel Feature – Dikes, levees, and other features that are off channel:
   a. Field edges
   b. Random dirt/gravel push-up berms that are behind other features
   c. Power line tower stands
3) Transportation Encroachment Feature – any feature associated with transportation:
   a. County Road – includes paved roads and major unpaved roads
   b. Railroad
   c. Interstate
   d. Bridge approaches
   e. Other roads (minor gravel roads, ranch roads, driveways)
4) Stream Stabilization Feature – a feature that stops bank erosion and prevents lateral channel migration. These features include:

    a. Riprap
    b. Car bodies
    c. Flow deflectors
    d. Levees that are on the river bank
5) Other – any other features, such as:
    a. Sewage plants
    b. Refineries

2.4.2 Feature Types (FEATURETYPE):

The Feature Type attribute defines the actual type of structure.

Possible values in the domain include the following:

1) Bridge Approach – Any road or railroad, existing or historic, that ramps up to a bridge crossing.
2) Car Bodies – Car bodies are usually not identifiable in the GIS. These features have been identified in the NRCS Physical Features Inventory.
3) Concrete Riprap or Rock Riprap– It is generally impossible to indentify the type of riprap in any photography. Any riprap that is noted as concrete or rock was likely mapped in the field by the NRCS and no further field investigation has been undertaken to verify this mapping. If additional NRCS-mapped features were extended, they generally were attributed as the same type (concrete or rock) as the original feature. Note: For riprap features digitized by DTM, it was impossible to determine the actual type of material used. In this case, the feature took on the attributes of adjacent bank protection, or it was assumed to be rock.
4) County Road – County road features consist of any road other than the Interstate that has, or appears to have, a sizeable road prism. This includes both paved and dirt roads. In many cases a dirt road may convert to a paved road over time, and no additional attributing was made to note the change. Minor roads, driveways, and temporary features are generally mapped as "Other".
5) Floodplain Dike/Levee – any dike or levee. These features include canal dikes, streambank protection, field berms, etc.
6) Flow Deflector – Flow deflectors consist of erosion control features such as barbs. Although these are typically point features, they were digitized as linear features comprising the entire series of deflectors. Where the flow deflectors are in association with other bank protections such as riprap or levees, they are attributed as flow deflectors.
7) In-Channel Diversion – An in-channel diversion is any features that extends across a stream channel. This includes permanent dams, rock diversions, and semi-permanent diversions such as maintained gravel berms.
8) Interstate – The Interstate feature type specifically identifies embankments associated with I-90 and I-94.
9) Other – Minor roads, driveways or other linear features that do not appear to have a road prism and thus do not impact the river corridor or floodplain are described as "other".
10) Railroad – The railroad grade commonly encroaches into the stream corridor. These linear embankments are specifically identified as rail lines.

11) Steel Retaining Wall – a single retaining wall occurrence just below Billings was attributed as such.

2.4.3 Mapping Reliability (HI_Reliability):

The Mapping Reliability attribute assigns a reliability rank to each individual mapped feature. The purpose of assigning a reliability rank is to estimate the degree of uncertainty associated with a particular mapped feature. Some of the mapped features are not clearly visible on a particular photo set; their presence is inferred based on indirect information such as the photo interpreter's knowledge of channel behavior and visible evidence in other photo suites. In general, if features were visible on the imagery, they were marked as High Reliability. If they were not visible, or interpreted from other information or sources, then they were marked as Moderate or Low Reliability.

The values associated with the Reliability domain include the following:

- *High Reliability* – Feature is clearly visible.
- *Medium Reliability* – Feature is inferred from other information.
- *Low Reliability* **–** Feature is not visible and no evidence of the feature was noted, but existence was noted from other sources.

2.4.4 River Function (Function):

The functionality of a feature refers to its relative level of influence on the active river channel at the time of photography. Some interpretation is used here to flag features that have the potential to influence processes such as lateral channel migration. In general, it is fairly straightforward to identify the functionality of bank armor, as that functionality is dictated by position relative to an active channel bankline. In contrast, the functionality of dikes and levees that are located out of the active channel corridor is difficult to discern without information regarding their hydraulic impacts on floodwaters. Dikes and levees were attributed in terms of apparent functionality with respect to either their impacts on channel migration, side channel access, or overbank flow patterns. However, due to inherent uncertainties in that attribution, the data for these features are summarized as total length of the mapped features, with no assumption regarding their overall impacts on flooding extents.

In the mapping effort, attempts have been made to avoid duplicating the function of features that run parallel to each other. For example, if a road is behind a riprapped bank, then the riprap would have a 'Yes' for Function, while the road would be 'No'. See Figure 2-1 below for an example.

- Yes **–** The feature is clearly influencing, or has the potential to restrict the lateral migration of the river.
- Maybe **–** These tended to be major features that were a moderate distance from the active channel, but still have the potential to restrict the flow of water, or the lateral migration of the channel in flood events.
- No **–** The feature is usually a great distance from the channel, is behind other bank protection features, or is along a non-alluvial boundary.

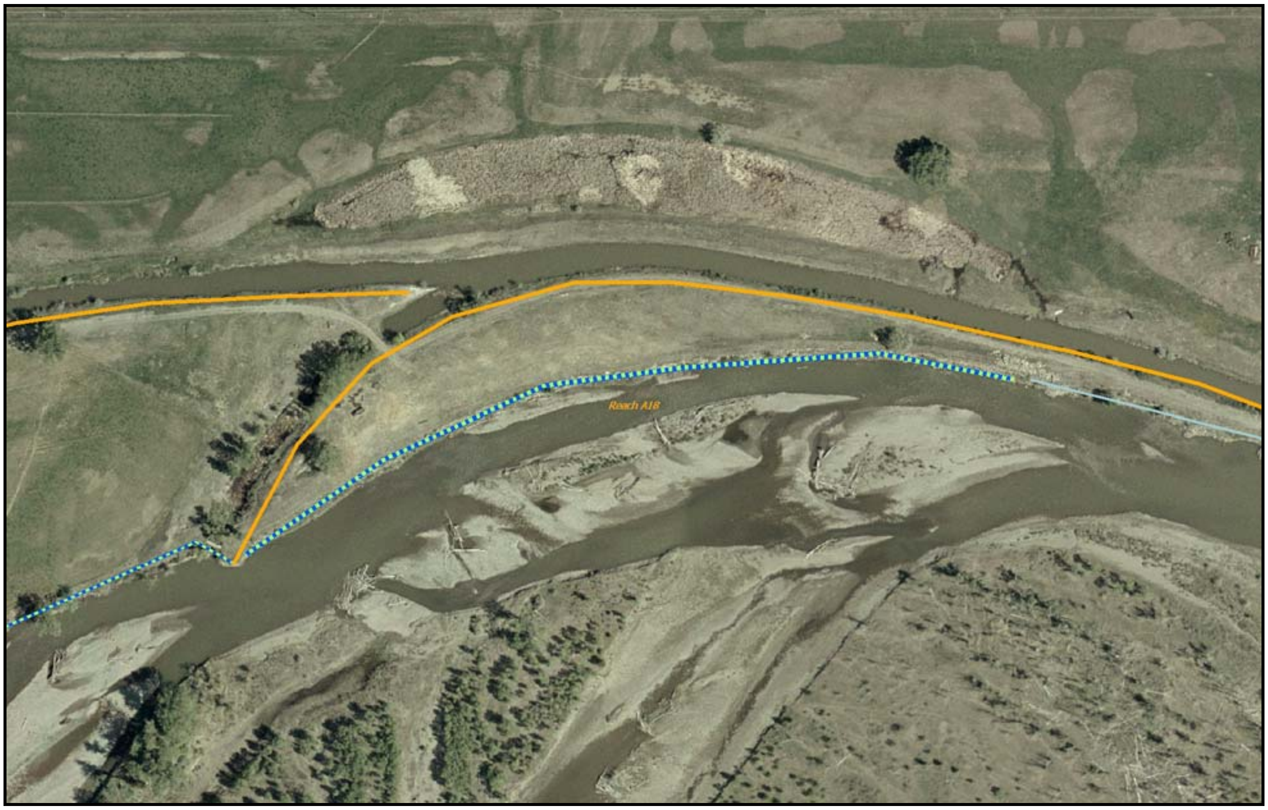

Figure 2-1. 2004 image and features from reach A18. The orange levee behind the green/blue riprap is not functional, while the riprap is functional.

3 Human Impacts Timeline Analysis

For each time series evaluated, the total length of mapped physical features has been quantified to determine their spatial and temporal distributions. The following sections include a series of preliminary plots that reflect that summary data, including cumulative length of stream stabilization measures, irrigation features, and transportation-related encroachments. The lengths of these features are summarized by the time frames defined by the aerial photography, as well as by county, geomorphic reach, and geomorphic reach type.

3.1 County-Based Summaries

The physical features data have been summarized by county to show general trends in their distribution and rate of emplacement. The extents of the features are described in terms of the percent of bankline affected to allow direct comparison of the three counties (Stillwater, Yellowstone, and Dawson).

3.1.1 Irrigation Feature Class

The majority of irrigation features, which include dikes, levees, ditches, and pump protection armor, were largely in place by 1950 (Figure 3-1). In both Stillwater and Yellowstone Counties, the length of these features is equivalent to just over 10 percent of the 2001 primary channel bank length, and in Dawson County, the length of functional irrigation features is approximately 6 percent of the primary channel bank length.

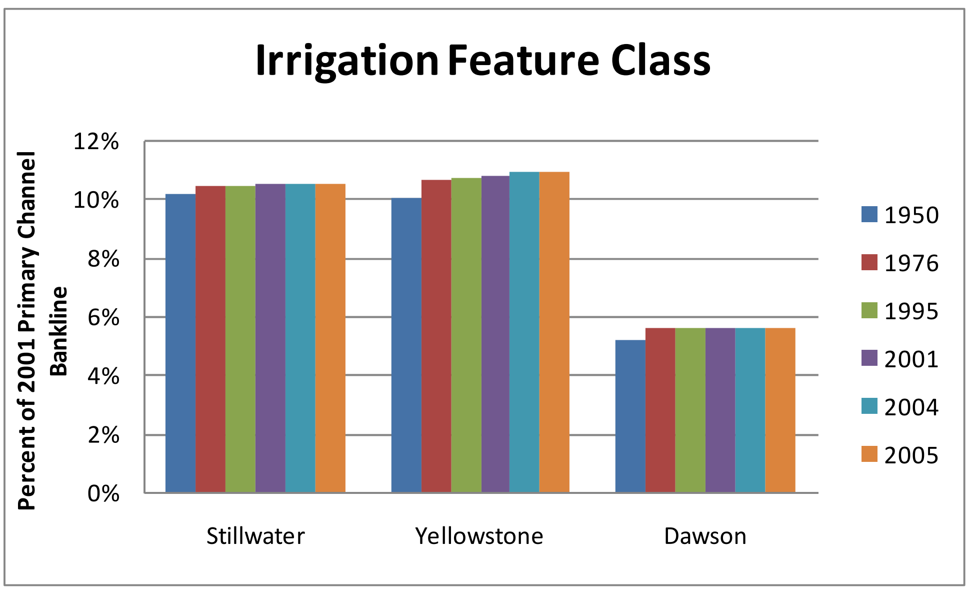

Figure 3-1. Irrigation feature extents for each county as percent of primary channel bankline, 1950-2005.

A plot of the percent change in total length of irrigation features since 1950 shows a continual increase in Yellowstone County through time, and consistent conditions in Dawson County (Figure 3-2). In Stillwater County, the total length of these features increased a few percent between 1950 and 2001, and no change has been identified since 2001.

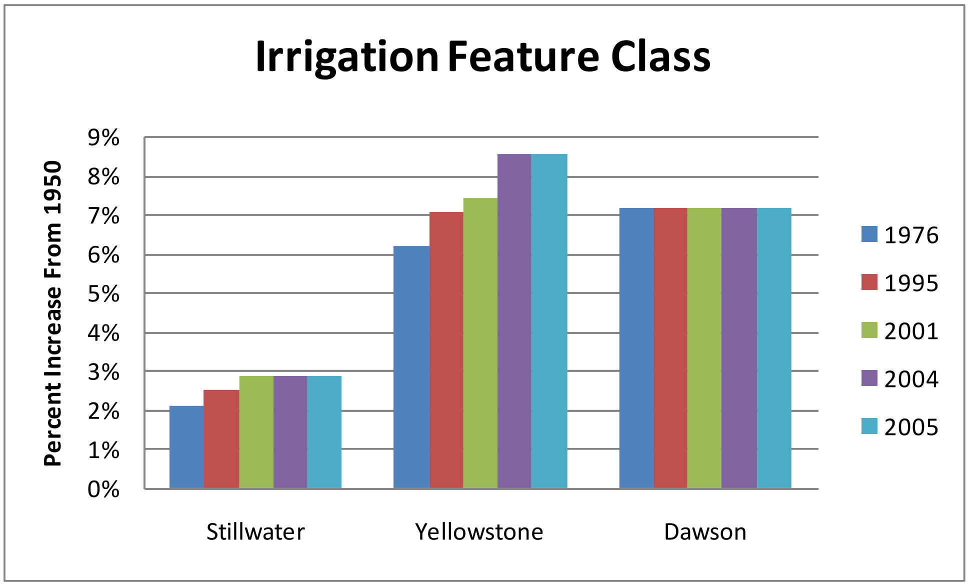

Figure 3-2. Percent increase in irrigation features relative to 1950 by county.

3.1.2 Stream Stabilization Feature Class

Stream stabilization measures include features that protect the bankline and limit lateral channel migration. For this summary, only those stabilization measures identified as functional at the time of photography are included. Because stream stabilization measures are placed on both the main channel and side channels, the length of bankline present at any given time frame is not truly represented by the primary channel alone. In order to more accurately reflect the percent of bankline affected by armor, it was necessary to calculate the total amount of primary and side channel bankline present in each time frame. To determine the length of bankline that would potentially be armored, the channel length was calculated in terms of primary plus anabranching channel length for each reach. This value was then doubled to estimate the total amount of bankline present in 1950, 1976, 1995, and 2001. Because flowlines have not been digitized on any photography post-2001, the 2001 bankline lengths were used to estimate the extent of armor present in 2004 and 2005.

All three counties show increases in stream stabilization lengths from 1950 to 2005 (Figure 3-3). Currently, Yellowstone County has the most extensive stabilization, with approximately 9% of the entire bankline affected (the bankline length includes the primary channel plus any anabranching side channels). In Dawson County, less than 2% of the total bankline is affected by stabilization measures.

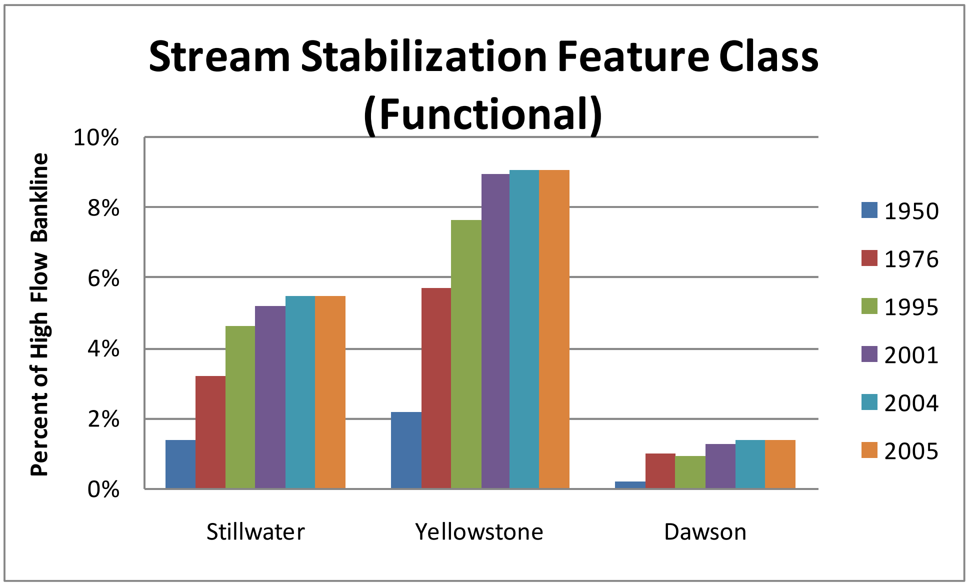

Figure 3-3. Stream stabilization feature extents for each county as percent of total bankline, 1950-2005.

Although Dawson County has the lowest total percent of bankline affected by stream stabilization measures, it shows the greatest relative increase in bank protection length since 1950 (Figure 3-4). The vast majority of this increase, which is on the order of a five-fold increase, occurred between 1950 and 1976, resulting from armor associated with the Glendive levee. During this time frame, the functional stream stabilization measures in Dawson County increased from 1,689 feet (1950) to 10,508 feet (1976). From 1950 to 2005, all three counties show continual increases in percent of stabilized bankline.

