

W-1 REACH SUMMARY

SUB-REACHES: N A

LOCATION: Waterloo Lane to Muller Lane Bridge

Geomorphic Setting

The investigation teams did not have access to properties in Reach W-1. Consequently, the information presented below is limited to that inferred from aerial photos and an aerial survey.

General

The West Fork of the Carson River in Reach W-1 currently carries only a portion of its historic flows due to the significant withdrawals associated with the Brockliss Slough and irrigation ditches. Furthermore, it appears that it has been channelized over much of its length as evidenced by its relatively straight character. Overall, the channel appears relatively stable with little evidence of vertical or lateral stability issues. Because much of its flow, including high flows, is diverted to the Brockliss Slough and because its floodplain is accessible to high flows, high flows do not exert great stresses on the system.

Land Use

Land use is predominantly agricultural and grazing lands with some moderately ruralized areas.

Relative Stability

stable

General

See Geomorphic Setting, above.

Bank Stability

Ground surveys and observations of Reach W-1 were not possible. However, observations from the Waterloo Lane bridge and recent aerial video footage indicated well vegetated and stable banks.

Vegetative Condition

Observations were limited to one point at the Waterloo Lane Bridge. From this vantage, W-1 exhibited a thick and healthy, but narrow (approximately 10-20 feet) riparian zone. Adjacent lands are largely irrigated pasture land and agricultural land.

Channel Recovery And Land Management Recommendations

NOTE TO READERS:

This report was originally submitted in December of 1996, prior to the New Year's Flood of January 1997. It should be noted in reading this document that the conclusions and recommendations stated in this report are based on observations which were made previous to the geomorphically significant flood event. The physical state of much of the observed areas has been significantly altered. In many reaches and subreaches, physical change resulting from these floods has been so significant as to render some recommendations inappropriate. Where such changes have been observed by local land managers, their opinions as to the appropriateness of recommendations should be observed. However, in our opinion, while site specific and short term recommendations may be less appropriate following the flood, general and long-term management considerations are still appropriate and relevant on a watershed scale.

As long as West Fork flows are split between the West Fork and the Brockliss Slough, there appears little that needs to be done beyond continuing with current land management practices. The channel offers little in terms of fish habitat or geomorphic variability, but is relatively stable. There is ample opportunity for reconfiguring the channel, by manipulating planform and sinuosity, to increase variability and habitat potential. However, such actions are likely unwarranted unless system-wide restoration is considered.

W-2 REACH SUMMARY

SUB-REACHES: N A

LOCATION: Muller Lane Bridge to Confluence with East Fork

Geomorphic Setting

Rosgen/Downs/Harvey-Watson Classifications

W-2: na/M/IV

General

W-2 is situated in the valley plain where the East Fork, West Fork and the Brockliss Slough come together. Historically, this was likely an area of frequent channel shifts and natural changes in the location of the confluence of the East and West Forks of the Carson River. With the imposition of property lines and ditch systems on this area came the need to control these shifts to protect property and ditch structures. Consequently, the West Fork of the Carson in Reach W-2 has been heavily impacted by ditching, channelization, and levee construction periodically over the last half of a century. High flows from each of these channels frequently access other of these channels creating new channels, opening up historic channels and confluences, and creating backwatering problems for upstream property owners. Review of historic aerial photographs of this reach indicate that some channelization has occurred at the top of the reach and considerable channelization has occurred in tributary sloughs and ditches.

W-2 is a channelized, slightly entrenched reach with a largely trapezoidal channel. Bed materials are largely sand, silt and small gravels which form point and transverse bar forms. While there has been little change in planform since the 1938 aerial photos, approximately 1/3 of a mile of new channel has been constructed parallel to the East Fork at the bottom of the reach to move the confluence with the East Fork downstream in an effort to displace backwatering problems upstream. The associated levee, while preventing overbank flows from moving across the valley (toward the Brockliss Slough), is likely exacerbating backwatering effects of the confluence.

Channel Capacity

No information is available.

Land Use

Land use is predominantly agricultural and irrigated grazing lands.

