Appendix G
Excess Transport Capacity Analysis

The availability and abundance of gravel or small cobble-sized material in the Upper Touchet basin plays a large role in the geomorphic processes that force bedforms, complexity, and connectivity. Through on-site assessment, it is clear that the reaches with ample gravel to small cobble-sized material, available throughout the reach, form pools at instream wood locations more easily, access the floodplain more frequently, and develop complex side channels and split flows. Many of these areas are associated with river avulsions or migrations shortly upstream, providing a potential source of these gravel-sized materials. However, for other reaches, as is often the case with confined and incised systems, the supply of material can become “locked” in the floodplain and is no longer accessed on a regular basis. The materials remaining in the channel bottom often represent lag deposits and collectively form an armor layer that resists pool formation and temporary sediment storage and facilitates high-energy flows through the reach. When this happens, a feedback loop of confinement and incision propagates and can extend downstream over time. Without human intervention or a large natural change, such as a large tree falling into the river and capturing additional wood and sediment, the dominant channel bed material becomes resistant to regularly occurring geomorphic change. With less frequent geomorphic change, the floodplain and the smaller material stored therein are accessed and mobilized less frequently, contributing to this feedback loop. The process of confinement often continues until a threshold and possibly catastrophic flow breaks the cycle.

One solution to this cycle is to provide another source of material that is sized to be frequently mobilized. This material can quickly cause localized geomorphic change, which in turn will release material “locked” in the floodplain and jumpstart the process of sediment transport and minor avulsions or migrations. For this reason, gravel augmentation is one of the restoration actions recommended in this assessment. However, to make decisions on the placement and amount of this restoration action, it is important to understand how the transport capacity of a reach might be different from other reaches in the basin. The following excess transport capacity analysis establishes a basin-wide trend in transport capacity based on the modeled shear stress and uses this trend to identify reaches of the basin where shear stress and transport capacity differ from the expectations for the basin. While this method does not determine what the transport capacity of a reach is, it can provide information about how the reach is different from other similar reaches in this basin, and provide enough clues for better recommendations for gravel augmentation and sediment transport continuity in general.

1.1 Analysis Overview

Shear stress has historically been used as a metric for understanding the bedload sediment transport capacity and potential for geomorphic change in a reach. Many commonly used transport models either use shear stress as a direct input or are indirectly related to shear stress (Wilcock 2001). For a full sediment transport model and detailed transport capacity information, the material size for each reach is usually required. Due to the large scale and scope of assessing the entire Touchet basin, this analysis does not include exact sediment size data. However, using shear stress information collected with a HEC-RAS 1D model, as well as general information about sediment sizes from field observations, trends and patterns for the basin can be determined and, taken over the whole basin, some information about the trends and patterns of the transport capacity in the basin can be inferred.

Shear stress (measured in pounds per foot*second [lb/ft^2]), is calculated in HEC-RAS as a product of hydraulic radius and friction slope and is used as a primary factor in many bedload transport equations (USACE 2016) and was chosen for this assessment as a representation of the bedload transport capacity of a reach. The 2-year event was chosen as the flow used for this analysis because it is the return flow in which geomorphic changes due to restoration efforts in this basin are expected to occur. Additionally, particular focus was placed on the 2-year flow event because it occurs more frequently than the 5-year flow event, and in reaches with process-based restoration efforts, immediate geomorphic response is desirable. This analysis and the associated prioritization focus on channel shear stress, which gives a better indication of the bedload transport capacity than total shear stress because vegetation and largely ineffective flow prevent most bedload transport on the floodplain. Finally, examining shear stress at a single cross section can display some statistical noise because the exact location of the cross sections may not fully capture the slope and confinement of the channel. Therefore, a length-weighted averaging method was required to determine a single shear stress value for each project area. The mechanisms of the shear stress averaging calculation are discussed in more detail in the following sections. This shear stress value will be referred to as the "modeled shear stress" for the purposes of this analysis.

These modeled shear stress values are only rough indicators of sediment transport, and these values only become useful when used to examine how they compare to large basin-wide trends. The primary factor that contributes to a reach naturally having higher transport capacity is the channel slope or valley slope. Reaches that are steeper, such as those generally seen in the upper portions of the basin, will naturally have more capacity for sediment transport regardless of external factors. Energy grade elevation is a HEC-RAS output that can be calculated for every cross section. The average grade slope was calculated for each project area, accounting for each cross section in a similar averaging method used for the modeled shear stress.

A relationship between energy grade slope and shear stress can be determined by plotting the average energy grade slope and average shear stress for each project area and fitting a regression line to the data. This regression line then represents the shear stress that the energy grade slopes indicate are normal for that reach; in this analysis this is called the "predicted shear stress."