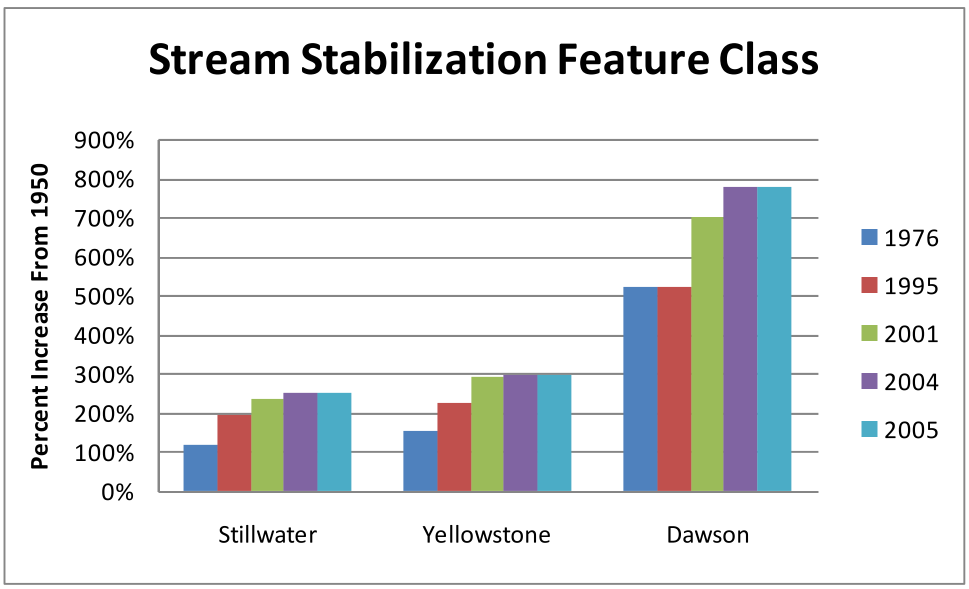

Figure 3-4. Percent increase in stream stabilization features relative to 1950 by county.

3.1.3 Transportation Encroachment Feature Class

Roads, railroads, and bridge approaches that encroach into the river corridor were largely in place in all three counties by 1976 (Figure 3-5). However, all counties show a considerable increase between 1950 and 1976 (Figure 3-6). In Yellowstone County, the length of features attributed as transportation encroachment increased almost 30% between 1950 and 1976. Note that the slight dips in the percent of transportation encroachment in some years reflects a removal of some features as a bridge was removed or replaced.

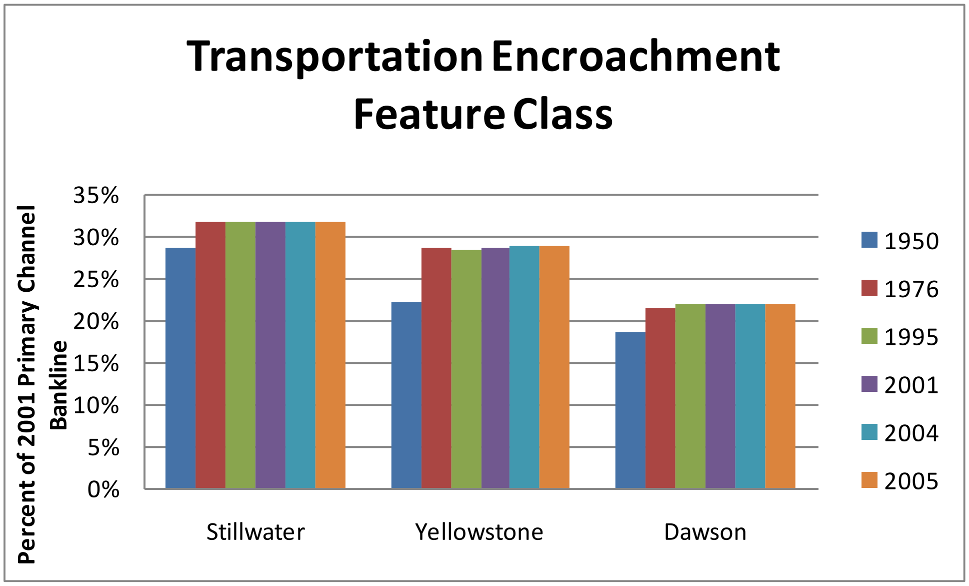

Figure 3-5. Transportation encroachment feature extents for each county as percent of total bankline, 1950-2005.

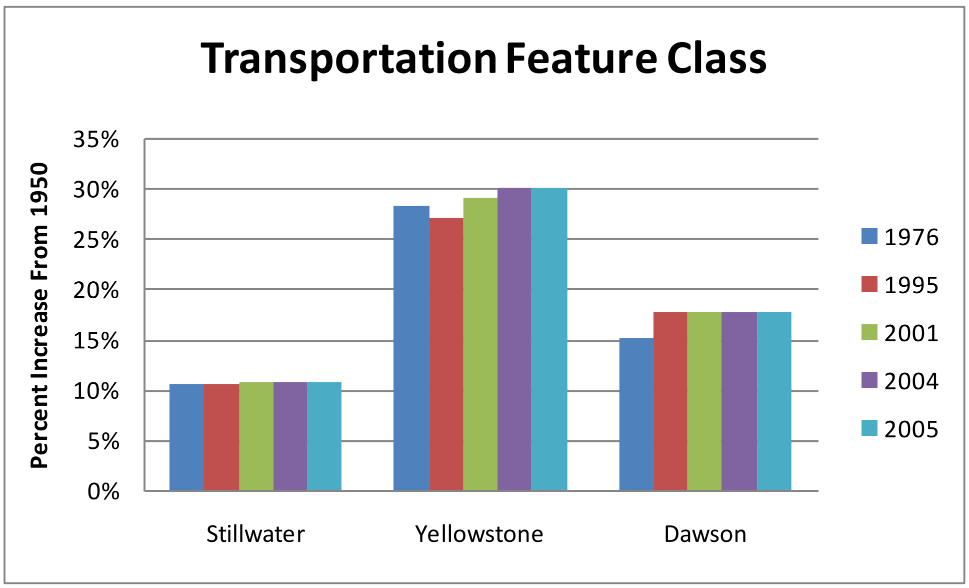

Figure 3-6. Percent increase in encroaching transportation features relative to 1950 by county.

3.1.4 Dikes and Levees Feature Types

The total lengths of dikes and levees in the river corridor through time have been summarized by feature type. A summary of the total length of dikes and levees presented as a percent of the 2001 main channel bank length indicates that Yellowstone County has the largest overall extent of mapped dike and levee features, amounting to over 40% of the total 2001 primary channel bank length (Figure 3-7). Yellowstone County shows a continual increase in dike/levee extent through time. In Stillwater County, the total length of dikes and levees is equivalent to just over 5% of the primary channel bankline, and in Dawson County, that value is approximately 13%. It is important to note, however, that the functionality of these features is unknown; numerous dikes and levees are shadowed by other features or located on the margin of the active floodplain. Thus the 40% value for Yellowstone County overestimates the length of dikes and levees that markedly affect channel migration, side channel access, and flooding patterns in the stream corridor.

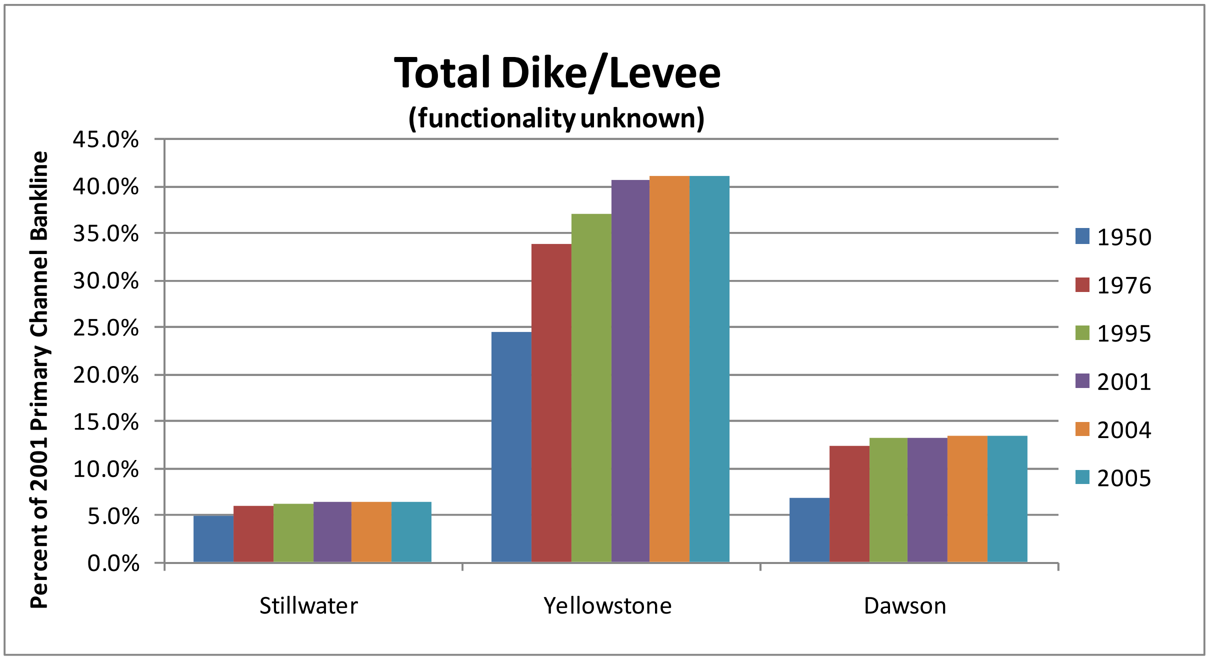

Figure 3-7. Dike and levee feature type extents for each county as percent of total bankline, 1950-2005.

In order to assess the increase of dike/levee length in each county through time, the data have been summarized in terms of annualized increase in feature type length (Figure 3-8). For this calculation, 1900 was assumed as the onset of dike and levee construction. The results of this calculation indicate that, assuming that dikes and levees were not present in 1900, the most rapid phases of dike construction occurred in Yellowstone County from 1900-1950 (2601 feet per year), and from 1995-2001 (3167 feet per year). If dikes and levees were constructed prior to 1900, then the 1900-1950 rate of change is overestimated.

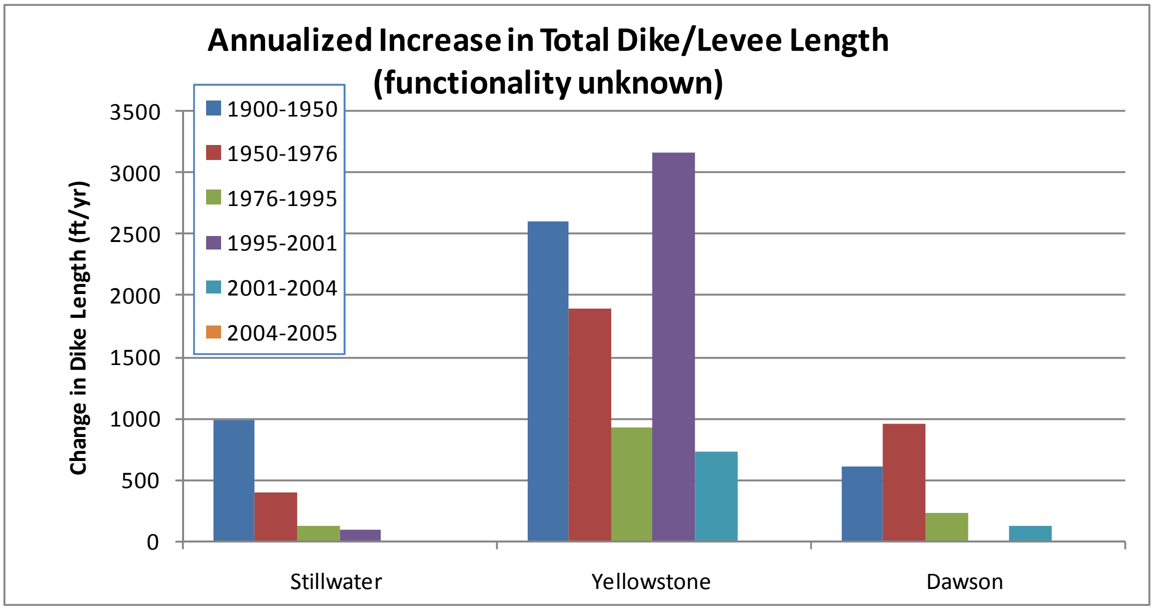

Figure 3-8. Dike and levee length in terms of annual increase (ft/year) for each county.

3.1.5 Bank Armor Feature Types

A summary of functional bank armor feature types, which include rock riprap, concrete riprap, flow deflectors, car bodies, and steel retaining walls, shows continual increases through time in all three counties (Figure 3-9). When the total length of mapped armor is normalized in terms of the total bank length provided by both the primary and side (anabranching) channels, approximately 8% of the bankline within Yellowstone County is armored. Just over 5% of the bankline in Stillwater County is armored, and in Dawson County, bank armor is present on less than 2% of the total bankline. These values do not include armor that is along bedrock valley margins.

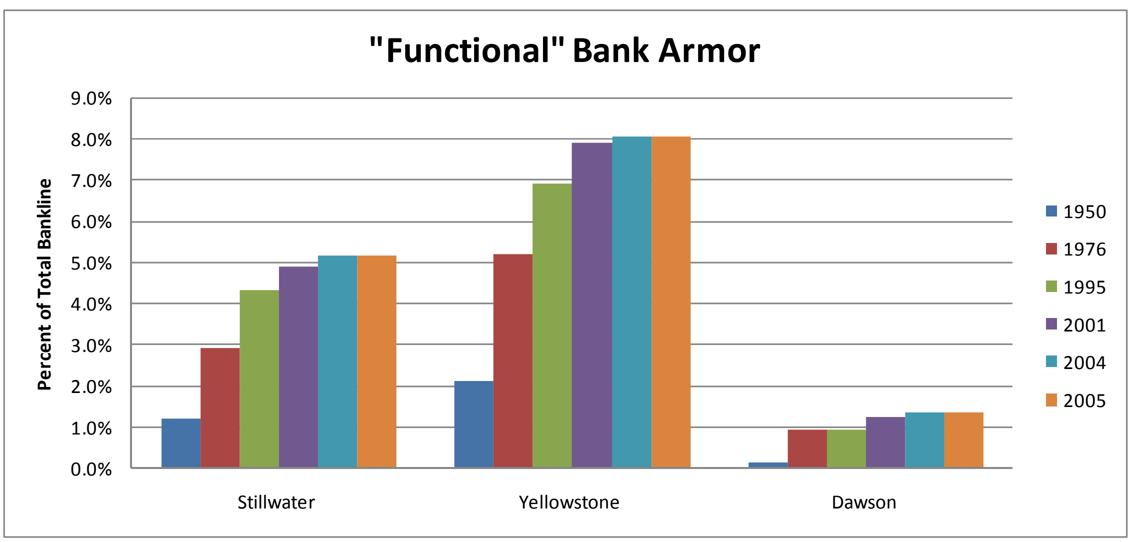

Figure 3-9. Bank armor feature type extents for each county as percent of total available bankline, 1950-2005.

When the bank armor extent data are summarized in terms of annual increase in bank armor length (ft/year), results indicate that the greatest rate of armor construction occurred in Yellowstone County between 1995 and 2001 (~4500 feet per year; Figure 3-10). In contrast, Dawson County has never exceeded an annual construction rate of 500 feet per year of bank armor.

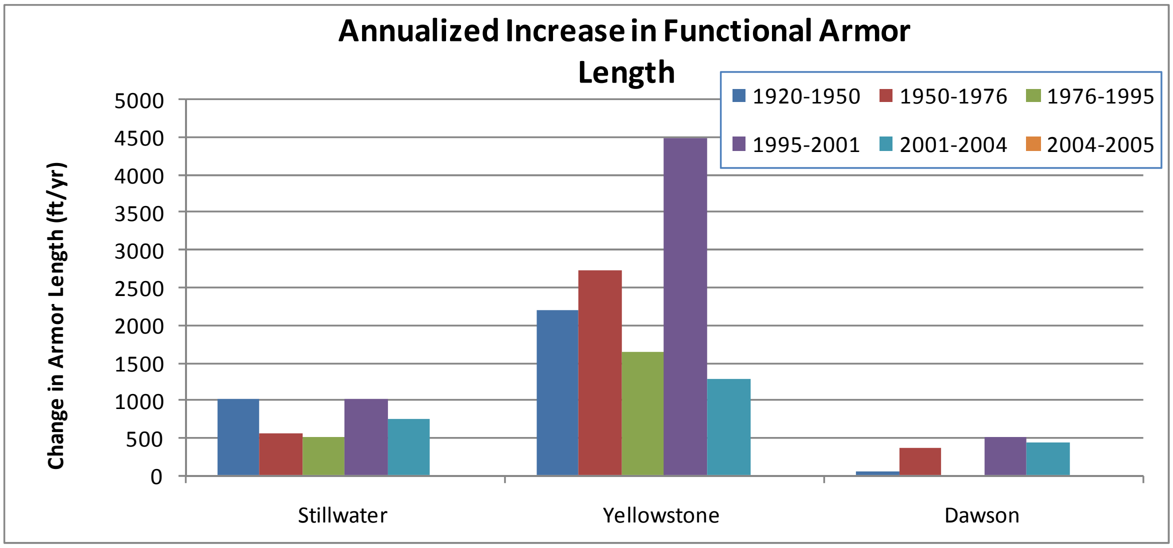

Figure 3-10. Bank armor length in terms of annual increase (ft/year) for each county.

A breakdown of types of functional bank armor indicates that car bodies, concrete riprap, and flow deflectors are most prevalent in Yellowstone County, whereas rock riprap is most extensive in Stillwater County (Figure 3-11).