Relative Stability
Moderately Unstable

General

The grade in W-2 appears stable. However, there is evidence of bank erosion and moderate lateral instability. Because much of the flow of the West Fork is diverted to the Brockliss Slough, high flow impacts are reduced. Additionally, the confluence with the East Fork may be reducing high flow velocities by backwatering the West Fork. However, this same confluence and backwatering can create new cutoff channels or reinstate historic cutoff channels between the two forks. This said, lateral instability is likely related to land management and grazing impacts. Banks are sparsely vegetated and unprotected from grazing.

Bank Stability
Moderate to Unstable

Banks in this reach are from 4-7 feet high and range in slope from 1:1 to 3:1. The predominant mode of bank failure is due to undercutting of banks at outside bends. Bank materials are primarily silt and fine grained materials. The primary bank stability issues appear to be related to grazing impacts and lack of riparian vegetation.

Vegetative Condition

Bank and floodplain vegetation is mostly grasses and sparse shrubs. The condition of vegetation is closely correlated with the degree of irrigation implemented. W-2 has no riparian corridor or riparian species present and little or no sprout or young plants along the channel margins.

Channel Recovery And Land Management Recommendations

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specific and short term recommendations may be less appropriate following the flood, general and long-term management considerations are still appropriate and relevant on a watershed scale.

Channel stability in W-2 would be greatly enhanced by riparian fencing and grazing management. Such activities should be supplemented with planting of riparian species, as little is available for generation, even with a rigorous grazing exclusion plan.

The primary landowner issues and concerns in this location are flooding associated with backwatering from the confluence of the East and West Forks. As discussed above, this area is comprised of a complex network of channels, ditches, and sloughs which have a history of channel and confluence shifts. Existing levees may offer some protection from large scale channel shifts. However, they may also be exacerbating backwatering problems by reducing available flood water storage areas on the associated floodplains. Due to the complexity of numerous channels and flow paths and confluences in this area, it is impossible to predict what channel shifts may occur in the future. Such prediction would involve extensive and expensive hydraulic modeling of the area between the East Fork and the Brockliss Slough and all associated channels.

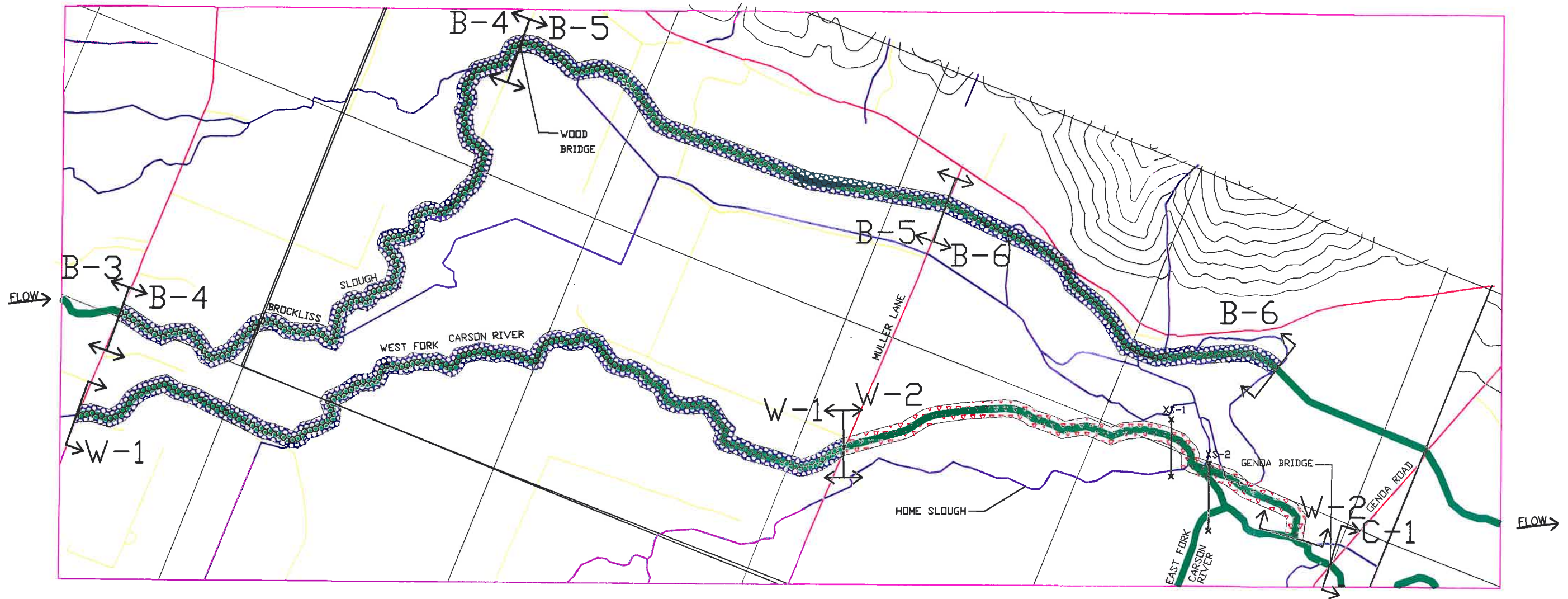
This area historically has been a very dynamic system of channels and will likely continue to be so. As its current land use is occasional grazing and the landowner has stated that there are no plans for development or agricultural use beyond grazing, there is likely little justification for the significant expenditures required to stabilize the existing channel configuration, in a permanent sense. While there is the reasonable concern that all channels will combine to form one large channel, this should not pose a problem for *upstream* landowners. However, it is unclear whether any of the existing bridges along the Genoa road would be capable of handling all flow from the East and West Forks and the Brockliss Slough.