This relationship is representative of how transport capacity changes throughout a river basin. In the upper reaches with higher slopes, sediment transport capacity will naturally be higher regardless of confinement or floodplain availability. However, moving further down the basin in areas such as the Lower North Fork or the Mainstem Touchet in general, which resides in the mostly flat Touchet Valley, the river will naturally have less capacity to transport material at a given flow. However, when the river in these areas is highly confined by levees or incision, slopes increase due to decreasing sinuosity and the stream power is more highly concentrated in one area, vastly increasing the sediment transport capacity of that reach. Therefore, the project areas that fall much higher than this relationship can be identified as having some external factor, such as confinement or lack of roughness, that is making sediment transport capacity higher than expected. Project areas that have higher transport capacity than they would naturally due to external confinement are highly likely to incise further, or reach bedrock or other transport resistant material, making restoration actions much more difficult.

The regression equation follows the power format described in Equation G-1. Because the Touchet basin spans a wide range of fluvial conditions in the different tributaries, forks, and mainstem, different regression equations were developed for each river in the basin. The details of those equations can be found in Table G-1. All of the rivers follow the format of a power law relationship shown in Equation G-1, with the exception of the North Fork, whose data better match an exponential relationship.

Equation G-1
Regression Equation for Predicted Shear

$$\tau_p = \mathrm{a}\, {S_{EG}}^{b}$$

where:

τ_p	=	Predicted shear stress
S_{EG}	=	Slope of the energy grade line
a, b	=	Coefficients that vary by river

Table G-1
Coefficients for Rivers in the Touchet Basin Following Equation G-1
(R^2 values represent the coefficient of determination)

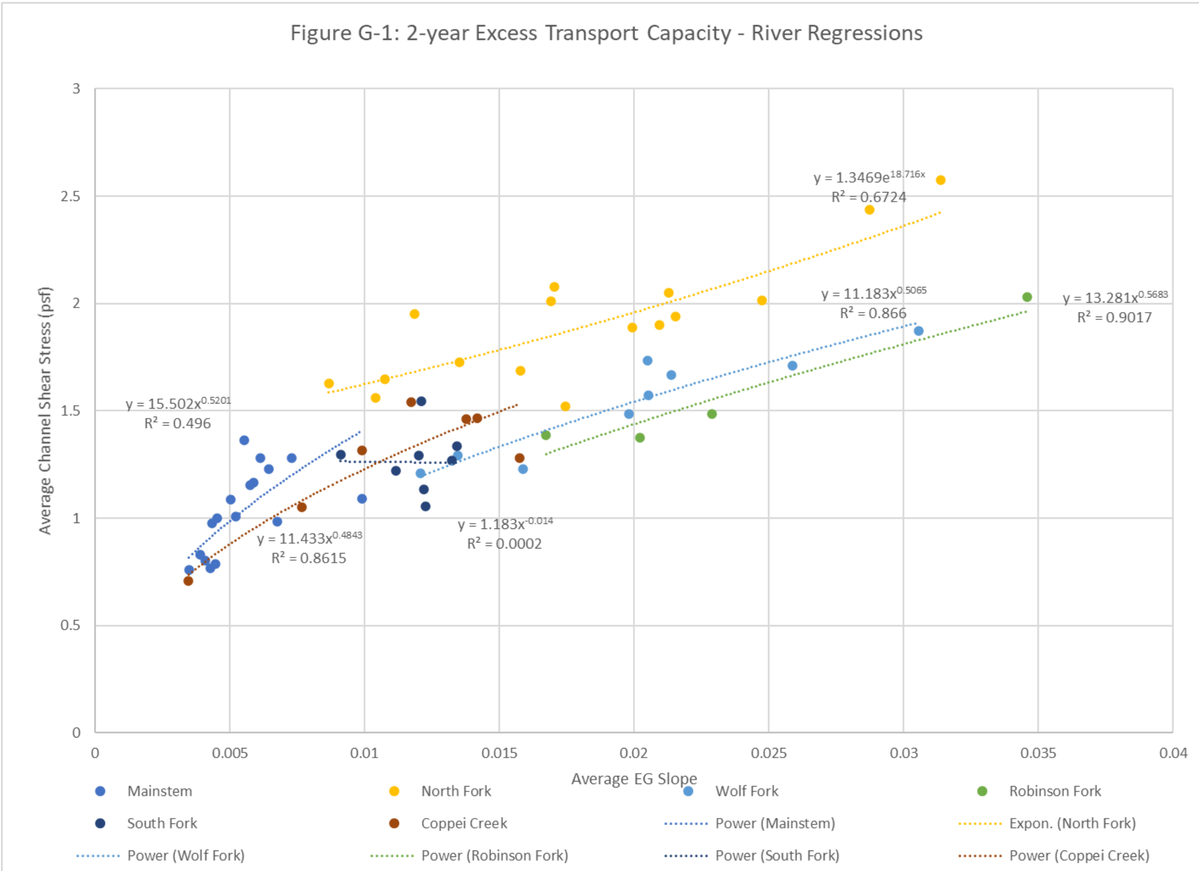
Location	a	b	R^2
Mainstem Touchet	15.502	0.5201	0.496
Coppei Creek	11.433	0.4843	0.8615
North Fork[1]	1.3469	18.716	0.6019
Wolf Fork	11.183	0.5065	0.866
Robinson Fork	13.281	0.5683	0.9017
South Fork	1.183	-0.014	0.0002[2]