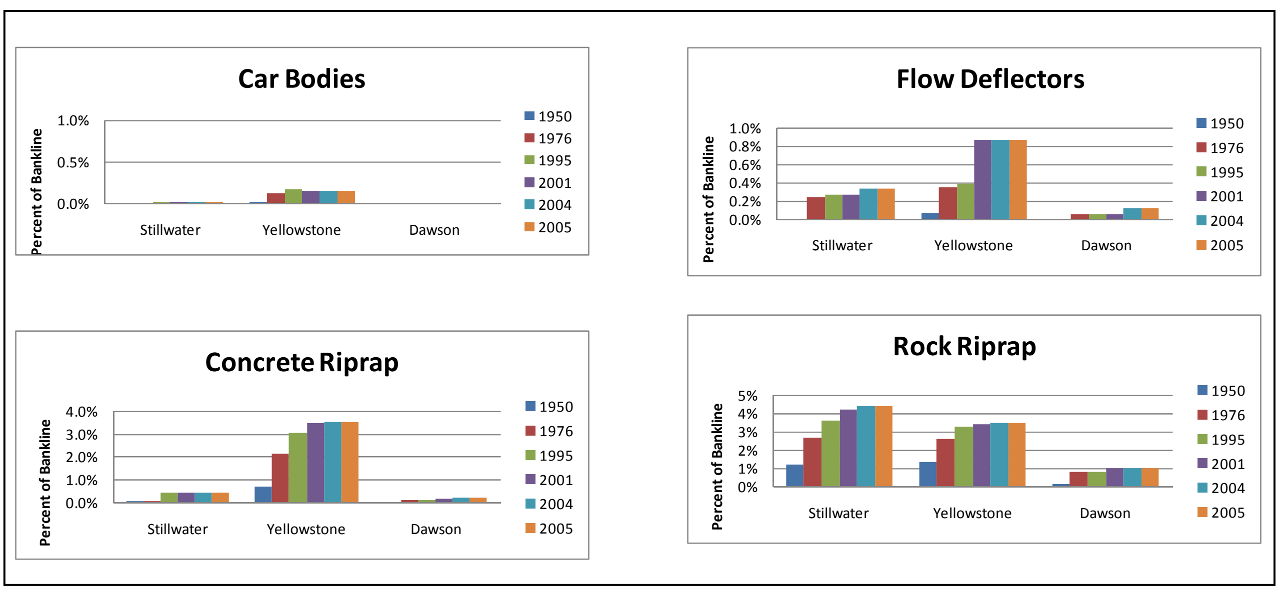

Figure 3-11. Percent of bankline protected by specific types of armor techniques, summarized by county.

3.1.6 Shadowed Features

Over the last 55 years, numerous features present in the stream corridor have been superseded by a more recent feature, which has likely made them ineffective with regard to their original purpose. A plot of the types of features that can be described as "shadowed" by another, more recent feature, is shown in Figure 3-12. The results of this summary indicate that the vast majority of shadowed features are located in Yellowstone County, and consist of road embankments, railroad embankments, and dikes and levees. This supports previous comments regarding the variable functionality of dikes and levees (Section 3.1.4).

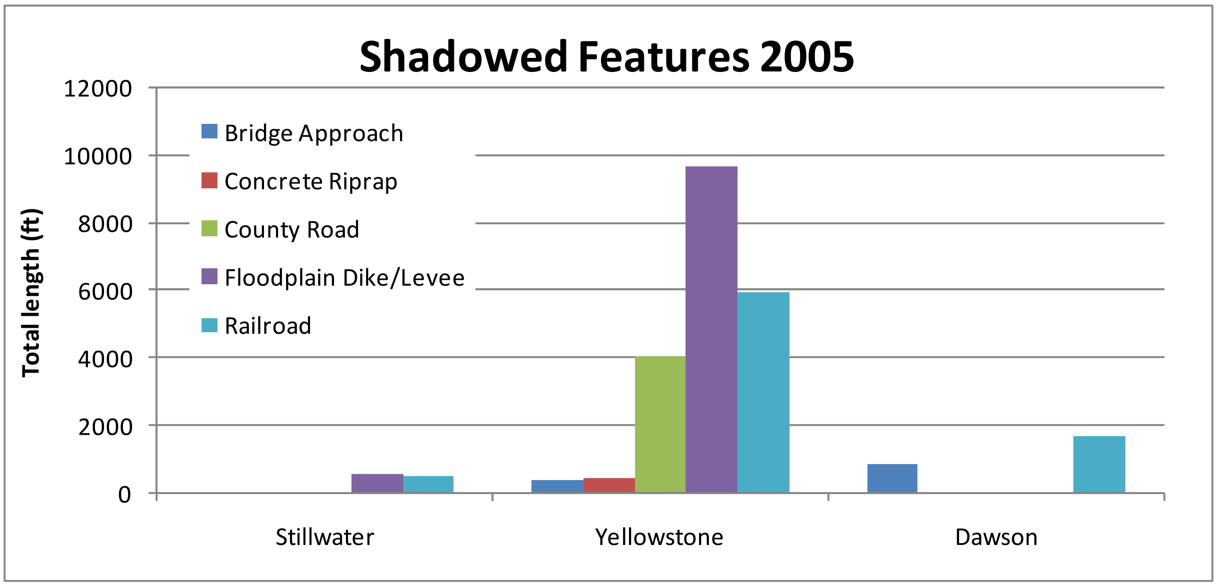

Figure 3-12. Lengths of features that became shadowed by another feature from 1950-2005.

3.2 Reach-Based Summaries

As part of the Cumulative Effects Assessment of the Yellowstone River corridor, the river has been divided into four major regions, referred to as Region A through Region D. Region A extends from near the Park/Sweetgrass County Line to the Clarks Fork of the Yellowstone confluence near Laurel. Region B extends from the Clarks Fork to the Bighorn River, and Region C reaches from the mouth of the Bighorn to the mouth of the Powder River. Region D extends from the Powder River confluence to the Missouri River in McKenzie County, North Dakota. Within these regions, the river has been further divided into a series of 66 reaches that reflect general channel form as observable on aerial photography (AGI and DTM, Inc., 2004). These reach types reflect varying types of channel forms that are observable on aerial photography.

The reaches evaluated in this effort include Reaches A10 through A16 in Stillwater County, Reaches A17, A18, and B1 through B12 in Yellowstone County, and Reaches D3 through D9 in Dawson County. For a description of these reaches, see the report entitled ***"Geomorphic Reconnaissance and GIS Development Yellowstone River, Montana: Springdale to the Missouri River Confluence"*** (AGI and DTM, Inc., 2004).

3.2.1 Irrigation Feature Class

When summarized by reach, the human impacts timeline assessment shows that the largest relative extents of irrigation related features occur in reaches A17 and A18, and in Reach D9. Reaches A17 and A18 are located near Laurel, and Reach D9 is located at Intake. In each of these reaches, irrigation feature lengths exceed 40% of the total primary channel bank length.

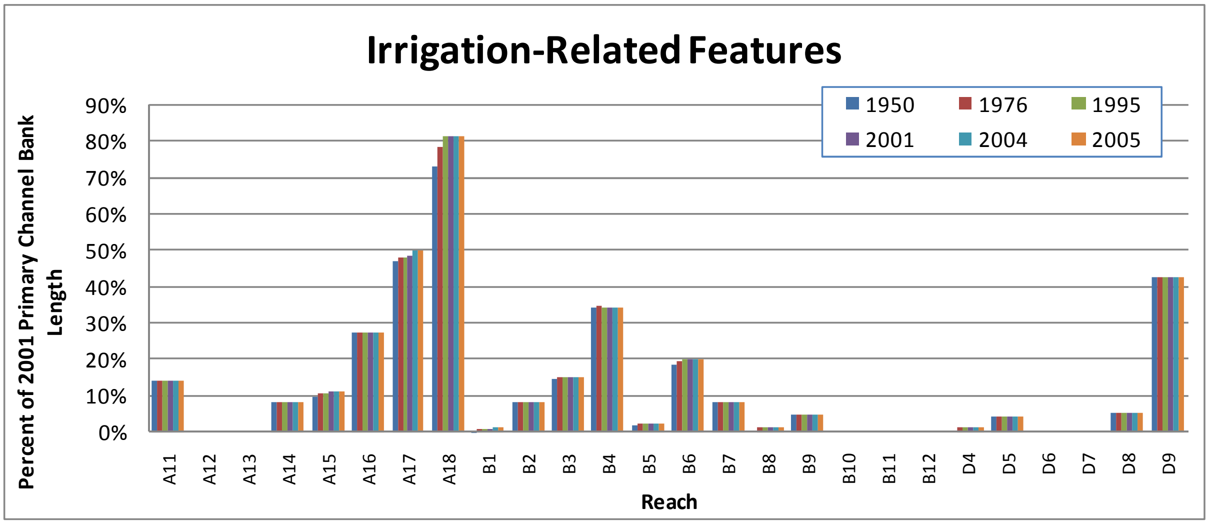

Figure 3-13. Irrigation feature class extents for each reach as percent of total bankline, 1950-2005.

3.2.2 Stream Stabilization Feature Class

With respect to functional stream stabilization features, Reaches A18 through B4 all show in excess of 10% total bankline affected (Figure 3-14). These reaches extend from Laurel through Billings to the Huntley Diversion Dam.

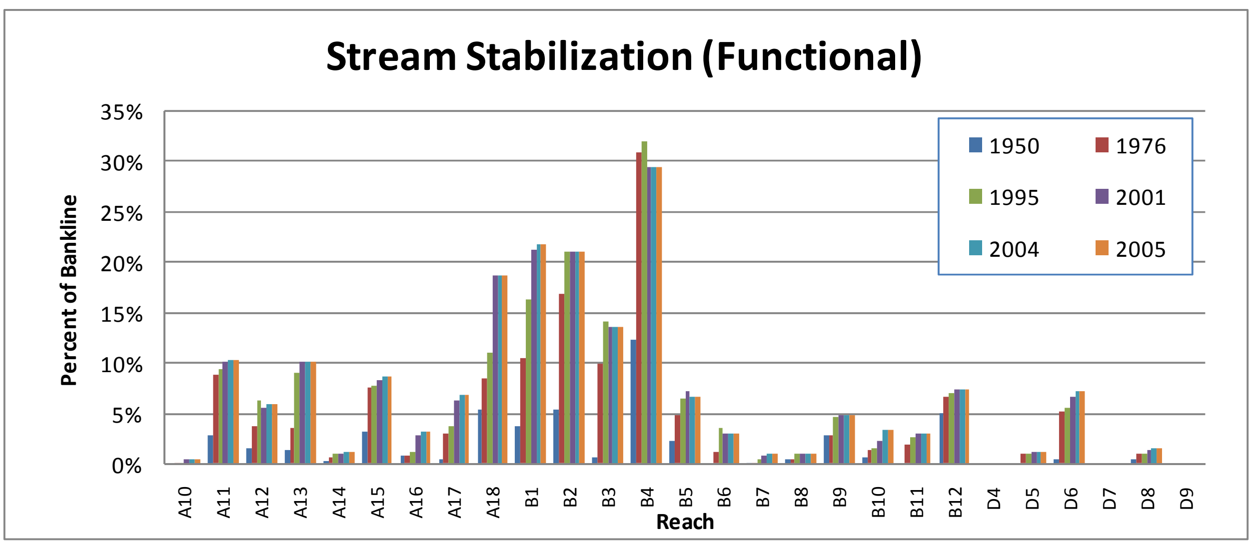

Figure 3-14. Stream stabilization feature class for each reach as percent of total bankline, 1950-2005.

3.2.3 Transportation Encroachment Feature Class

The features mapped as transportation encroachments affect the greatest proportion of the stream corridor in Reach A10, where a corridor length equivalent to over 90% of the total bank length is affected by county roads, interstate, and the railroad (Figure 3-15). This reach is located at Reed Point. Transportation encroachments are also consistently high downstream of Reed Point to Reach A14, near Columbus. From Pompey's Pillar (B8) to the Bighorn River confluence (B12), transportation encroachments exceed 30% of the bankline length, and at Glendive (D6) that value exceeds 40%.

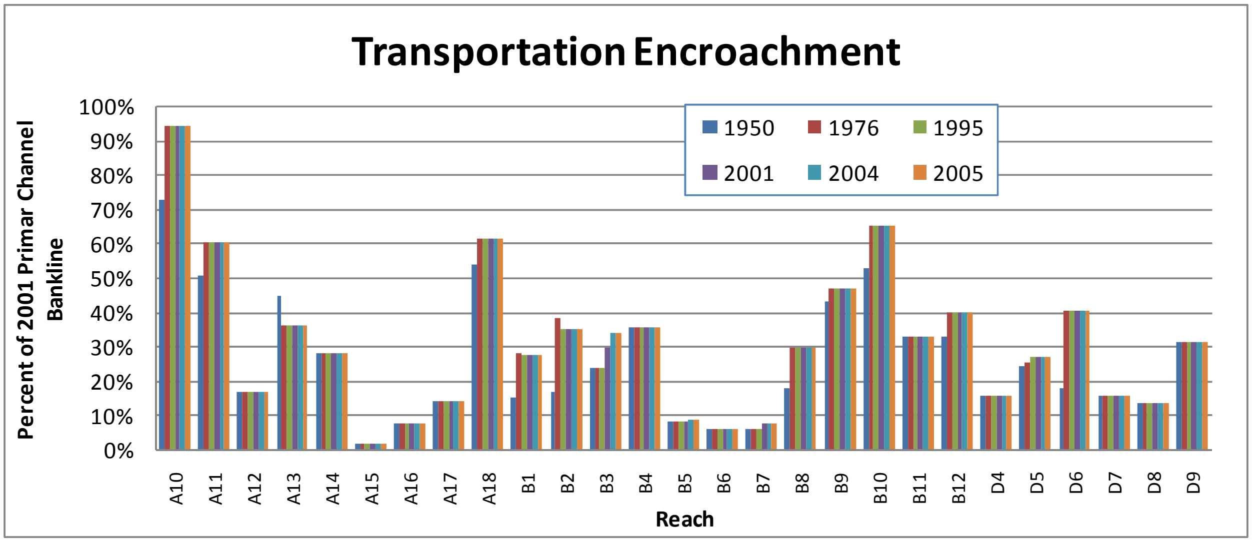

Figure 3-15. Transportation encroachment feature class for each reach as percent of total bankline, 1950-2005.

3.3 Channel Type-Based Summaries

The classification approach adopted for the Cumulative Effects Assessment reflects the overall channel pattern (straight, meandering, braided, or anabranching), as well as the relative role of the valley wall or inset high terraces in confining the river corridor (unconfined, partially confined, confined). A total of 10 channel types have been developed for the entire river, and 7 of those types are present in the three assessed counties (Table 3-1). In order to identify the trends within a given reach type, the physical features have been summarized by these 7 channel types. For a more detailed description of the geomorphology of each of these reaches, see the report entitled ***"Geomorphic Reconnaissance and GIS Development Yellowstone River, Montana: Springdale to the Missouri River Confluence"*** (AGI and DTM, Inc., 2004).

Table 3-1. Reach classification summary.

Type Abbrev.	*Classification*	*Reaches*	*Slope (ft/ft)*	*Planform/ Sinuosity*	*Major Elements of Channel Form*
UA	Unconfined anabranching	A17, A18, B5, B9, B12,	<.0022	Mult. Channels	Primary thread with vegetated islands
PCA	Partially confined anabranching	A14, A16, B8, B11, D5, D7, D8	<.0023	Mult. Channels	Partial bedrock control; Primary thread with vegetated islands
UB	Unconfined braided	B1, B3, B7	<.0024	Mult. Channels	Primary thread with unvegetated gravel bars; Average braiding parameter generally >2 for entire reach
PCB	Partially confined braided	A11, A12, A15, B2, B6	<.0022	Mult. Channels	Partial bedrock control; primary thread with gravel bars; Average braiding parameter generally >2
PCM	Partially confined meandering	B10	<.0014	Sinuosity >1.2	Partial bedrock control; main channel thread with point bars; average braiding parameter <2
PCS	Partially confined straight	A10, B4	<.0020	Sinuosity <1.3	Partial bedrock control; low sinuosity channel along valley wall
PCM/I	Partially confined meandering/islands	D4, D6, D9	<.0007	Mult. Channels	Partial bedrock control; sinuous main thread with stable, vegetated bars

3.3.1 Dikes and Levees

The total length of dikes and levees summarized by reach type indicates that the Partly Confined Straight (PCS) channel type has the highest extent of dikes/levees relative to the total bank length in the reach (Figure 3-16). This reach type includes reach B4, which is a long straight reach that includes Huntley Diversion Dam. In the other PCS reach type (A10), no levees were mapped. Hence the extensive feature length for this reach type is likely related directly to infrastructure associated with Huntley Diversion Dam. This suggests that this reach may be "forced" into its channel type due to human impacts.

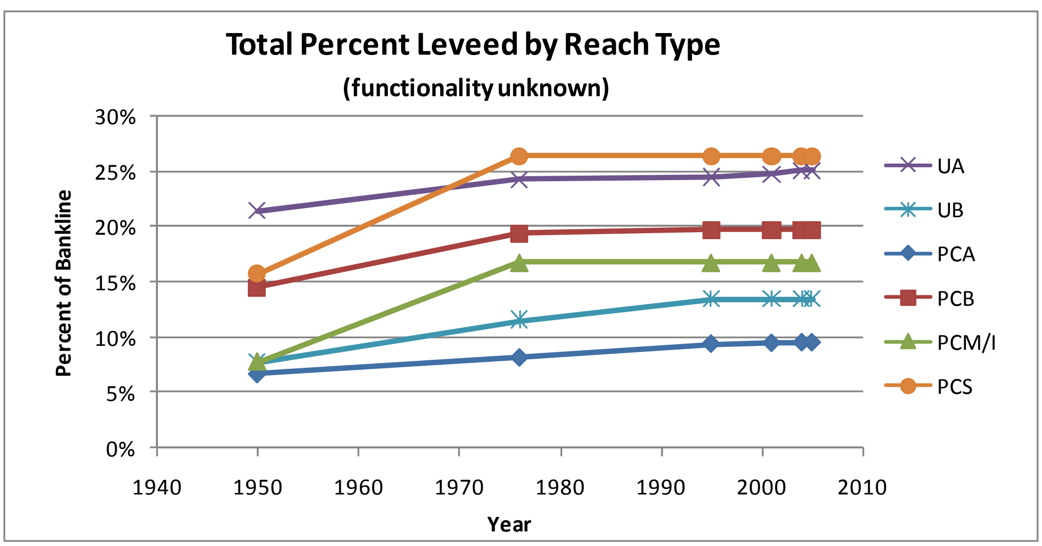

Figure 3-16. Total dike/levee length as a percent of total bankline, summarized by geomorphic reach type.