Below are specific recommendations:

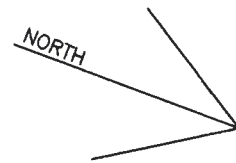
- Perform hydraulic analysis of existing bridges along Genoa Road to determine if they are sufficient for existing channel configuration and flows. If bridges are to be modified, designs should incorporate allowances for future channel shifts and combinations. Ideally, each bridge should be sufficient to convey the sum of flows from all three channels (East Fork, West Fork, and Brockliss Slough).
- Removal of existing levees may reduce backwatering problems upstream by allowing diffusion of flows over greater floodplain areas. This may either reduce or increase the likelihood of significant channel shifts in the future. Creating gaps in the levees may encourage overflow and the

benefits associated with overflow with reduced potential for significant channel shifts relative to complete levee removal.


- Implement riparian fencing and grazing management which encourages development of a riparian corridor which will increase channel stability and encourage existing channels to maintain their present configuration.
- The entire area adjacent to W-2, from the East Fork to the Brockliss Slough above the Genoa road has tremendous potential for natural development of wetland habitat and flood water retention and storage, if allowed to flow across the floodplain (by removing levees or portions of levees).
- Allowing the various channels to migrate and shift according to natural processes may, in the long run, provide greater stability, habitat, floodwater storage, and reduced backwatering than efforts to control the channels and maintain them in their present configuration. Bridge and channel hydraulics at Genoa road crossings should be evaluated.








REACH W-1 - W-2
 APPROX. SCALE: 1" = 2100'



LEGEND

- CARSON RIVER
- ROADS
- MAIN ROADS
- TRIBUTARY CHANNELS/DITCHES
-  CROSS SECTION

STABILITY

-  EXTREMELY UNSTABLE
-  UNSTABLE
-  MODERATELY UNSTABLE
-  STABLE
-  VERY STABLE

BROCKLISS SLOUGH REACH SUMMARY

REACHES: B-1, B-2, B-3, B-4, B-5, B-6

LOCATION: Highway 88 to Genoa Road

Geomorphic Setting

Rosgen/Downs/Harvey-Watson Classifications

B2: na/S/NA B3: C5/C/NA B4: C6c/S/NA B5: na/d/NA

B6: na/d/NA

General

For the purpose of summarizing reach characteristics, Brockliss Slough reaches B-2 through B-6 have been lumped together as they exhibit similar characteristics and management issues. In most reaches, observations were based only on those properties and sections which the field team had access to. For the most part, these were considered representative of the reach based on video footage of an aerial flight. Furthermore, the field teams did not have access to the properties on Reach B-1, which is not addressed in this summary.

The Brockliss Slough is apparently an historic West Fork channel which has been put to use as a diversion and irrigation water canal. As with the West Fork, which serves the same purposes, some sections of the Brockliss Slough are natural channel conditions, while other sections have been channelized and straightened (particularly B-3, B-5, and B-6). Because the slough was at one time the primary West Fork channel and now carries roughly half of the West Fork flow, neither the Brockliss nor the West Fork show evidence of channel instability associated with high flows.