Notes:

1. The North Fork data are better fit by an exponential relationship, which is reasonable considering the North Fork study area extends further into the headwaters than the other reaches and may have project areas with higher slopes and shear stresses. The equation format for this river is $\tau_{\mathrm{p}} = \mathrm{a}\, e^{(\mathrm{b}\ x\ S_{EG})}$.
2. The South Fork coefficient of determination shows almost no correlation. The South Fork project areas have energy grade slopes that remain similar for the length of the reach. Therefore, the near flat regression curve described above is consistent with the concept of the methodology and identifies reaches that are drastically larger or smaller than the expected value.

Figure G-1 shows the regression curves for each river and how it relates the average energy grade slope and shear stress for each project area. There are several plain outliers to these trends, as well as many other project areas that are significantly higher than the regression average. These outliers and high values are the project areas that have much more transport capacity than would be expected of a project area in the specific river in the Touchet basin with similar slopes. With this information, restoration actions that will account for this high transport capacity can be recommended for individual project areas, and basin-wide trends can be established for basin-wide actions such as gravel augmentation. These recommendations and how they affect individual project areas can be found in Appendix I, Prioritized Reaches.

Figure G-1
Modeled Shear Stress vs. Energy Grade Slope



Aside from graphically seeing how the outliers occur to the trends, numerical values for excess transport capacity were determined that describe the variance from this trend. Equation G-1 is used to determine a "predicted shear stress" value for each project area, predicted by the energy grade slopes and the relationship described in this regression equation. By differencing the modeled shear stress and the predicted shear stress, the variance from the regression equation can be determined as shown in Equation G-2. For a full list of the values of the modeled shear stress, predicted shear stress, energy grade slopes, and excess transport capacity, see Table G-4 at the end of this appendix.

Equation G-2

$$\text{ETC} = \tau_m - \tau_p$$

where:

ETC	=	Excess transport capacity
τ_m	=	Modeled shear stress
τ_p	=	Predicted shear stress

1.2 Bedload Transport Trends and Patterns

This section briefly describes some of the basin-wide trends and findings from the excess transport capacity analysis. This section references figures that are provided at the end of the appendix.

First, it should be noted that almost all project areas known to be highly confined will show high excess transport capacity. Examples include project areas MS-7, MS-8, MS-15, and MS-16, which are all behind the levees of Waitsburg and Dayton. Additionally, project areas NF-4, NF-7, and NF-9 all have significant levees or confinement. In the South Fork, SF-3 is noticeable for having a very large excess transport capacity and in fact is a highly confined reach that has incised to bedrock in many places. Channel confinement is a classic way of increasing the transport capacity in a reach. Straightening meanders, removing overbank flows and storage area, and decreasing roughness and complexity are all effects of channel confinement and causes of increased sediment transport. The reaches that will likely have a larger bed sediment size and be resistant to geomorphic change are exactly the type of reaches that need to be addressed with restoration strategies that are catered to reducing excess transport capacity.

Additionally, there are a few distinct groupings evident in Figure G-2. First, the Lower Mainstem Touchet up to the Waitsburg levee (MS-1 to MS-5) is below the expected transport capacity. These areas are generally less confined and have some channel migration corridors throughout. However, during field observations, there were some noted instances of channel confinements in the form of old push up berms or small levees and some incision. It should be considered that these project areas are being compared to the Upper Mainstem Touchet, which for the most part is much more highly confined. So, while these project areas are not fully unconfined, they are lesser confined sections of the Mainstem Touchet.