The Unconfined Anabranching reach type has dikes/levees that constitute over 25% of the total bank length (Figure 3-16). This reach type is typified by split flow and a dynamic planform, which has likely driven the construction of levee and dike features. The Partially Confined Meandering/Islands (PCM/I) channel type shows a major increase in percent of bankline levees between 1950 and 1976. This increase is associated with the installation of the Glendive levee.

3.3.2 Bank Armor

A plot of bank armor extent summarized by reach type includes that the most extensive bank protection is found in the PCS channel type, which includes the Huntley Diversion Dam reach (B4). The relatively high bank protection extent values in this reach type are due to the length of the armor in Reach B4, as well as the shortage of side channels in reach (lower total bank length). These data, in combination with the dike/levee results described above, suggest that Reach B4 may be a forced channel type due to human impacts.

The remaining reach types that have relatively high extents of armored bank include the Unconfined Anabranching (UA), Unconfined Braided (UB), and Partially Confined Braided (PCB) reach types. The braided reach types are characterized by split flow, extensive open gravel bars, and relatively rapid rates of bank erosion. The relatively high extents of bank armor are likely the result high rates of channel migration characteristic of the braided reach types. Reaches that are meandering (PCM/I), or anabranching reaches that follow the valley wall (PCA) tend to have relatively low extent of functional armoring.

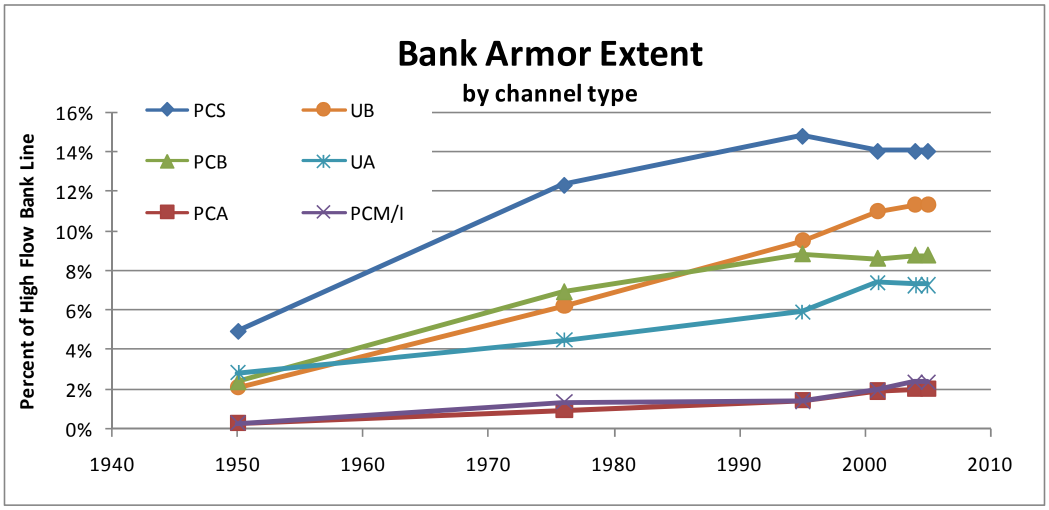

Figure 3-17. Percent of total bankline affected by "functional" armor, summarized by geomorphic reach type.

3.4 Urban vs. Rural Reach Summaries

Although reach type appears to have some influence on the extents of bank armor and levees in the assessed area, the level of development within the reaches is quite variable. In order to discern the extents of these features in rural versus urban reaches, each reach was generally classified in terms of its level of development. Urban reaches are those located within the communities of Reed Point, Columbus, Laurel, Billings, and Glendive (Table 3-2).

Table 3-2. Urban and rural reach designations.

County	*Reach*	*Reach Type*	*Urban/Rural*	*Community*
Stillwater	A10	PCS	Urban	Reed Point
	A11	PCB	Rural	
	A12	PCB	Rural	
	A13	PCA	Urban	Columbus
	A14	PCA	Rural	
	A15	PCB	Rural	
	A16	PCA	Rural	
Yellowstone	A17	UA	Rural	
	A18	UA	Urban	Laurel
	B1	UB	Urban	U/S Billings
	B2	PCB	Urban	Billings
	B3	UB	Urban	Billings
	B4	PCS	Rural	
	B5	UA	Rural	
	B6	PCB	Rural	
	B7	UB	Rural	
	B8	PCA	Rural	
	B9	UA	Rural	
	B10	PCM	Rural	
	B11	PCA	Rural	
	B12	UA	Rural	
Dawson	D4	PCM/I	Rural	
	D5	PCA	Rural	
	D6	PCM/I	Urban	Glendive
	D7	PCA	Rural	
	D8	PCA	Rural	
	D9	PCM/I	Rural	

3.4.1 Dikes and Levees

A summary of dike extent for each reach, sorted by channel type, indicates that in most channel types, the urban reaches have a relatively extensive network of dike and levee features. The exceptions to this trend are in rural Reach B4 at Huntley Diversion (PCS channel type), and in rural Reach A17 just upstream of Columbus (UA channel type), both of which have a relatively high extent of dike/levee features.

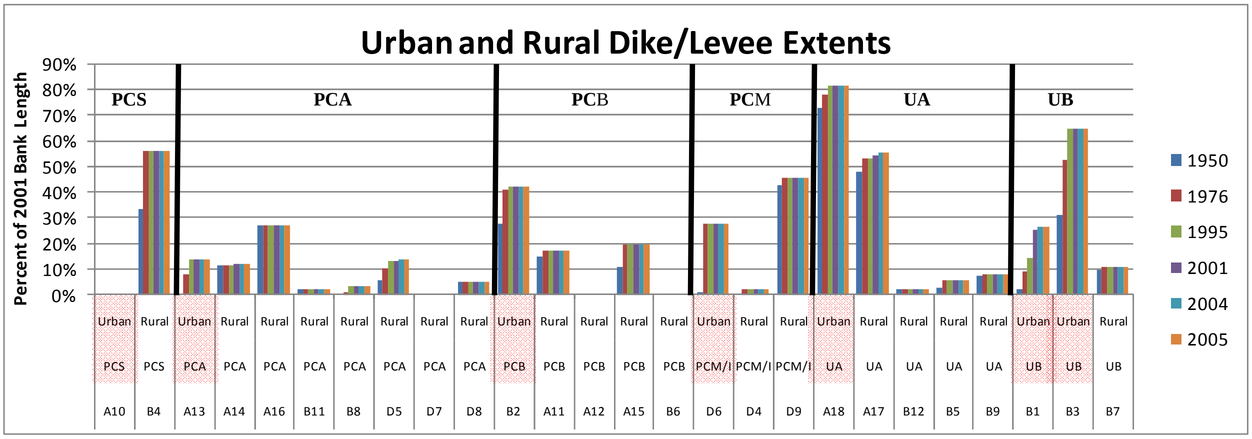

Figure 3-18. Dike and levee extents through time for each reach sorted by reach type, with urban reaches highlighted.

A summation of total length of dikes and levees in rural and urban reaches for a given reach type shows that with the exception of straight channel types (PCS), urban reaches cumulatively depict a longer extent of dike features relative to rural reaches of the same type. The anomalous trend in the straight reach type reflects reach B4 at Huntley Diversion, which is a rural reach that shows a large extent of diking (Figure 3-19).

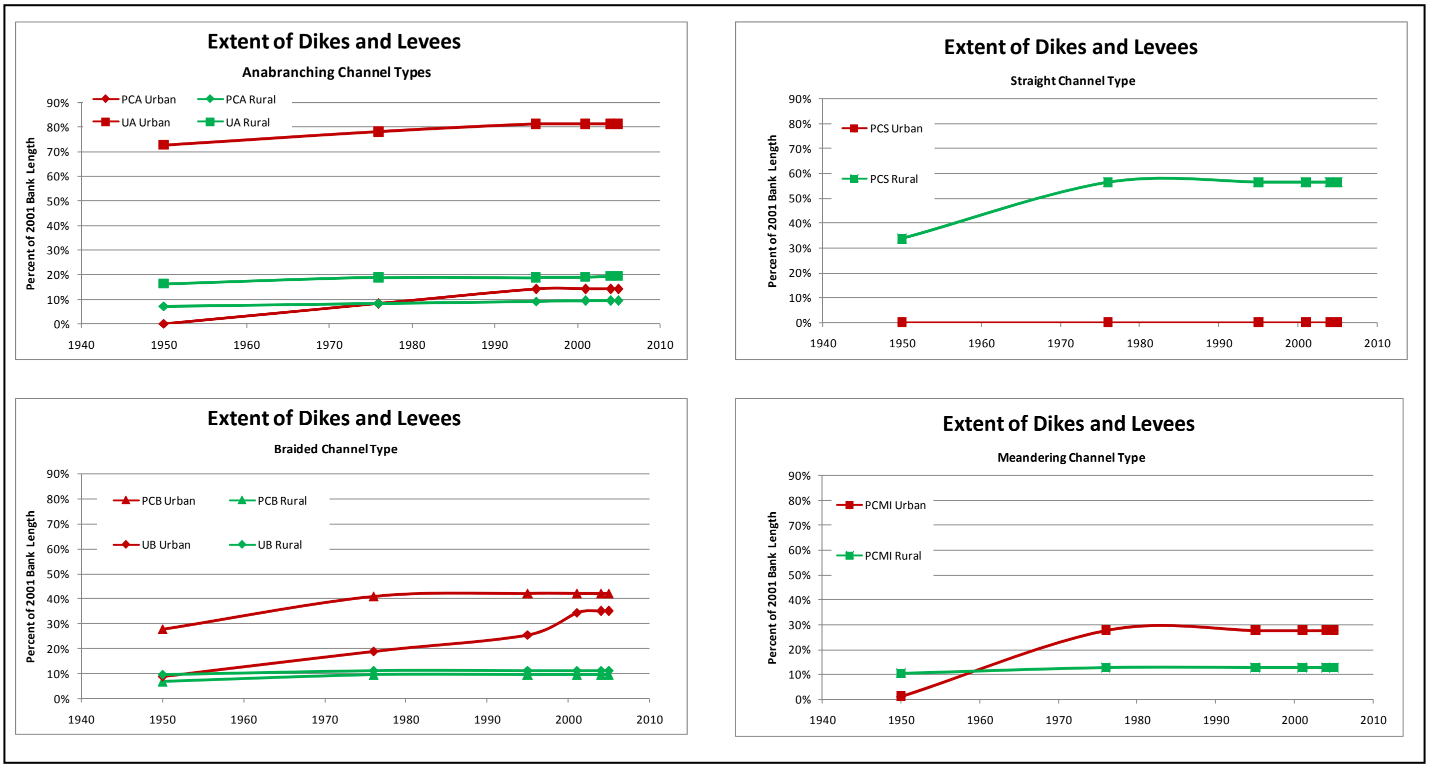

Figure 3-19. Extent of dikes and levees in rural and urban reach types.

3.4.2 Bank Armor

Bank armor extents for reaches designated as urban or rural are shown in Figure 3-20 and Figure 3-21. The results indicate that urban reaches tend to have a higher extent of bank armor than rural reaches. The primary exception to this is Reach B4 at Huntley Diversion. Also, Reach D6, which includes portions of Glendive, has relatively low armoring extents.

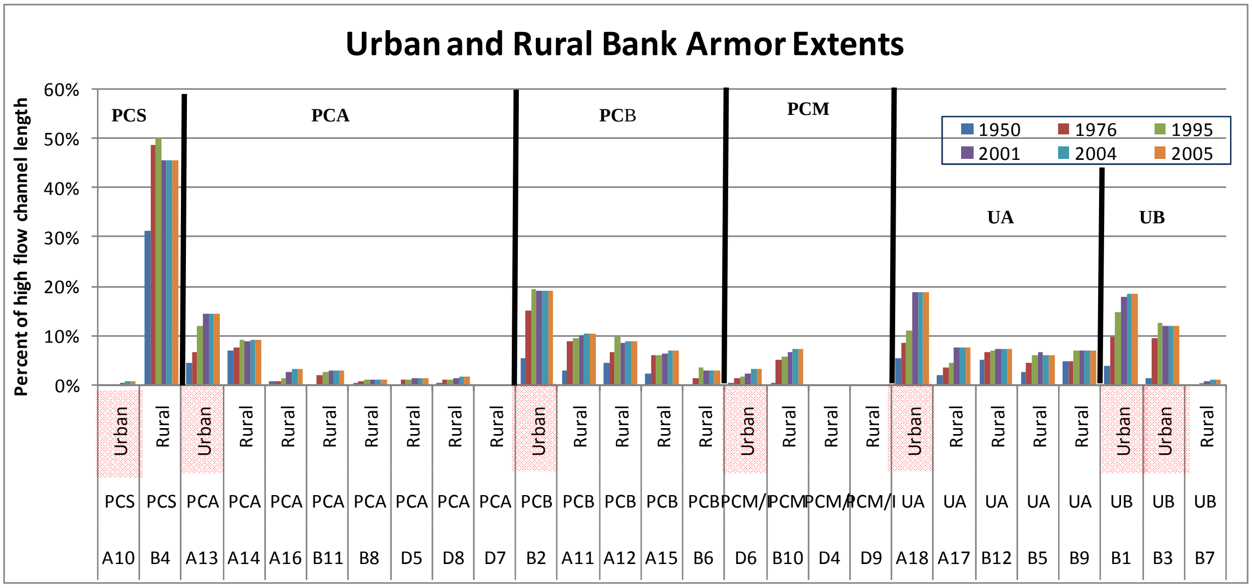

Figure 3-20. Functional bank armor extents through time for each reach sorted by reach type

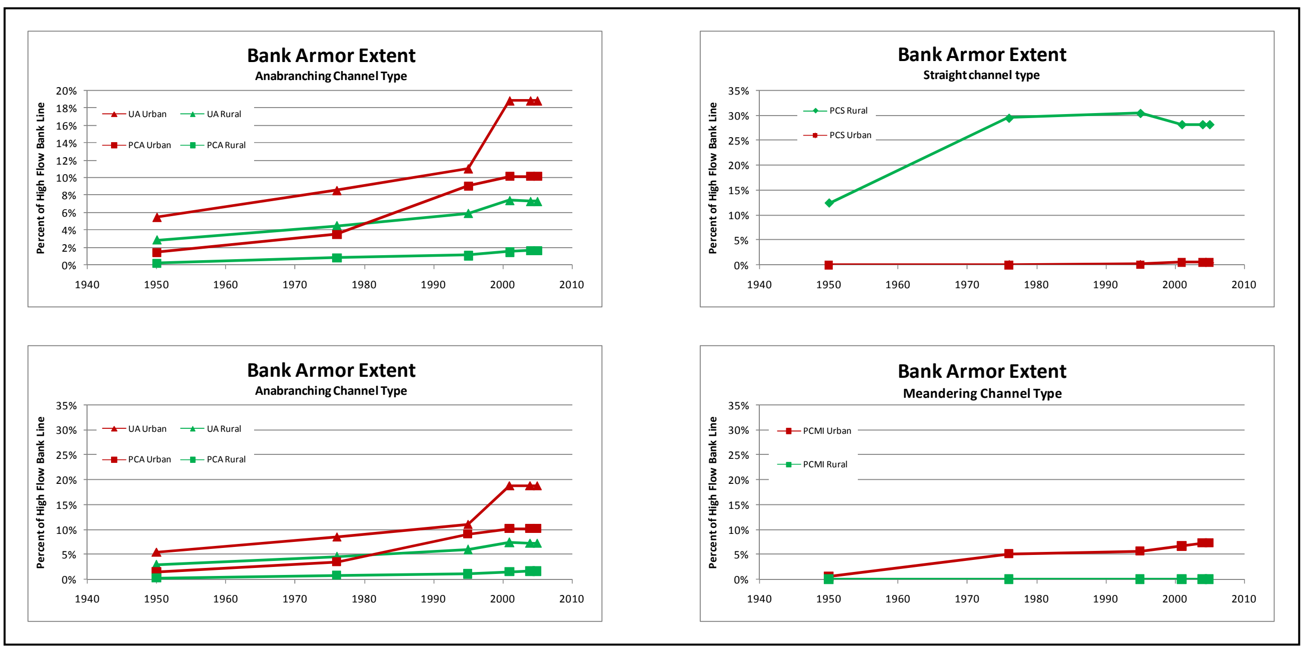

Figure 3-21. Extent of functional bank armor in rural and urban reach types.

4 Conclusions

This project focused on developing an emplacement timeline for a series of physical features located in the Yellowstone River corridor within Stillwater, Yellowstone and Dawson Counties. To address this goal, aerial photography from the 1950's, 1976-77, 1995, 2001, 2004 and 2005 were assessed for the presence and functionality of features such as bank protection, diversions, dikes and levees.

From this work, the following general conclusions can be drawn from the data.

- The single biggest factor driving bank armoring appears to be urbanization. Reaches in more developed communities tend to have higher armor extents, regardless of reach type.

- Reach B4, which is a rural reach at the Huntley Diversion, has a markedly large extent of both dike/levee features as well as bank armor. The length of active bankline in the reach is relatively low due to limited side channel extent; these data suggest that this may be a geomorphic reach type (currently Partly Confined Straight; PCS) that has been "forced" from another, more dynamic reach type.