Historically, the Brockliss Slough was likely a sinuous C-type channel with a thick riparian corridor, as is in evidence in relatively undisturbed sections. Due to the proximity of the East Fork and the potential for widespread valley flooding where the East and West Forks and Brockliss slough share a valley floodplain, it is possible that channel shifts and confluence shifts occurred throughout the valley. Existing infrastructure, roads, and bridges now restrict such channel shifts to some degree.

Much of the Brockliss Slough system is in a stable state with a healthy and stabilizing riparian corridor. The majority of channel instability is associated with land management (grazing) problems and diversion structures. Diversion structures affect bedload transport and channel grade and in some instances result in stability concerns. However, due to the relatively low

channel slope throughout the valley, vertical channel stability issues are generally limited to localized grade breaks at diversion structures. The upper reaches of the Brockliss have bed particle sizes in the gravel to cobble range. Particle sizes decrease downstream to sand and silt materials with some small gravels.

Land Use

Lands adjacent to Brockliss Slough reaches are predominantly irrigated agricultural and grazing lands with isolated ruralized areas.

Relative Stability

Stable

General

The majority of Brockliss Slough reaches are considered stable. The exception to this is Reach B-3 which is moderately unstable. This reach exhibited some channel incision and widespread bank instability associated with straightening and channelization as evidenced on air photos taken in 1938 and 1990. At some point during this time frame, a very sinuous reach was channelized and displaced. Subsequent land use has allowed grazing of channel banks and eliminated riparian vegetation. While the current grade appears stable, the channel is migrating laterally to gain length. Irrigation return ditches are perched and headcutting through pasture land to meet the degraded channel elevation.

The Brockliss Slough has numerous diversion structures throughout all of its reaches. In most cases, these structures create localized instability and/or the potential for future instability. Observations common to most of these structures reveal that there is aggradation upstream and channel incision below these structures. This is likely a result of restricted bedload transport through the structures. Stream channels continually transport bed material. Where diversion structures prevent the inflow of bed materials to replace that moving downstream, bed degradation occurs which destabilizes channel banks.

Bank Stability

Stable to Unstable

Bank stability throughout the Brockliss Slough reaches is closely related to riparian condition and grazing practices. The observed sections of reaches B-2, B-5, and B-6 appeared stable with healthy, though narrow, riparian

corridors. B-3 was largely unstable due to an absence of riparian vegetation and active grazing and trampling of banks. B-4 exhibited moderate stability and isolated sections of unstable banks, again associated with grazing practices and absence of riparian vegetation.

Bank heights throughout the Brockliss Slough reaches ranged from 2 to 7 feet, with the highest banks in Reach B-3 where the channelized section is moderately incised. Bank slopes ranged from 3:1 or flatter in the upper reaches, to 1:1 in areas of bank instability in downstream reaches. Riparian zones were largely limited to channel banks. As discussed above, additional areas of isolated bank instability are associated with diversion structures. Banks below these structures, where the channel is moderately incised, are unstable.

Vegetative Condition

All reaches of the Brockliss Slough exhibit narrow riparian zones. The width and condition of the riparian zone are highly variable within reaches. Riparian zone widths range from 0 to 30 feet. Average widths in the upper reaches range from 10 to 20 feet, while average widths in B-5 and B-6 are only 2 feet. In these latter reaches, riparian zones are confined to channel banks. With the exception of Reach B-3, most riparian zones show sprout, young and mature age classes of riparian vegetation, but little to no dead or decadent vegetation.

Floodplain vegetation in the upper reaches consists primarily of irrigated pasture land grasses in good condition, or irrigated hay fields. The lower reaches, particularly B-6, are range lands with more sparse vegetation and more common shrubby species.