- Braided (UB, PCB) and Unconfined Anabranching (UA) reach types in both rural and urban areas consistently show a relatively high extent of bank armoring. When normalized to the high flow bankline length present at the time of photography, the urban braided reaches show consistent increases from 1950 to 2005, from less than 5% bank armor in 1950 to over 10% in 2005. Unconfined Anabranching reach types, which are those reaches with extensive split flow around islands and little valley wall influence, all exceed 5% in total armoring; the urban UA reach evaluated (A18 at Laurel) shows 19% armor.

- Yellowstone County has shown a steady increase in the length of Dike/Levee features throughout the period of record, with the greatest increase happening between 1995 and 2001. This corresponds to a similar increase in functional bank armoring in Yellowstone County, again with the greatest increase occurring between 1995 and 2001. On average, over 5,500 feet of Dike/Levee (1,000 feet) and Bank Armor (4,500 feet) per year was added during that time period. This increase may reflect a response to the high water years of 1996 and 1997, as well as increased pressure to develop near the river.

- Stillwater and Yellowstone counties show a steady increase in total length of functional stream stabilization features from 1950 through 2001. After 2001, the rates of increase largely level off. Dawson County shows a large jump in stream stabilization features between 1950 to 1976. This is associated with the installation of the Glendive levee. A second, smaller increase is seen between 1995 and 2001.

- In Yellowstone County, thousands of feet of road, railroad, and levee features have been eclipsed by more recent features since 1950.

- Features associated with irrigation activities were largely in place by the 1950s. Yellowstone County does show a slight (2%) increase in irrigation features from 1950 to 2005.

- While there was a slight jump in the total length of transportation features for all three counties between 1950 and 1976, since that time, the totals have been stable.

The detailed mapping of physical features in Stillwater, Yellowstone and Dawson Counties showed strong correlations between the locations of physical features, their growth over time, and the types of channels they are associated with. With the exception of channel type, no additional analysis has been made using other geomorphic parameters such as braiding, sinuosity, or Reach Complexity Index (RCI). Additionally, no attempt was made to correlate the presence or absence of physical features with other data sets such as changes in Riparian Vegetation or the Restricted Migration Areas of the Channel Migration Zone work. A logical next step for this work is to look for additional relationships within these other data sets on the reach scale.

5 References

AGI and DTM, Inc., 2004. Geomorphic Reconnaissance and GIS Development, Yellowstone River, Montana: Springdale to the Missouri River Confluence: Report prepared for Custer County Conservation District, Miles City, MT., 108p.

Appendix A. Summary of Results (Normalized to 2001 Primary Channel Bank Length)

Reach	Reach Type	2001 Primary Channel Length (ft)	Feature Class	Feature Type	Functional?	Length of Feature (ft)						Percent of Bank Length (Relative to 2001 Primary Channel)					
						1950	1976	1995	2001	2004	2005	1950	1976	1995	2001	2004	2005
A10	PCS	22,534	Stream Stabilization	Car Bodies	No					175	175	0%	0%	0%	0%	0%	0%
				Rock RipRap	Yes		64	64	353	353	353	0%	0%	0%	1%	1%	1%
			Stream Stabilization Total				64	64	353	528	528	0%	0%	0%	1%	1%	1%
			Transportation Encroachment	Bridge Approach	Yes	1,778	1,763	1,763	1,940	1,940	1,940	4%	4%	4%	4%	4%	4%
				County Road	Maybe		7,323	7,323	7,323	7,323	7,323	0%	16%	16%	16%	16%	16%
					No	11,122	6,506	6,506	6,506	6,506	6,506	25%	14%	14%	14%	14%	14%
				Interstate	No		6,852	6,852	6,852	6,852	6,852	0%	15%	15%	15%	15%	15%
				Railroad	No	7,176	7,176	7,176	7,176	7,176	7,176	16%	16%	16%	16%	16%	16%
					Yes	12,715	12,715	12,715	12,715	12,715	12,715	28%	28%	28%	28%	28%	28%
			Transportation Encroachment Total			32,792	42,335	42,335	42,512	42,512	42,512	73%	94%	94%	94%	94%	94%
A11	PCB	36,818	Irrigation	Floodplain Dike/Levee	Maybe	8,086	8,086	8,086	8,086	8,086	8,086	11%	11%	11%	11%	11%	11%
					Yes	2,334	2,334	2,334	2,334	2,334	2,334	3%	3%	3%	3%	3%	3%
				In Channel Diversion	Yes			177	177	177	177	0%	0%	0%	0%	0%	0%
			Irrigation Total			10,420	10,420	10,597	10,597	10,597	10,597	14%	14%	14%	14%	14%	14%
			Other Off Channel	Floodplain Dike/Levee	Maybe	671	671	671	671	671	671	1%	1%	1%	1%	1%	1%
			Other Off Channel Total			671	671	671	671	671	671	1%	1%	1%	1%	1%	1%
			Stream Stabilization	Floodplain Dike/Levee	No		1,744	1,744	1,744	1,744	1,744	0%	2%	2%	2%	2%	2%
				Flow Deflector	Yes		262	283	283	283	283	0%	0%	0%	0%	0%	0%
				Rock RipRap	Yes	3,808	10,376	10,937	11,983	12,206	12,206	5%	14%	15%	16%	17%	17%
			Stream Stabilization Total			3,808	12,382	12,963	14,009	14,233	14,233	5%	17%	18%	19%	19%	19%
			Transportation Encroachment	Bridge Approach	No	1,605	1,605	1,605	1,605	1,605	1,605	2%	2%	2%	2%	2%	2%
					Yes	1,740	4,032	4,032	4,032	4,032	4,032	2%	5%	5%	5%	5%	5%
				County	No	10,422	10,422	10,422	10,422	10,422	10,422	14%	14%	14%	14%	14%	14%

Reach	Reach Type	2001 Primary Channel Length (ft)	Feature Class	Feature Type	Functional?	Length of Feature (ft)						Percent of Bank Length (Relative to 2001 Primary Channel)					
						1950	1976	1995	2001	2004	2005	1950	1976	1995	2001	2004	2005
				Road													
				Interstate	No		5,091	5,091	5,091	5,091	5,091	0%	7%	7%	7%	7%	7%
				Railroad	No	11,957	11,957	11,957	11,957	11,957	11,957	16%	16%	16%	16%	16%	16%
					Yes	11,429	11,429	11,429	11,429	11,429	11,429	16%	16%	16%	16%	16%	16%
			Transportation Encroachment Total			37,153	44,536	44,536	44,536	44,536	44,536	50%	60%	60%	60%	60%	60%
A12	PCB	32,166	Stream Stabilization	Flow Deflector	Yes		1,697	1,697	1,734	2,093	2,093	0%	3%	3%	3%	3%	3%
				Rock RipRap	No	3,309	3,309	3,309	3,309	3,309	3,309	5%	5%	5%	5%	5%	5%
					Yes	1,731	2,555	4,636	4,794	4,794	4,794	3%	4%	7%	7%	7%	7%
			Stream Stabilization Total			5,040	7,561	9,642	9,837	10,196	10,196	8%	12%	15%	15%	16%	16%
			Transportation Encroachment	County Road	No	2,487	2,487	2,487	2,487	2,487	2,487	4%	4%	4%	4%	4%	4%
				Railroad	No	8,100	8,100	8,100	8,100	8,100	8,100	13%	13%	13%	13%	13%	13%
			Transportation Encroachment Total			10,587	10,587	10,587	10,587	10,587	10,587	16%	16%	16%	16%	16%	16%
A13	PCA	18,980	Other	Floodplain Dike/Levee	Yes		2,395	4,675	4,675	4,675	4,675	0%	6%	12%	12%	12%	12%
			Other Total				2,395	4,675	4,675	4,675	4,675	0%	6%	12%	12%	12%	12%
			Other Off Channel	Floodplain Dike/Levee	Maybe		666	666	666	666	666	0%	2%	2%	2%	2%	2%
			Other Off Channel Total				666	666	666	666	666	0%	2%	2%	2%	2%	2%
			Stream Stabilization	Concrete RipRap	Yes			2,822	2,822	2,822	2,822	0%	0%	7%	7%	7%	7%
				Rock RipRap	No	2,340	2,340	2,340	3,259	3,259	3,259	6%	6%	6%	9%	9%	9%
					Yes	1,066	2,652	4,294	4,929	4,929	4,929	3%	7%	11%	13%	13%	13%
			Stream Stabilization Total			3,406	4,993	9,457	11,010	11,010	11,010	9%	13%	25%	29%	29%	29%
			Transportation Encroachment	Bridge Approach	No	1,024	1,295	1,295	1,295	1,295	1,295	3%	3%	3%	3%	3%	3%
					Yes	1,951	454	454	454	454	454	5%	1%	1%	1%	1%	1%
				County Road	No	3,834	1,347	1,347	1,347	1,347	1,347	10%	4%	4%	4%	4%	4%
					Yes	4,097	4,409	4,409	4,409	4,409	4,409	11%	12%	12%	12%	12%	12%
				Railroad	No	4,600	4,600	4,600	5,126	5,126	5,126	12%	12%	12%	14%	14%	14%
					Yes	1,527	1,527	1,527	1,001	1,001	1,001	4%	4%	4%	3%	3%	3%

Reach	Reach Type	2001 Primary Channel Length (ft)	Feature Class	Feature Type	Functional?	Length of Feature (ft)						Percent of Bank Length (Relative to 2001 Primary Channel)					
						1950	1976	1995	2001	2004	2005	1950	1976	1995	2001	2004	2005
			Transportation Encroachment Total			17,032	13,632	13,632	13,632	13,632	13,632	45%	36%	36%	36%	36%	36%
A14	PCA	41,087	Irrigation	Floodplain Dike/Levee	No	6,820	6,820	6,820	6,820	6,820	6,820	8%	8%	8%	8%	8%	8%
				In Channel Diversion	Yes		207	207	207	207	207	0%	0%	0%	0%	0%	0%
			Irrigation Total			6,820	7,027	7,027	7,027	7,027	7,027	8%	9%	9%	9%	9%	9%
			Other Off Channel	Floodplain Dike/Levee	Maybe	1,132	1,132	1,132	1,132	1,132	1,132	1%	1%	1%	1%	1%	1%
					No	1,444	1,444	1,444	1,444	1,444	1,444	2%	2%	2%	2%	2%	2%
					Yes				290	290	290	0%	0%	0%	0%	0%	0%
			Other Off Channel Total			2,576	2,576	2,576	2,866	2,866	2,866	3%	3%	3%	3%	3%	3%
			Stream Stabilization	Floodplain Dike/Levee	Yes		258	258	471	471	471	0%	0%	0%	1%	1%	1%
				Flow Deflector	Yes		185	185	185	400	400	0%	0%	0%	0%	0%	0%
				Rock RipRap	No	12,989	12,989	12,989	12,989	12,989	12,989	16%	16%	16%	16%	16%	16%
					Yes	567	567	1,168	1,168	1,168	1,168	1%	1%	1%	1%	1%	1%
			Stream Stabilization Total			13,555	13,998	14,599	14,813	15,028	15,028	16%	17%	18%	18%	18%	18%
			Transportation Encroachment	County Road	No	556	556	556	556	556	556	1%	1%	1%	1%	1%	1%
					Yes	1,173	1,173	1,173	1,173	1,173	1,173	1%	1%	1%	1%	1%	1%
				Other	Maybe	542	542	542	542	542	542	1%	1%	1%	1%	1%	1%
					Yes	10,358	10,358	10,358	10,358	10,358	10,358	13%	13%	13%	13%	13%	13%
				Railroad	No	6,329	6,329	6,329	6,329	6,329	6,329	8%	8%	8%	8%	8%	8%
					Yes	4,052	4,052	4,052	4,052	4,052	4,052	5%	5%	5%	5%	5%	5%
			Transportation Encroachment Total			23,010	23,010	23,010	23,010	23,010	23,010	28%	28%	28%	28%	28%	28%
A15	PCB	31,077	Irrigation	Floodplain Dike/Levee	Yes	5,561	6,313	6,313	6,313	6,313	6,313	9%	10%	10%	10%	10%	10%
				In Channel Diversion	Yes	473	473	473	642	642	642	1%	1%	1%	1%	1%	1%
			Irrigation Total			6,035	6,786	6,786	6,955	6,955	6,955	10%	11%	11%	11%	11%	11%
			Other Off Channel	Floodplain Dike/Levee	No		1,549	1,549	1,549	1,549	1,549	0%	2%	2%	2%	2%	2%
					Yes		2,377	2,377	2,377	2,377	2,377	0%	4%	4%	4%	4%	4%

Reach	Reach Type	2001 Primary Channel Length (ft)	Feature Class	Feature Type	Functional?	Length of Feature (ft)						Percent of Bank Length (Relative to 2001 Primary Channel)					
						1950	1976	1995	2001	2004	2005	1950	1976	1995	2001	2004	2005
			Other Off Channel Total				3,926	3,926	3,926	3,926	3,926	0%	6%	6%	6%	6%	6%
			Stream Stabilization	Concrete RipRap	Yes	449	449	449	449	449	449	1%	1%	1%	1%	1%	1%
				Floodplain Dike/Levee	Yes	1,287	1,833	1,833	1,833	1,833	1,833	2%	3%	3%	3%	3%	3%
				Rock RipRap	Yes	2,363	5,630	6,605	6,605	7,003	7,003	4%	9%	11%	11%	11%	11%
			Stream Stabilization Total			4,099	7,911	8,887	8,887	9,285	9,285	7%	13%	14%	14%	15%	15%
			Transportation Encroachment	Railroad	No	1,031	1,031	1,031	1,031	1,031	1,031	2%	2%	2%	2%	2%	2%
			Transportation Encroachment Total			1,031	1,031	1,031	1,031	1,031	1,031	2%	2%	2%	2%	2%	2%
A16	PCA	40,532	Irrigation	Floodplain Dike/Levee	Maybe	6,265	6,265	6,265	6,265	6,265	6,265	8%	8%	8%	8%	8%	8%
					No	8,940	8,940	9,515	9,515	9,515	9,515	11%	11%	12%	12%	12%	12%
					Yes	6,981	6,981	6,407	6,407	6,407	6,407	9%	9%	8%	8%	8%	8%
			Irrigation Total			22,187	22,187	22,187	22,187	22,187	22,187	27%	27%	27%	27%	27%	27%
			Stream Stabilization	Car Bodies	Yes	79	79	112	112	112	112	0%	0%	0%	0%	0%	0%
				Concrete RipRap	Yes			262	262	262	262	0%	0%	0%	0%	0%	0%
				Rock RipRap	Yes	1,441	1,441	1,976	5,043	5,949	5,949	2%	2%	2%	6%	7%	7%
			Stream Stabilization Total			1,521	1,521	2,350	5,418	6,324	6,324	2%	2%	3%	7%	8%	8%
			Transportation Encroachment	Other	Maybe	636	636	636	636	636	636	1%	1%	1%	1%	1%	1%
					No	1,033	1,033	1,033	1,033	1,033	1,033	1%	1%	1%	1%	1%	1%
				Railroad	Yes	4,239	4,239	4,239	4,239	4,239	4,239	5%	5%	5%	5%	5%	5%
			Transportation Encroachment Total			5,908	5,908	5,908	5,908	5,908	5,908	7%	7%	7%	7%	7%	7%
A17	UA	34,137	Irrigation	Floodplain Dike/Levee	Maybe	659	659	659	659	659	659	1%	1%	1%	1%	1%	1%
					No	15,553	16,237	16,237	17,509	18,272	18,272	23%	24%	24%	26%	27%	27%
					Yes	15,941	15,941	15,941	15,037	15,034	15,034	23%	23%	23%	22%	22%	22%
			Irrigation Total			32,154	32,838	32,838	33,205	33,965	33,965	47%	48%	48%	49%	50%	50%
			Other	Floodplain Dike/Levee	No		2,677	2,677	2,677	2,677	2,677	0%	4%	4%	4%	4%	4%
			Other Total				2,677	2,677	2,677	2,677	2,677	0%	4%	4%	4%	4%	4%

Reach	Reach Type	2001 Primary Channel Length (ft)	Feature Class	Feature Type	Functional?	Length of Feature (ft)						Percent of Bank Length (Relative to 2001 Primary Channel)					
						1950	1976	1995	2001	2004	2005	1950	1976	1995	2001	2004	2005
			Other Off Channel	Floodplain Dike/Levee	No	361	576	576	576	576	576	1%	1%	1%	1%	1%	1%
				Other	No	2,200	2,200	2,200	2,200	2,200	2,200	3%	3%	3%	3%	3%	3%
			Other Off Channel Total			2,562	2,776	2,776	2,776	2,776	2,776	4%	4%	4%	4%	4%	4%
			Stream Stabilization	Concrete RipRap	Yes	366	988	988	3,055	3,645	3,645	1%	1%	1%	4%	5%	5%
				Floodplain Dike/Levee	Yes				412	412	412	0%	0%	0%	1%	1%	1%
				Flow Deflector	Yes				812	812	812	0%	0%	0%	1%	1%	1%
				Rock RipRap	No		344					0%	1%	0%	0%	0%	0%
					Yes	272	3,348	3,886	4,200	4,200	4,200	0%	5%	6%	6%	6%	6%
			Stream Stabilization Total			638	4,681	4,875	8,478	9,068	9,068	1%	7%	7%	12%	13%	13%
			Transportation Encroachment	Bridge Approach	Maybe	2,161	2,161	2,161	2,161	2,161	2,161	3%	3%	3%	3%	3%	3%
					Yes	1,834	1,834	1,834	1,834	1,834	1,834	3%	3%	3%	3%	3%	3%
				Other	Maybe	978	978	978	978	978	978	1%	1%	1%	1%	1%	1%
					No	4,483	4,483	4,483	4,483	4,483	4,483	7%	7%	7%	7%	7%	7%
			Transportation Encroachment Total			9,455	9,455	9,455	9,455	9,455	9,455	14%	14%	14%	14%	14%	14%
A18	UA	12,433	Irrigation	Floodplain Dike/Levee	No	11,762	11,762	12,709	15,559	15,559	15,559	47%	47%	51%	63%	63%	63%
					Yes	6,316	7,649	7,462	4,612	4,612	4,612	25%	31%	30%	19%	19%	19%
			Irrigation Total			18,079	19,411	20,171	20,171	20,171	20,171	73%	78%	81%	81%	81%	81%
			Stream Stabilization	Car Bodies	Yes			569	569	569	569	0%	0%	2%	2%	2%	2%
				Concrete RipRap	Yes	2,825	2,825	2,825	4,648	4,648	4,648	11%	11%	11%	19%	19%	19%
				Flow Deflector	Yes				1,467	1,467	1,467	0%	0%	0%	6%	6%	6%
				Rock RipRap	Yes	121	2,374	2,374	3,576	3,576	3,576	0%	10%	10%	14%	14%	14%
			Stream Stabilization Total			2,946	5,199	5,769	10,260	10,260	10,260	12%	21%	23%	41%	41%	41%
			Transportation Encroachment	Bridge Approach	Yes	1,153	1,153	1,153	1,153	1,153	1,153	5%	5%	5%	5%	5%	5%
				County Road	Maybe	1,438	1,438	1,438	1,438	1,438	1,438	6%	6%	6%	6%	6%	6%
					No	4,749	8,672	8,672	9,414	9,414	9,414	19%	35%	35%	38%	38%	38%
					Yes	5,126	3,083	3,083	2,340	2,340	2,340	21%	12%	12%	9%	9%	9%

Reach	Reach Type	2001 Primary Channel Length (ft)	Feature Class	Feature Type	Functional?	Length of Feature (ft)						Percent of Bank Length (Relative to 2001 Primary Channel)					
						1950	1976	1995	2001	2004	2005	1950	1976	1995	2001	2004	2005
				Other	No	912	912	912	912	912	912	4%	4%	4%	4%	4%	4%
			Transportation Encroachment Total			13,377	15,257	15,257	15,257	15,257	15,257	54%	61%	61%	61%	61%	61%
B1	UB	80,555	Irrigation	Floodplain Dike/Levee	Maybe		1,851	1,851	1,851	1,851	1,851	0%	1%	1%	1%	1%	1%
					No	103	103	103	103	434	434	0%	0%	0%	0%	0%	0%
			Irrigation Total			103	1,954	1,954	1,954	2,284	2,284	0%	1%	1%	1%	1%	1%
			Other	Floodplain Dike/Levee	Yes			1,210	1,210	1,210	1,210	0%	0%	1%	1%	1%	1%
			Other Total					1,210	1,210	1,210	1,210	0%	0%	1%	1%	1%	1%
			Other Off Channel	Floodplain Dike/Levee	No	4,058	4,716	4,716	12,890	12,890	12,890	3%	3%	3%	8%	8%	8%
					Yes		3,184	2,655	6,776	6,776	6,776	0%	2%	2%	4%	4%	4%
			Other Off Channel Total			4,058	7,900	7,370	19,666	19,666	19,666	3%	5%	5%	12%	12%	12%
			Stream Stabilization	Car Bodies	Yes	341	1,039	1,180	1,180	1,180	1,180	0%	1%	1%	1%	1%	1%
				Concrete RipRap	No			447	447	447	447	0%	0%	0%	0%	0%	0%
					Yes	5,569	16,943	25,463	30,809	31,097	31,097	3%	11%	16%	19%	19%	19%
				Floodplain Dike/Levee	No			3,937	3,937	4,822	4,822	0%	0%	2%	2%	3%	3%
					Yes		5,137	8,399	14,324	14,520	14,520	0%	3%	5%	9%	9%	9%
				Flow Deflector	Yes	1,589	914	914	6,024	6,024	6,024	1%	1%	1%	4%	4%	4%
				Rock RipRap	No		2,491	2,491	2,491	3,560	3,560	0%	2%	2%	2%	2%	2%
					Yes	7,373	15,707	16,844	17,341	18,724	18,724	5%	10%	10%	11%	12%	12%
			Stream Stabilization Total			14,872	42,231	59,675	76,554	80,375	80,375	9%	26%	37%	48%	50%	50%
			Transportation Encroachment	Bridge Approach	Yes	3,230	5,909	5,909	5,909	5,909	5,909	2%	4%	4%	4%	4%	4%
				County Road	Maybe	5,263	5,263	5,263	5,263	5,263	5,263	3%	3%	3%	3%	3%	3%
					No	2,306	9,695	9,883	9,883	9,883	9,883	1%	6%	6%	6%	6%	6%
					Yes	2,223	2,223	669	669	669	669	1%	1%	0%	0%	0%	0%
				Interstate	No		7,583	7,583	7,583	7,583	7,583	0%	5%	5%	5%	5%	5%
				Other	Maybe	8,144	8,144	5,456	5,456	5,456	5,456	5%	5%	3%	3%	3%	3%
					No	3,224	6,258	9,625	9,839	9,839	9,839	2%	4%	6%	6%	6%	6%
			Transportation Encroachment Total			24,390	45,075	44,387	44,601	44,601	44,601	15%	28%	28%	28%	28%	28%

Reach	Reach Type	2001 Primary Channel Length (ft)	Feature Class	Feature Type	Functional?	Length of Feature (ft)						Percent of Bank Length (Relative to 2001 Primary Channel)					
						1950	1976	1995	2001	2004	2005	1950	1976	1995	2001	2004	2005
B2	PCB	32,233	Irrigation	Floodplain Dike/Levee	No	2,155	5,400	5,400	5,400	5,400	5,400	3%	8%	8%	8%	8%	8%
					Yes	3,246						5%	0%	0%	0%	0%	0%
			Irrigation Total			5,400	5,400	5,400	5,400	5,400	5,400	8%	8%	8%	8%	8%	8%
			Other	Floodplain Dike/Levee	No	9,922	15,009	15,009	15,009	15,009	15,009	15%	23%	23%	23%	23%	23%
					Yes	2,513	2,513	2,513	2,513	2,513	2,513	4%	4%	4%	4%	4%	4%
			Other Total			12,435	17,523	17,523	17,523	17,523	17,523	19%	27%	27%	27%	27%	27%
			Other Off Channel	Floodplain Dike/Levee	No			757	757	757	757	0%	0%	1%	1%	1%	1%
			Other Off Channel Total					757	757	757	757	0%	0%	1%	1%	1%	1%
			Stream Stabilization	Concrete RipRap	No			292	292	292	292	0%	0%	0%	0%	0%	0%
					Yes	5,062	15,933	17,713	17,713	17,713	17,713	8%	25%	27%	27%	27%	27%
				Floodplain Dike/Levee	No		1,136	1,136	1,136	1,136	1,136	0%	2%	2%	2%	2%	2%
					Yes		2,331	2,331	2,331	2,331	2,331	0%	4%	4%	4%	4%	4%
				Rock RipRap	Yes	1,100	2,973	3,758	3,758	3,758	3,758	2%	5%	6%	6%	6%	6%
				Steel Retaining Wall	Yes	275	275	275	275	275	275	0%	0%	0%	0%	0%	0%
			Stream Stabilization Total			6,437	22,650	25,506	25,506	25,506	25,506	10%	35%	40%	40%	40%	40%
			Transportation Encroachment	County Road	Maybe	3,001	3,001	1,864	1,864	1,864	1,864	5%	5%	3%	3%	3%	3%
					No	286	4,362	5,498	5,498	5,498	5,498	0%	7%	9%	9%	9%	9%
					Yes	2,814	1,541	1,541	1,541	1,541	1,541	4%	2%	2%	2%	2%	2%
				Interstate	No		9,768	9,768	9,768	9,768	9,768	0%	15%	15%	15%	15%	15%
					Yes		610	610	610	610	610	0%	1%	1%	1%	1%	1%
				Other	Maybe	1,735	1,735	1,735	1,735	1,735	1,735	3%	3%	3%	3%	3%	3%
					No	1,587	2,225	126	126	126	126	2%	3%	0%	0%	0%	0%
				Railroad	Yes	1,491	1,491	1,491	1,491	1,491	1,491	2%	2%	2%	2%	2%	2%
			Transportation Encroachment Total			10,913	24,732	22,633	22,633	22,633	22,633	17%	38%	35%	35%	35%	35%
B3	UB	23,124	Irrigation	Floodplain Dike/Levee	No	5,877	5,877	5,877	5,877	5,877	5,877	13%	13%	13%	13%	13%	13%
					Yes	911	1,125	1,125	1,125	1,125	1,125	2%	2%	2%	2%	2%	2%
			Irrigation Total			6,788	7,002	7,002	7,002	7,002	7,002	15%	15%	15%	15%	15%	15%

Reach	Reach Type	2001 Primary Channel Length (ft)	Feature Class	Feature Type	Functional?	Length of Feature (ft)						Percent of Bank Length (Relative to 2001 Primary Channel)					
						1950	1976	1995	2001	2004	2005	1950	1976	1995	2001	2004	2005
			Other	Floodplain Dike/Levee	No	6,991	6,991	7,446	7,446	7,446	7,446	15%	15%	16%	16%	16%	16%
					Yes	455	455					1%	1%	0%	0%	0%	0%
			Other Total			7,446	7,446	7,446	7,446	7,446	7,446	16%	16%	16%	16%	16%	16%
			Other Off Channel	Floodplain Dike/Levee	Maybe		3,354	3,354	3,354	3,354	3,354	0%	7%	7%	7%	7%	7%
					No	155	3,671	3,769	3,769	3,769	3,769	0%	8%	8%	8%	8%	8%
					Yes			1,887	1,887	1,887	1,887	0%	0%	4%	4%	4%	4%
			Other Off Channel Total			155	7,025	9,010	9,010	9,010	9,010	0%	15%	19%	19%	19%	19%
			Stream Stabilization	Concrete RipRap	Yes			592	592	592	592	0%	0%	1%	1%	1%	1%
				Floodplain Dike/Levee	No		1,373	3,658	3,658	3,658	3,658	0%	3%	8%	8%	8%	8%
					Yes		1,493	2,836	2,836	2,836	2,836	0%	3%	6%	6%	6%	6%
				Flow Deflector	Yes		3,244	3,244	3,244	3,244	3,244	0%	7%	7%	7%	7%	7%
				Rock RipRap	No	841	841	841	841	841	841	2%	2%	2%	2%	2%	2%
					Yes	913	5,438	9,335	9,335	9,335	9,335	2%	12%	20%	20%	20%	20%
			Stream Stabilization Total			1,755	12,390	20,506	20,506	20,506	20,506	4%	27%	44%	44%	44%	44%
			Transportation Encroachment	County Road	No	5,505	5,505	5,505	5,505	5,505	5,505	12%	12%	12%	12%	12%	12%
				Other	Maybe					2,012	2,012	0%	0%	0%	0%	4%	4%
					No	303	303	303	3,060	3,060	3,060	1%	1%	1%	7%	7%	7%
				Railroad	No	3,943	3,943	3,943	3,943	3,943	3,943	9%	9%	9%	9%	9%	9%
					Yes	1,206	1,206	1,206	1,206	1,206	1,206	3%	3%	3%	3%	3%	3%
			Transportation Encroachment Total			10,957	10,957	10,957	13,714	15,726	15,726	24%	24%	24%	30%	34%	34%
B4	PCS	19,897	Irrigation	Floodplain Dike/Levee	Maybe	6,781	6,781	6,781	6,781	6,781	6,781	17%	17%	17%	17%	17%	17%
					No	6,594	6,594	6,594	6,594	6,594	6,594	17%	17%	17%	17%	17%	17%
				In Channel Diversion	Yes	237	474	237	237	237	237	1%	1%	1%	1%	1%	1%
			Irrigation Total			13,612	13,849	13,612	13,612	13,612	13,612	34%	35%	34%	34%	34%	34%
			Other Off Channel	Floodplain Dike/Levee	No		4,300	4,300	4,300	4,300	4,300	0%	11%	11%	11%	11%	11%

Reach	Reach Type	2001 Primary Channel Length (ft)	Feature Class	Feature Type	Functional?	Length of Feature (ft)						Percent of Bank Length (Relative to 2001 Primary Channel)					
						1950	1976	1995	2001	2004	2005	1950	1976	1995	2001	2004	2005
			Other Off Channel Total				4,300	4,300	4,300	4,300	4,300	0%	11%	11%	11%	11%	11%
			Stream Stabilization	Concrete RipRap	Yes		6,452	6,452	6,960	6,960	6,960	0%	16%	16%	17%	17%	17%
				Floodplain Dike/Levee	No		3,818	3,818	3,818	3,818	3,818	0%	10%	10%	10%	10%	10%
					Yes		887	887	887	887	887	0%	2%	2%	2%	2%	2%
				Flow Deflector	Yes		3,241	3,241	3,241	3,241	3,241	0%	8%	8%	8%	8%	8%
				Rock RipRap	No	10,926	10,926	10,926	10,926	10,926	10,926	27%	27%	27%	27%	27%	27%
					Yes	7,241	7,241	7,241	7,481	7,481	7,481	18%	18%	18%	19%	19%	19%
			Stream Stabilization Total			18,166	32,564	32,564	33,312	33,312	33,312	46%	82%	82%	84%	84%	84%
			Transportation Encroachment	Other	No	619	619	619	619	619	619	2%	2%	2%	2%	2%	2%
				Railroad	No	13,543	13,543	13,543	13,543	13,543	13,543	34%	34%	34%	34%	34%	34%
			Transportation Encroachment Total			14,162	14,162	14,162	14,162	14,162	14,162	36%	36%	36%	36%	36%	36%
B5	UA	39,214	Irrigation	Floodplain Dike/Levee	No	1,736	1,736	1,736	1,736	1,736	1,736	2%	2%	2%	2%	2%	2%
			Irrigation Total			1,736	1,736	1,736	1,736	1,736	1,736	2%	2%	2%	2%	2%	2%
			Other Off Channel	Floodplain Dike/Levee	Maybe	449	449	449	449	449	449	1%	1%	1%	1%	1%	1%
			Other Off Channel Total			449	449	449	449	449	449	1%	1%	1%	1%	1%	1%
			Stream Stabilization	Concrete RipRap	Yes	2,429	5,218	8,316	9,344	9,344	9,344	3%	7%	11%	12%	12%	12%
				Floodplain Dike/Levee	No		1,361	1,361	1,361	1,361	1,361	0%	2%	2%	2%	2%	2%
					Yes		1,082	1,082	1,082	1,082	1,082	0%	1%	1%	1%	1%	1%
				Flow Deflector	Yes		645	645	2,736	1,391	1,391	0%	1%	1%	3%	2%	2%
				Rock RipRap	No	376	376	376	376	376	376	0%	0%	0%	0%	0%	0%
					Yes	2,046	2,218	2,218	2,218	2,218	2,218	3%	3%	3%	3%	3%	3%
			Stream Stabilization Total			4,851	10,900	13,999	17,117	15,772	15,772	6%	14%	18%	22%	20%	20%
			Transportation Encroachment	Bridge Approach	No	2,130	2,130	2,130	2,130	2,130	2,130	3%	3%	3%	3%	3%	3%
					Yes	366	366	366	366	366	366	0%	0%	0%	0%	0%	0%
				County Road	No	2,565	2,565	2,565	2,565	2,565	2,565	3%	3%	3%	3%	3%	3%
				Other	No	114	114	209	209	318	318	0%	0%	0%	0%	0%	0%
				Railroad	No	1,238	1,238	1,238	1,238	1,238	1,238	2%	2%	2%	2%	2%	2%

Reach	Reach Type	2001 Primary Channel Length (ft)	Feature Class	Feature Type	Functional?	Length of Feature (ft)						Percent of Bank Length (Relative to 2001 Primary Channel)					
						1950	1976	1995	2001	2004	2005	1950	1976	1995	2001	2004	2005
			Transportation Encroachment Total			6,412	6,412	6,507	6,507	6,617	6,617	8%	8%	8%	8%	8%	8%
B6	PCB	32,409	Irrigation	Floodplain Dike/Levee	Maybe		557	887	887	887	887	0%	1%	1%	1%	1%	1%
					No	11,978	11,978	11,978	11,978	11,978	11,978	18%	18%	18%	18%	18%	18%
			Irrigation Total			11,978	12,535	12,865	12,865	12,865	12,865	18%	19%	20%	20%	20%	20%
			Stream Stabilization	Car Bodies	Yes		1,702	1,702	1,702	1,702	1,702	0%	3%	3%	3%	3%	3%
				Concrete RipRap	Yes			2,981	2,981	2,981	2,981	0%	0%	5%	5%	5%	5%
			Stream Stabilization Total				1,702	4,683	4,683	4,683	4,683	0%	3%	7%	7%	7%	7%
			Transportation Encroachment	County Road	No	2,860	2,860	2,860	2,860	2,860	2,860	4%	4%	4%	4%	4%	4%
					Yes	895	895	895	895	895	895	1%	1%	1%	1%	1%	1%
			Transportation Encroachment Total			3,755	3,755	3,755	3,755	3,755	3,755	6%	6%	6%	6%	6%	6%
B7	UB	45,770	Irrigation	Floodplain Dike/Levee	No	4,483	4,483	4,483	4,483	4,483	4,483	5%	5%	5%	5%	5%	5%
					Yes	3,004	3,004	3,004	3,004	3,004	3,004	3%	3%	3%	3%	3%	3%
			Irrigation Total			7,487	7,487	7,487	7,487	7,487	7,487	8%	8%	8%	8%	8%	8%
			Other Off Channel	Floodplain Dike/Levee	Yes	1,296	2,794	2,794	2,794	2,794	2,794	1%	3%	3%	3%	3%	3%
			Other Off Channel Total			1,296	2,794	2,794	2,794	2,794	2,794	1%	3%	3%	3%	3%	3%
			Stream Stabilization	Concrete RipRap	Yes			428	1,147	1,619	1,619	0%	0%	0%	1%	2%	2%
				Rock RipRap	Yes	240	240	511	692	692	692	0%	0%	1%	1%	1%	1%
			Stream Stabilization Total			240	240	939	1,839	2,311	2,311	0%	0%	1%	2%	3%	3%
			Transportation Encroachment	Bridge Approach	No	714	714	714	1,115	1,115	1,115	1%	1%	1%	1%	1%	1%
					Yes	2,017	2,017	2,017	2,949	2,949	2,949	2%	2%	2%	3%	3%	3%
				County Road	No	2,068	2,068	2,068	2,068	2,068	2,068	2%	2%	2%	2%	2%	2%
				Other	No	685	685	685	685	685	685	1%	1%	1%	1%	1%	1%
			Transportation Encroachment Total			5,485	5,485	5,485	6,818	6,818	6,818	6%	6%	6%	7%	7%	7%
B8	PCA	48,159	Irrigation	Floodplain Dike/Levee	Yes		1,314	1,314	1,314	1,314	1,314	0%	1%	1%	1%	1%	1%
			Irrigation Total				1,314	1,314	1,314	1,314	1,314	0%	1%	1%	1%	1%	1%