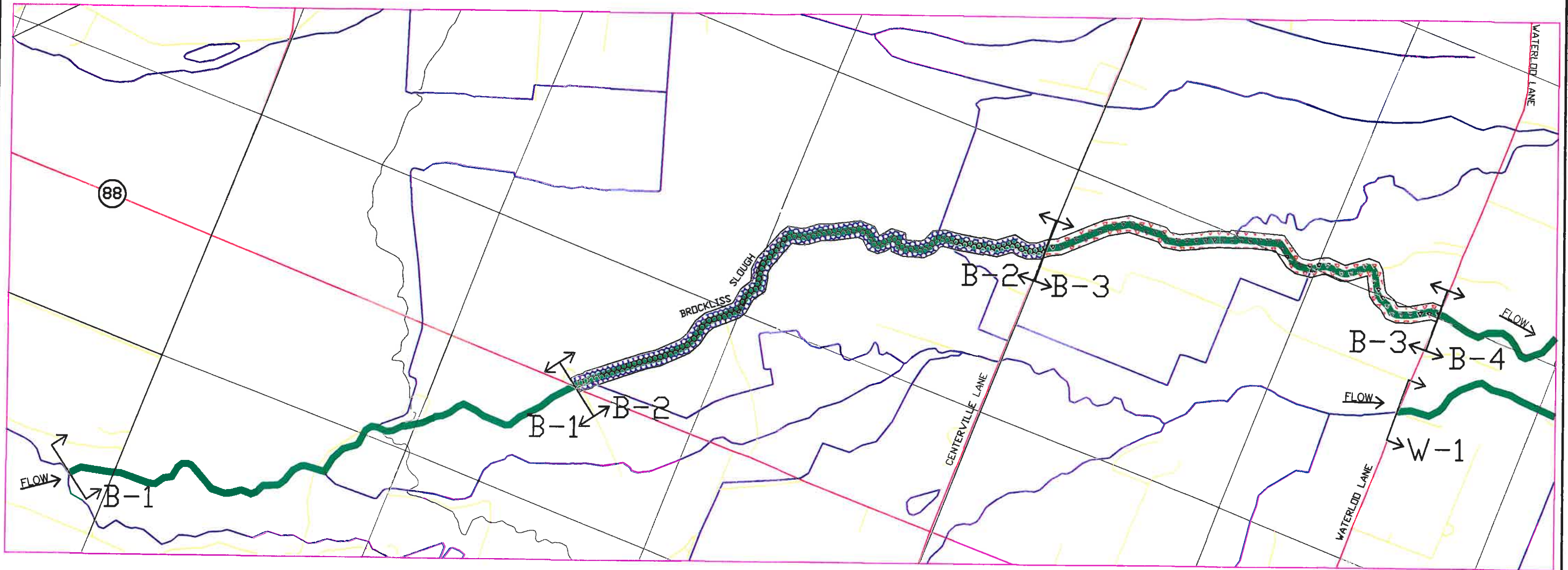
In all reaches, there is a distinct correlation between grazing practices, fence lines, and riparian condition and riparian zone width. Without exception, those areas which are fenced off from grazing exhibit a healthy riparian corridor of willows, sedges, and grasses. Because floodplain elevations are relatively close to channel bed elevations, the near channel moisture regime, in combination with irrigation of the floodplain, allows for growth of healthy riparian communities. The exception to this is in B-3, which is moderately incised in part of the reach and which has limited riparian fencing. This combination of an elevated floodplain (relative to the channel) and grazing impacts has resulted in stretches of the reach with little to no riparian vegetation.

Channel Recovery And Land Management Recommendations

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- Where riparian corridors are fenced there is a healthy riparian corridor in all reaches of the Brockliss Slough. Furthermore, these areas exhibit little to no lateral channel stability problems. For this reason, it is recommended that fencing of a riparian corridor be implemented throughout the B Reaches. Furthermore, as existing fences are replaced or repaired, they should be located to allow a 20-30 foot riparian corridor at a minimum.
- The majority of diversion structures in the Brockliss Slough are causing aggradation upstream and bed degradation downstream. In some areas this has contributed to lateral stability problems as well. Diversion structures should be redesigned and constructed to allow bedload transport, particularly during high flow periods. Due to apparently low sediment transport rates during low flows, this should relieve the majority of problems associated with diversions.
- In a few isolated areas, riprap has been used to stabilize banks where bank failure has occurred. Almost without exception, moderate bank resloping, revegetation and grazing exclusion would accomplish the same stability as riprap in this system. Because riparian vegetation allows for greater habitat and minor natural channel adjustments, it should be encouraged rather than riprap whenever possible.