Reach	Reach Type	2001 Primary Channel Length (ft)	Feature Class	Feature Type	Functional?	Length of Feature (ft)						Percent of Bank Length (Relative to 2001 Primary Channel)					
						1950	1976	1995	2001	2004	2005	1950	1976	1995	2001	2004	2005
			Other Off Channel	Floodplain Dike/Levee	Maybe			2,190	2,190	2,190	2,190	0%	0%	2%	2%	2%	2%
			Other Off Channel Total					2,190	2,190	2,190	2,190	0%	0%	2%	2%	2%	2%
			Stream Stabilization	Flow Deflector	Yes			199	199	199	199	0%	0%	0%	0%	0%	0%
				Rock RipRap	No		479	479	479	479	479	0%	0%	0%	0%	0%	0%
					Yes	1,010	1,010	2,360	2,360	2,360	2,360	1%	1%	2%	2%	2%	2%
			Stream Stabilization Total			1,010	1,489	3,038	3,038	3,038	3,038	1%	2%	3%	3%	3%	3%
			Transportation Encroachment	Interstate	No		11,402	11,402	11,402	11,402	11,402	0%	12%	12%	12%	12%	12%
				Railroad	No	5,836	5,836	7,187	7,187	7,187	7,187	6%	6%	7%	7%	7%	7%
					Yes	11,433	11,433	10,081	10,081	10,081	10,081	12%	12%	10%	10%	10%	10%
			Transportation Encroachment Total			17,269	28,670	28,670	28,670	28,670	28,670	18%	30%	30%	30%	30%	30%
B9	UA	24,510	Irrigation	Floodplain Dike/Levee	Maybe	2,233	2,233	2,233	2,233	2,233	2,233	5%	5%	5%	5%	5%	5%
				In Channel Diversion	Yes	198	198	198	198	198	198	0%	0%	0%	0%	0%	0%
			Irrigation Total			2,431	2,431	2,431	2,431	2,431	2,431	5%	5%	5%	5%	5%	5%
			Other	Floodplain Dike/Levee	No			173	173	173	173	0%	0%	0%	0%	0%	0%
					Yes		173					0%	0%	0%	0%	0%	0%
			Other Total				173	173	173	173	173	0%	0%	0%	0%	0%	0%
			Other Off Channel	Floodplain Dike/Levee	Yes	1,545	1,545	1,545	1,545	1,545	1,545	3%	3%	3%	3%	3%	3%
			Other Off Channel Total			1,545	1,545	1,545	1,545	1,545	1,545	3%	3%	3%	3%	3%	3%
			Stream Stabilization	Rock RipRap	No	2,701	2,701	2,701	2,701	2,701	2,701	6%	6%	6%	6%	6%	6%
					Yes	3,634	3,747	5,528	6,190	6,190	6,190	7%	8%	11%	13%	13%	13%
			Stream Stabilization Total			6,336	6,448	8,229	8,891	8,891	8,891	13%	13%	17%	18%	18%	18%
			Transportation Encroachment	County Road	No	6,980	6,980	6,980	6,980	6,980	6,980	14%	14%	14%	14%	14%	14%
				Interstate	No		1,745	1,745	1,745	1,745	1,745	0%	4%	4%	4%	4%	4%
				Railroad	No	8,083	8,083	8,083	8,083	8,083	8,083	16%	16%	16%	16%	16%	16%
					Yes	6,011	6,011	6,011	6,011	6,011	6,011	12%	12%	12%	12%	12%	12%

Reach	Reach Type	2001 Primary Channel Length (ft)	Feature Class	Feature Type	Functional?	Length of Feature (ft)						Percent of Bank Length (Relative to 2001 Primary Channel)					
						1950	1976	1995	2001	2004	2005	1950	1976	1995	2001	2004	2005
			Transportation Encroachment Total			21,074	22,819	22,819	22,819	22,819	22,819	43%	47%	47%	47%	47%	47%
B10	PCM	38,094	Stream Stabilization	Concrete RipRap	Yes			255	255	255	255	0%	0%	0%	0%	0%	0%
				Flow Deflector	Yes				742	2,131	2,131	0%	0%	0%	1%	3%	3%
				Rock RipRap	Yes	1,048	1,956	2,172	2,172	2,172	2,172	1%	3%	3%	3%	3%	3%
			Stream Stabilization Total			1,048	1,956	2,427	3,169	4,558	4,558	1%	3%	3%	4%	6%	6%
			Transportation Encroachment	County Road	No	19,403	19,403	19,403	19,403	19,403	19,403	25%	25%	25%	25%	25%	25%
				Interstate	No		9,540	9,540	9,540	9,540	9,540	0%	13%	13%	13%	13%	13%
				Railroad	No	13,852	14,776	14,776	14,776	16,347	16,347	18%	19%	19%	19%	21%	21%
					Yes	6,809	5,885	5,885	5,885	4,314	4,314	9%	8%	8%	8%	6%	6%
			Transportation Encroachment Total			40,064	49,605	49,605	49,605	49,605	49,605	53%	65%	65%	65%	65%	65%
B11	PCA	42,826	Other Off Channel	Floodplain Dike/Levee	No	1,523	1,523	1,523	2,005	2,005	2,005	2%	2%	2%	2%	2%	2%
					Yes	482	482	482				1%	1%	1%	0%	0%	0%
			Other Off Channel Total			2,005	2,005	2,005	2,005	2,005	2,005	2%	2%	2%	2%	2%	2%
			Stream Stabilization	Flow Deflector	Yes				939	939	939	0%	0%	0%	1%	1%	1%
				Rock RipRap	Yes		4,133	5,643	6,103	6,103	6,103	0%	5%	7%	7%	7%	7%
			Stream Stabilization Total				4,133	5,643	7,042	7,042	7,042	0%	5%	7%	8%	8%	8%
			Transportation Encroachment	Bridge Approach	Yes	3,362	3,362	3,362	3,362	3,362	3,362	4%	4%	4%	4%	4%	4%
				County Road	No	11,967	11,967	11,967	11,967	11,967	11,967	14%	14%	14%	14%	14%	14%
				Railroad	No	3,644	3,644	3,644	3,644	3,644	3,644	4%	4%	4%	4%	4%	4%
					Yes	9,047	9,047	9,047	9,047	9,047	9,047	11%	11%	11%	11%	11%	11%
			Transportation Encroachment Total			28,020	28,020	28,020	28,020	28,020	28,020	33%	33%	33%	33%	33%	33%
B12	UA	24,028	Other Off Channel	Floodplain Dike/Levee	Yes	987	987	987	987	987	987	2%	2%	2%	2%	2%	2%
			Other Off Channel Total			987	987	987	987	987	987	2%	2%	2%	2%	2%	2%
			Stream Stabilization	Rock RipRap	Yes	7,346	8,666	9,392	10,182	10,182	10,182	15%	18%	20%	21%	21%	21%
			Stream Stabilization Total			7,346	8,666	9,392	10,182	10,182	10,182	15%	18%	20%	21%	21%	21%

Reach	Reach Type	2001 Primary Channel Length (ft)	Feature Class	Feature Type	Functional?	Length of Feature (ft)						Percent of Bank Length (Relative to 2001 Primary Channel)					
						1950	1976	1995	2001	2004	2005	1950	1976	1995	2001	2004	2005
			Transportation Encroachment	Bridge Approach	Yes	562	562	562	562	562	562	1%	1%	1%	1%	1%	1%
				Interstate	No		3,548	3,548	3,548	3,548	3,548	0%	7%	7%	7%	7%	7%
				Railroad	No	7,610	8,910	9,716	9,716	9,716	9,716	16%	19%	20%	20%	20%	20%
					Yes	7,486	6,185	5,379	5,379	5,379	5,379	16%	13%	11%	11%	11%	11%
			Transportation Encroachment Total			15,658	19,206	19,206	19,206	19,206	19,206	33%	40%	40%	40%	40%	40%
D4	PCM/I	57,997	Irrigation	Floodplain Dike/Levee	Yes		1,978	1,978	1,978	1,978	1,978	0%	2%	2%	2%	2%	2%
			Irrigation Total				1,978	1,978	1,978	1,978	1,978	0%	2%	2%	2%	2%	2%
			Other Off Channel	Floodplain Dike/Levee	Maybe		481	481	481	481	481	0%	0%	0%	0%	0%	0%
			Other Off Channel Total				481	481	481	481	481	0%	0%	0%	0%	0%	0%
			Transportation Encroachment	Railroad	No	18,032	18,032	18,032	18,032	18,032	18,032	16%	16%	16%	16%	16%	16%
			Transportation Encroachment Total			18,032	18,032	18,032	18,032	18,032	18,032	16%	16%	16%	16%	16%	16%
D5	PCA	66,626	Irrigation	Floodplain Dike/Levee	No	6,008	6,008	6,008	6,008	6,008	6,008	5%	5%	5%	5%	5%	5%
			Irrigation Total			6,008	6,008	6,008	6,008	6,008	6,008	5%	5%	5%	5%	5%	5%
			Other	Floodplain Dike/Levee	No		669	1,444	1,444	1,444	1,444	0%	1%	1%	1%	1%	1%
					Yes		564	564	564	564	564	0%	0%	0%	0%	0%	0%
			Other Total				1,233	2,007	2,007	2,007	2,007	0%	1%	2%	2%	2%	2%
			Other Off Channel	Floodplain Dike/Levee	No		1,074	1,074	2,292	2,661	2,661	0%	1%	1%	2%	2%	2%
					Yes	1,760	5,276	8,819	7,601	7,601	7,601	1%	4%	7%	6%	6%	6%
			Other Off Channel Total			1,760	6,350	9,893	9,893	10,262	10,262	1%	5%	7%	7%	8%	8%
			Stream Stabilization	Concrete RipRap	Yes				1,036	1,036	1,036	0%	0%	0%	1%	1%	1%
				Rock RipRap	Maybe		526	526	526	526	526	0%	0%	0%	0%	0%	0%
					Yes		3,318	3,318	3,318	3,318	3,318	0%	2%	2%	2%	2%	2%
			Stream Stabilization Total				3,844	3,844	4,879	4,879	4,879	0%	3%	3%	4%	4%	4%
			Transportation Encroachment	Bridge Approach	Yes	1,707	1,707	1,707	1,707	1,707	1,707	1%	1%	1%	1%	1%	1%

Reach	Reach Type	2001 Primary Channel Length (ft)	Feature Class	Feature Type	Functional?	Length of Feature (ft)						Percent of Bank Length (Relative to 2001 Primary Channel)					
						1950	1976	1995	2001	2004	2005	1950	1976	1995	2001	2004	2005
				County Road	Maybe	4,937	4,937	4,937	4,937	4,937	4,937	4%	4%	4%	4%	4%	4%
					No	8,962	8,962	8,962	8,962	8,962	8,962	7%	7%	7%	7%	7%	7%
				Other	No	2,394	3,975	6,409	6,409	6,409	6,409	2%	3%	5%	5%	5%	5%
				Railroad	No	11,728	11,728	11,728	11,728	11,728	11,728	9%	9%	9%	9%	9%	9%
					Yes	2,189	2,189	2,189	2,189	2,189	2,189	2%	2%	2%	2%	2%	2%
			Transportation Encroachment Total			31,917	33,499	35,933	35,933	35,933	35,933	24%	25%	27%	27%	27%	27%
D6	PCM/I	29,301	Other	Floodplain Dike/Levee	Maybe		6,290	6,290	6,290	6,290	6,290	0%	11%	11%	11%	11%	11%
					Yes	688	8,431	8,431	8,431	8,431	8,431	1%	14%	14%	14%	14%	14%
			Other Total			688	14,720	14,720	14,720	14,720	14,720	1%	25%	25%	25%	25%	25%
			Other Off Channel	Floodplain Dike/Levee	No		1,505	1,505	1,505	1,505	1,505	0%	3%	3%	3%	3%	3%
			Other Off Channel Total				1,505	1,505	1,505	1,505	1,505	0%	3%	3%	3%	3%	3%
			Stream Stabilization	Concrete RipRap	Yes		963	963	963	1,559	1,559	0%	2%	2%	2%	3%	3%
				Flow Deflector	Yes		605	605	605	605	605	0%	1%	1%	1%	1%	1%
				Rock RipRap	Yes	728	3,060	3,060	4,156	4,156	4,156	1%	5%	5%	7%	7%	7%
			Stream Stabilization Total			728	4,628	4,628	5,724	6,320	6,320	1%	8%	8%	10%	11%	11%
			Transportation Encroachment	Bridge Approach	No		1,903	1,903	1,903	1,903	1,903	0%	3%	3%	3%	3%	3%
					Yes	1,375	5,911	5,911	5,911	5,911	5,911	2%	10%	10%	10%	10%	10%
				County Road	Yes		2,447	2,447	2,447	2,447	2,447	0%	4%	4%	4%	4%	4%
				Other	Yes		4,542	4,542	4,542	4,542	4,542	0%	8%	8%	8%	8%	8%
				Railroad	No	7,215	8,934	8,934	8,934	8,934	8,934	12%	15%	15%	15%	15%	15%
					Yes	1,719						3%	0%	0%	0%	0%	0%
			Transportation Encroachment Total			10,309	23,736	23,736	23,736	23,736	23,736	18%	41%	41%	41%	41%	41%
D7	PCA	40,314	Transportation Encroachment	Railroad	Maybe	2,689	2,689	2,689	2,689	2,689	2,689	3%	3%	3%	3%	3%	3%
					No	1,453	1,453	1,453	1,453	1,453	1,453	2%	2%	2%	2%	2%	2%
					Yes	8,387	8,387	8,387	8,387	8,387	8,387	10%	10%	10%	10%	10%	10%
			Transportation Encroachment Total			12,529	12,529	12,529	12,529	12,529	12,529	16%	16%	16%	16%	16%	16%

Reach	Reach Type	2001 Primary Channel Length (ft)	Feature Class	Feature Type	Functional?	Length of Feature (ft)						Percent of Bank Length (Relative to 2001 Primary Channel)					
						1950	1976	1995	2001	2004	2005	1950	1976	1995	2001	2004	2005
D8	PCA	53,643	Irrigation	Floodplain Dike/Levee	No	5,268	5,268	5,268	5,268	5,268	5,268	5%	5%	5%	5%	5%	5%
				In Channel Diversion	Yes	669	669	669	669	669	669	1%	1%	1%	1%	1%	1%
			Irrigation Total			5,936	5,936	5,936	5,936	5,936	5,936	6%	6%	6%	6%	6%	6%
			Other Off Channel	Floodplain Dike/Levee	Yes	478	478	478	478	478	478	0%	0%	0%	0%	0%	0%
			Other Off Channel Total			478	478	478	478	478	478	0%	0%	0%	0%	0%	0%
			Stream Stabilization	Flow Deflector	Yes					734	734	0%	0%	0%	0%	1%	1%
				Rock RipRap	Yes	962	2,562	2,562	3,433	3,433	3,433	1%	2%	2%	3%	3%	3%
			Stream Stabilization Total			962	2,562	2,562	3,433	4,168	4,168	1%	2%	2%	3%	4%	4%
			Transportation Encroachment	County Road	No	4,206	4,206	4,206	4,206	4,206	4,206	4%	4%	4%	4%	4%	4%
				Railroad	Maybe	5,465	5,465	5,465	5,465	5,465	5,465	5%	5%	5%	5%	5%	5%
					No	4,835	4,835	4,835	4,835	4,835	4,835	5%	5%	5%	5%	5%	5%
			Transportation Encroachment Total			14,506	14,506	14,506	14,506	14,506	14,506	14%	14%	14%	14%	14%	14%
D9	PCM/I	18,461	Irrigation	Floodplain Dike/Levee	No	13,136	13,136	13,136	13,136	13,136	13,136	36%	36%	36%	36%	36%	36%
					Yes	2,602	2,602	2,602	2,602	2,602	2,602	7%	7%	7%	7%	7%	7%
			Irrigation Total			15,737	15,737	15,737	15,737	15,737	15,737	43%	43%	43%	43%	43%	43%
			Other Off Channel	Floodplain Dike/Levee	No		1,038	1,038	1,038	1,038	1,038	0%	3%	3%	3%	3%	3%
			Other Off Channel Total				1,038	1,038	1,038	1,038	1,038	0%	3%	3%	3%	3%	3%
			Transportation Encroachment	Railroad	No	11,580	11,580	11,580	11,580	11,580	11,580	31%	31%	31%	31%	31%	31%
			Transportation Encroachment Total			11,580	11,580	11,580	11,580	11,580	11,580	31%	31%	31%	31%	31%	31%

Appendix B. Stream Stabilization Feature Class Results

(Normalized to High Flow Bank Length at Time of Photography)

Reach	Reach Type	High Flow (Primary +Anabranching) Channel Length (ft)				Feature Class	Feature Type	Functional?	Length of Feature						Percent of Entire Bank Length (including side channels)*					
		1950	1976	1995	2001				1950	1976	1995	2001	2004	2005	1950	1976	1995	2001	2004	2005
A10	PCS	43,560	40,063	29,490	32,717	Stream Stabilization	Car Bodies	No					175	175	0%	0%	0%	0%	0%	0%
							Rock RipRap	Yes		64	64	353	353	353	0%	0%	0%	1%	1%	1%
						Stream Stabilization Total				64	64	353	528	528	0%	0%	0%	1%	1%	1%
A11	PCB	68,007	60,319	59,661	59,893	Stream Stabilization	Floodplain Dike/Levee	No		1,744	1,744	1,744	1,744	1,744	0%	1%	1%	1%	1%	1%
							Flow Deflector	Yes		262	283	283	283	283	0%	0%	0%	0%	0%	0%
							Rock RipRap	Yes	3,808	10,376	10,937	11,983	12,206	12,206	3%	9%	9%	10%	10%	10%
						Stream Stabilization Total			3,808	12,382	12,963	14,009	14,233	14,233	3%	10%	11%	12%	12%	12%
A12	PCB	57,710	56,345	49,758	57,180	Stream Stabilization	Flow Deflector	Yes		1,697	1,697	1,734	2,093	2,093	0%	2%	2%	2%	2%	2%
							Rock RipRap	No	3,309	3,309	3,309	3,309	3,309	3,309	3%	3%	3%	3%	3%	3%
								Yes	1,731	2,555	4,636	4,794	4,794	4,794	1%	2%	5%	4%	4%	4%
						Stream Stabilization Total			5,040	7,561	9,642	9,837	10,196	10,196	4%	7%	10%	9%	9%	9%
A13	PCA	37,051	37,804	39,267	38,186	Stream Stabilization	Concrete RipRap	Yes			2,822	2,822	2,822	2,822	0%	0%	4%	4%	4%	4%
							Rock RipRap	No	2,340	2,340	2,340	3,259	3,259	3,259	3%	3%	3%	4%	4%	4%
								Yes	1,066	2,652	4,294	4,929	4,929	4,929	1%	4%	5%	6%	6%	6%
						Stream Stabilization Total			3,406	4,993	9,457	11,010	11,010	11,010	5%	7%	12%	14%	14%	14%
A14	PCA	98,249	90,115	79,180	79,735	Stream Stabilization	Floodplain Dike/Levee	Yes		258	258	471	471	471	0%	0%	0%	0%	0%	0%
							Flow Deflector	Yes		185	185	185	400	400	0%	0%	0%	0%	0%	0%

Reach	Reach Type	High Flow (Primary +Anabranching) Channel Length (ft)				Feature Class	Feature Type	Functional?	Length of Feature						Percent of Entire Bank Length (including side channels)*					
		1950	1976	1995	2001				1950	1976	1995	2001	2004	2005	1950	1976	1995	2001	2004	2005
							Rock RipRap	No	12,989	12,989	12,989	12,989	12,989	12,989	7%	7%	8%	8%	8%	8%
								Yes	567	567	1,168	1,168	1,168	1,168	0%	0%	1%	1%	1%	1%
						Stream Stabilization Total			13,555	13,998	14,599	14,813	15,028	15,028	7%	8%	9%	9%	9%	9%
A15	PCB	62,495	52,190	57,658	53,260	Stream Stabilization	Concrete RipRap	Yes	449	449	449	449	449	449	0%	0%	0%	0%	0%	0%
							Floodplain Dike/Levee	Yes	1,287	1,833	1,833	1,833	1,833	1,833	1%	2%	2%	2%	2%	2%
							Rock RipRap	Yes	2,363	5,630	6,605	6,605	7,003	7,003	2%	5%	6%	6%	7%	7%
						Stream Stabilization Total			4,099	7,911	8,887	8,887	9,285	9,285	3%	8%	8%	8%	9%	9%
A16	PCA	99,478	104,629	94,888	94,242	Stream Stabilization	Car Bodies	Yes	79	79	112	112	112	112	0%	0%	0%	0%	0%	0%
							Concrete RipRap	Yes			262	262	262	262	0%	0%	0%	0%	0%	0%
							Rock RipRap	Yes	1,441	1,441	1,976	5,043	5,949	5,949	1%	1%	1%	3%	3%	3%
						Stream Stabilization Total			1,521	1,521	2,350	5,418	6,324	6,324	1%	1%	1%	3%	3%	3%
A17	UA	72,724	72,402	63,429	65,506	Stream Stabilization	Concrete RipRap	Yes	366	988	988	3,055	3,645	3,645	0%	1%	1%	2%	3%	3%
							Floodplain Dike/Levee	Yes				412	412	412	0%	0%	0%	0%	0%	0%
							Flow Deflector	Yes				812	812	812	0%	0%	0%	1%	1%	1%
							Rock RipRap	No		344					0%	0%	0%	0%	0%	0%
								Yes	272	3,348	3,886	4,200	4,200	4,200	0%	2%	3%	3%	3%	3%
						Stream Stabilization Total			638	4,681	4,875	8,478	9,068	9,068	0%	3%	4%	6%	7%	7%
A18	UA	26,817	30,370	26,105	27,246	Stream Stabilization	Car Bodies	Yes			569	569	569	569	0%	0%	1%	1%	1%	1%
							Concrete RipRap	Yes	2,825	2,825	2,825	4,648	4,648	4,648	5%	5%	5%	9%	9%	9%

Reach	Reach Type	High Flow (Primary +Anabranching) Channel Length (ft)				Feature Class	Feature Type	Functional?	Length of Feature						Percent of Entire Bank Length (including side channels)*					
		1950	1976	1995	2001				1950	1976	1995	2001	2004	2005	1950	1976	1995	2001	2004	2005
							Flow Deflector	Yes				1,467	1,467	1,467	0%	0%	0%	3%	3%	3%
							Rock RipRap	Yes	121	2,374	2,374	3,576	3,576	3,576	0%	4%	5%	7%	7%	7%
						Stream Stabilization Total			2,946	5,199	5,769	10,260	10,260	10,260	5%	9%	11%	19%	19%	19%
B1	UB	199,643	188,307	161,988	163,826	Stream Stabilization	Car Bodies	Yes	341	1,039	1,180	1,180	1,180	1,180	0%	0%	0%	0%	0%	0%
							Concrete RipRap	No			447	447	447	447	0%	0%	0%	0%	0%	0%
								Yes	5,569	16,943	25,463	30,809	31,097	31,097	1%	4%	8%	9%	9%	9%
							Floodplain Dike/Levee	No			3,937	3,937	4,822	4,822	0%	0%	1%	1%	1%	1%
								Yes		5,137	8,399	14,324	14,520	14,520	0%	1%	3%	4%	4%	4%
							Flow Deflector	Yes	1,589	914	914	6,024	6,024	6,024	0%	0%	0%	2%	2%	2%
							Rock RipRap	No		2,491	2,491	2,491	3,560	3,560	0%	1%	1%	1%	1%	1%
								Yes	7,373	15,707	16,844	17,341	18,724	18,724	2%	4%	5%	5%	6%	6%
						Stream Stabilization Total			14,872	42,231	59,675	76,554	80,375	80,375	4%	11%	18%	23%	25%	25%
B2	PCB	60,396	63,505	56,779	57,097	Stream Stabilization	Concrete RipRap	No			292	292	292	292	0%	0%	0%	0%	0%	0%
								Yes	5,062	15,933	17,713	17,713	17,713	17,713	4%	13%	16%	16%	16%	16%
							Floodplain Dike/Levee	No		1,136	1,136	1,136	1,136	1,136	0%	1%	1%	1%	1%	1%
								Yes		2,331	2,331	2,331	2,331	2,331	0%	2%	2%	2%	2%	2%
							Rock RipRap	Yes	1,100	2,973	3,758	3,758	3,758	3,758	1%	2%	3%	3%	3%	3%
							Steel Retaining Wall	Yes	275	275	275	275	275	275	0%	0%	0%	0%	0%	0%
						Stream Stabilization Total			6,437	22,650	25,506	25,506	25,506	25,506	5%	18%	22%	22%	22%	22%
B3	UB	63,812	51,161	56,512	58,294	Stream Stabilization	Concrete RipRap	Yes			592	592	592	592	0%	0%	1%	1%	1%	1%
							Floodplain Dike/Levee	No		1,373	3,658	3,658	3,658	3,658	0%	1%	3%	3%	3%	3%
								Yes		1,493	2,836	2,836	2,836	2,836	0%	1%	3%	2%	2%	2%
							Flow Deflector	Yes		3,244	3,244	3,244	3,244	3,244	0%	3%	3%	3%	3%	3%

Reach	Reach Type	High Flow (Primary +Anabranching) Channel Length (ft)				Feature Class	Feature Type	Functional?	Length of Feature						Percent of Entire Bank Length (including side channels)*					
		1950	1976	1995	2001				1950	1976	1995	2001	2004	2005	1950	1976	1995	2001	2004	2005
							Rock RipRap	No	841	841	841	841	841	841	1%	1%	1%	1%	1%	1%
								Yes	913	5,438	9,335	9,335	9,335	9,335	1%	5%	8%	8%	8%	8%
						Stream Stabilization Total			1,755	12,390	20,506	20,506	20,506	20,506	1%	12%	18%	18%	18%	18%
B4	PCS	29,251	28,741	27,827	31,385	Stream Stabilization	Concrete RipRap	Yes		6,452	6,452	6,960	6,960	6,960	0%	11%	12%	11%	11%	11%
							Floodplain Dike/Levee	No		3,818	3,818	3,818	3,818	3,818	0%	7%	7%	6%	6%	6%
								Yes		887	887	887	887	887	0%	2%	2%	1%	1%	1%
							Flow Deflector	Yes		3,241	3,241	3,241	3,241	3,241	0%	6%	6%	5%	5%	5%
							Rock RipRap	No	10,926	10,926	10,926	10,926	10,926	10,926	19%	19%	20%	17%	17%	17%
								Yes	7,241	7,241	7,241	7,481	7,481	7,481	12%	13%	13%	12%	12%	12%
						Stream Stabilization Total			18,166	32,564	32,564	33,312	33,312	33,312	31%	57%	59%	53%	53%	53%
B5	UA	97,476	96,432	94,000	105,448	Stream Stabilization	Concrete RipRap	Yes	2,429	5,218	8,316	9,344	9,344	9,344	1%	3%	4%	4%	4%	4%
							Floodplain Dike/Levee	No		1,361	1,361	1,361	1,361	1,361	0%	1%	1%	1%	1%	1%
								Yes		1,082	1,082	1,082	1,082	1,082	0%	1%	1%	1%	1%	1%
							Flow Deflector	Yes		645	645	2,736	1,391	1,391	0%	0%	0%	1%	1%	1%
							Rock RipRap	No	376	376	376	376	376	376	0%	0%	0%	0%	0%	0%
								Yes	2,046	2,218	2,218	2,218	2,218	2,218	1%	1%	1%	1%	1%	1%
						Stream Stabilization Total			4,851	10,900	13,999	17,117	15,772	15,772	2%	6%	7%	8%	7%	7%
B6	PCB	58,401	69,864	65,159	76,327	Stream Stabilization	Car Bodies	Yes		1,702	1,702	1,702	1,702	1,702	0%	1%	1%	1%	1%	1%
							Concrete RipRap	Yes			2,981	2,981	2,981	2,981	0%	0%	2%	2%	2%	2%
						Stream Stabilization Total				1,702	4,683	4,683	4,683	4,683	0%	1%	4%	3%	3%	3%
B7	UB	115,680	110,761	88,537	98,332	Stream Stabilization	Concrete RipRap	Yes			428	1,147	1,619	1,619	0%	0%	0%	1%	1%	1%

Reach	Reach Type	High Flow (Primary +Anabranching) Channel Length (ft)				Feature Class	Feature Type	Functional?	Length of Feature						Percent of Entire Bank Length (including side channels)*					
		1950	1976	1995	2001				1950	1976	1995	2001	2004	2005	1950	1976	1995	2001	2004	2005
							Rock RipRap	Yes	240	240	511	692	692	692	0%	0%	0%	0%	0%	0%
						Stream Stabilization Total			240	240	939	1,839	2,311	2,311	0%	0%	1%	1%	1%	1%
B8	PCA	127,729	115,185	129,214	121,665	Stream Stabilization	Flow Deflector	Yes			199	199	199	199	0%	0%	0%	0%	0%	0%
							Rock RipRap	No		479	479	479	479	479	0%	0%	0%	0%	0%	0%
								Yes	1,010	1,010	2,360	2,360	2,360	2,360	0%	0%	1%	1%	1%	1%
						Stream Stabilization Total			1,010	1,489	3,038	3,038	3,038	3,038	0%	1%	1%	1%	1%	1%
B9	UA	64,541	68,259	59,287	63,599	Stream Stabilization	Rock RipRap	No	2,701	2,701	2,701	2,701	2,701	2,701	2%	2%	2%	2%	2%	2%
								Yes	3,634	3,747	5,528	6,190	6,190	6,190	3%	3%	5%	5%	5%	5%
						Stream Stabilization Total			6,336	6,448	8,229	8,891	8,891	8,891	5%	5%	7%	7%	7%	7%
B10	PCM	92,452	75,458	80,620	65,299	Stream Stabilization	Concrete RipRap	Yes			255	255	255	255	0%	0%	0%	0%	0%	0%
							Flow Deflector	Yes				742	2,131	2,131	0%	0%	0%	1%	2%	2%
							Rock RipRap	Yes	1,048	1,956	2,172	2,172	2,172	2,172	1%	1%	1%	2%	2%	2%
						Stream Stabilization Total			1,048	1,956	2,427	3,169	4,558	4,558	1%	1%	2%	2%	3%	3%
B11	PCA	108,064	105,501	105,857	110,812	Stream Stabilization	Flow Deflector	Yes				939	939	939	0%	0%	0%	0%	0%	0%
							Rock RipRap	Yes		4,133	5,643	6,103	6,103	6,103	0%	2%	3%	3%	3%	3%
						Stream Stabilization Total				4,133	5,643	7,042	7,042	7,042	0%	2%	3%	3%	3%	3%
B12	UA	71,736	65,683	67,227	68,527	Stream Stabilization	Rock RipRap	Yes	7,346	8,666	9,392	10,182	10,182	10,182	5%	7%	7%	7%	7%	7%
						Stream Stabilization Total			7,346	8,666	9,392	10,182	10,182	10,182	5%	7%	7%	7%	7%	7%
D4	PCM/I	98,340	93,141	88,018	81,760	Stream Stabilization				0	0	0	0	0	0%	0%	0%	0%	0%	0%

Reach	Reach Type	High Flow (Primary +Anabranching) Channel Length (ft)				Feature Class	Feature Type	Functional?	Length of Feature						Percent of Entire Bank Length (including side channels)*					
		1950	1976	1995	2001				1950	1976	1995	2001	2004	2005	1950	1976	1995	2001	2004	2005
						Stream Stabilization Total				0	0	0	0	0	0%	0%	0%	0%	0%	0%
D5	PCA	162,564	167,787	174,598	167,695	Stream Stabilization	Concrete RipRap	Yes				1,036	1,036	1,036	0%	0%	0%	0%	0%	0%
							Rock RipRap	Maybe		526	526	526	526	526	0%	0%	0%	0%	0%	0%
								Yes		3,318	3,318	3,318	3,318	3,318	0%	1%	1%	1%	1%	1%
						Stream Stabilization Total				3,844	3,844	4,879	4,879	4,879	0%	1%	1%	1%	1%	1%
D6	PCM/I	65,575	44,870	41,160	42,972	Stream Stabilization	Concrete RipRap	Yes		963	963	963	1,559	1,559	0%	1%	1%	1%	2%	2%
							Flow Deflector	Yes		605	605	605	605	605	0%	1%	1%	1%	1%	1%
							Rock RipRap	Yes	728	3,060	3,060	4,156	4,156	4,156	1%	3%	4%	5%	5%	5%
						Stream Stabilization Total			728	4,628	4,628	5,724	6,320	6,320	1%	5%	6%	7%	7%	7%
D7	PCA	103,784	95,699	100,012	96,417	Stream Stabilization				0	0	0	0	0	0%	0%	0%	0%	0%	0%
						Stream Stabilization Total				0	0	0	0	0	0%	0%	0%	0%	0%	0%
D8	PCA	108,919	118,066	122,669	121,026	Stream Stabilization	Flow Deflector	Yes					734	734	0%	0%	0%	0%	0%	0%
							Rock RipRap	Yes	962	2,562	2,562	3,433	3,433	3,433	0%	1%	1%	1%	1%	1%
						Stream Stabilization Total			962	2,562	2,562	3,433	4,168	4,168	0%	1%	1%	1%	2%	2%
D9	PCM/I	31,342	28,094	36,048	36,974	Stream Stabilization				0	0	0	0	0	0%	0%	0%	0%	0%	0%
						Stream Stabilization Total				0	0	0	0	0	0%	0%	0%	0%	0%	0%

This is a test

2004 and 2005 features normalized to 2001 bank length