REACHS B-1 - B-3
 APPROX. SCALE: 1" = 2100'

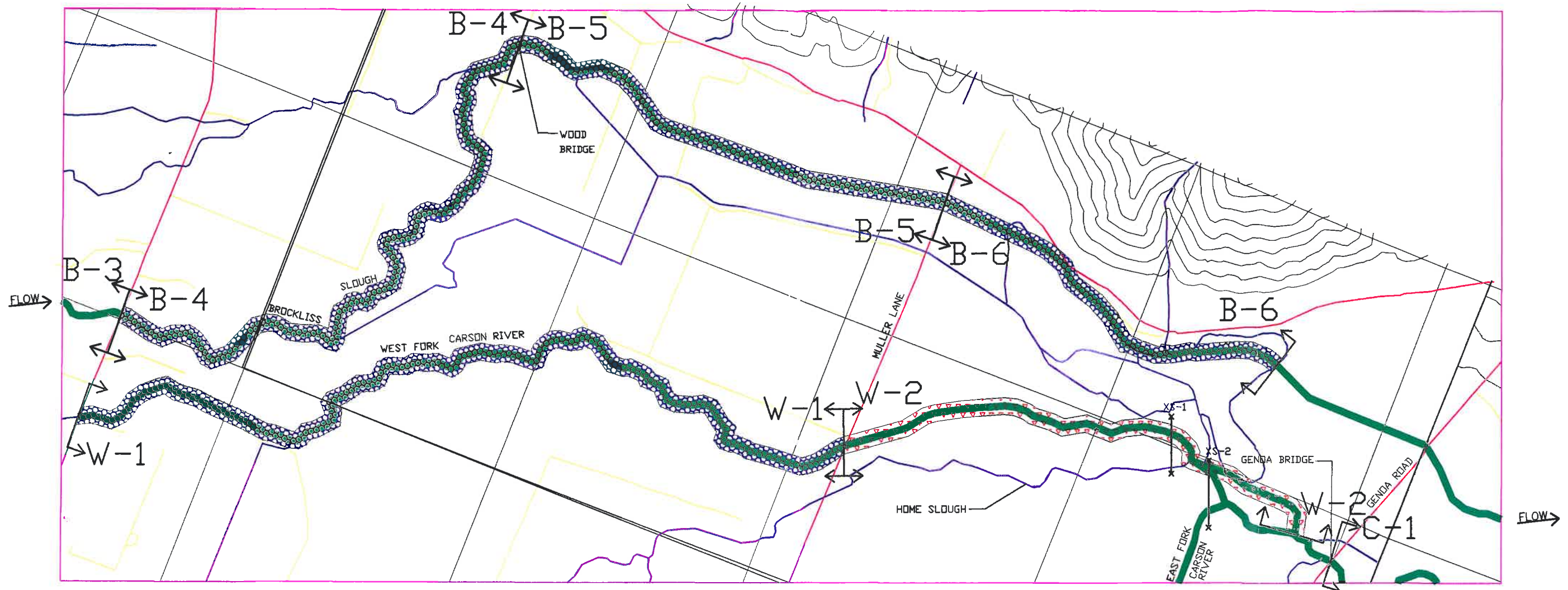


LEGEND

- CARSON RIVER
- ROADS
- MAIN ROADS
- TRIBUTARY CHANNELS/DITCHES
- CROSS SECTION

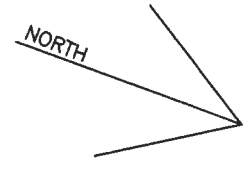
STABILITY

- EXTREMELY UNSTABLE
- UNSTABLE
- MODERATELY STABLE
- STABLE
- VERY STABLE



REACH B-4 - B-6

APPOX. SCALE: 1" = 2100'



LEGEND

- CARSON RIVER
- ROADS
- MAIN ROADS
- TRIBUTARY CHANNELS/DITCHES
- CROSS SECTION

STABILITY

- EXTREMELY UNSTABLE
- UNSTABLE
- MODERATELY UNSTABLE
- STABLE
- VERY STABLE