The second grouping to consider is the Upper Mainstem Touchet (MS-10 to MS-16). These areas almost all have some form of confinement, either leveed or extreme incision, as in the case of MS-10, which is deeply incised as it goes under Gallaher and Hogeye Road bridges. The exception to this trend is MS-14, which is the project area that borders the quarry on the right bank. This area was walked during field observations and was noted for having free lateral movement, multiple side channels, and a large (though poorly vegetated) active floodplain. These conditions are an outlier in the Upper Touchet but may be an indication for the kind of conditions this analysis is targeting. It should be noted that while MS-17 is behind the Dayton levee on the right bank, the left bank is not confined by the bedrock wall and later levee that confine the left bank of MS-16 and therefore does not show the excess transport capacity expected of a leveed reach.

1.3 Scoring for Prioritization

In order to fit analysis results into the prioritization process, each project area is ranked, classified, and scored in each of the three prioritization metrics (Complexity, Connectivity, and Excess Transport Capacity). Project areas are ranked in the Connectivity metric from best to worst based on the Excess Transport Capacity scores. Because different regression equations were used for each river, the Excess Transport Capacity metric should be comparable between reaches. Each project area then has a rank for the Excess Transport Capacity prioritization metric and can be classified and scored according to the classification and scoring systems outlined in Table G-2.

Table G-2
Excess Transport Capacity

Percentile Rank	Class	Class Score	Metric Score Threshold[1]	Class Conceptualization
90th to Top	1	5	0.031	These project areas have extremely high transport capacity for their slopes compared to what is typical in the basin, and restoration efforts. These project areas should be a primary target for restoration actions focused on sediment transport balance.
80th to 90th	2	3	0.01	Project areas in this class have significantly higher transport capacity than other project areas in this assessment. These project areas should be a secondary target for restoration actions focused on sediment transport balance.
43rd to 80th	3	1	0.00	Project areas in this class have only slightly higher transport capacity than would be expected, and sediment transport balance restoration actions should only be targeted when other restoration actions are already considered for the project area.
Bottom to 43rd	4	0	N/A	Projects areas in this class have a normal or less amount of transport capacity based on their slopes.

Notes:

1. This is the score that defines the lower limit for the corresponding classification for this metric. These data can be used to track progression of project areas and compare to how they would rank according to the levels of this assessment, as new restoration projects are completed and new data become available.

Similar to the Connectivity metric classifications, projects that rank highly in Excess Transport Capacity indicate that these are the project areas where the balance of sediment transport to slope is out of the ordinary. Therefore, project areas that rank high in the Excess Transport Capacity metric are those where efforts to balance sediment transport and remove confinement from the active channel migration area should be focused. The percentile rank where the classes change for the Excess Transport Capacity metric were chosen based on distinctive threshold values where the actual transport capacity score is much different from those ranked directly around it. Additionally, below 50% already indicates that the project area is at or below the transport capacity for the reach and will not require any restoration focused on restoring sediment transport balance.

1.4 Detailed Instructions for Performing this Analysis

Part of the purpose of this assessment is to define repeatable and data driven methods for assessing project areas and how they have progressed in relation to their goals. This section provides the detailed steps taken to perform the excess transport capacity analysis of the Touchet River so that these analyses can be repeated in the future for additional analyses and evaluation of progress. Table G-3 provides the data that will need to be collected to reassess the project areas for excess transport capacity.

Table G-3
Raw Data Needed to Perform Excess Transport Capacity Analysis

Data Needed	Used For	Source
Topography digital elevation model (DEM)	1D hydraulic modeling	LiDAR, preferably blue/green and 0.5-meter horizontal accuracy or greater
Hydrology	Flows used in hydraulic modeling	Hydrologic gage data[1]
Cross sectional shear stress and energy grade elevation	Modeled shear stress	1D hydraulic modeling results
Project area delineations	Calculation of the average model results per project area	Project area shapefiles from this assessment

Notes:
1. See Appendix C for a description of gage locations on the Touchet River, and methods used to interpret those data.

The following steps will assume the user has adequate GIS knowledge and access to the same data sources as those produced in this report.

Examining shear stress at a single cross section can display some statistical noise because the exact location of the cross sections may not fully capture the slope and confinement of the channel. Additionally, the shear stress at a single cross section represents only the channel configuration at that exact location and may vary quite a bit over the length of a project area. The simple solution to this is to take the average of the shear stresses at all cross sections in the project area. However, because the cross sections represent the shear stress at a given point, an averaging technique shown in Equation G-3 has been applied to each project area. Every pair of cross sections represents a length of channel between these two cross sections, so the shear stress over this length can be more accurately represented as the average of the upstream cross section and the downstream cross section, referred to here as the reach average shear stress. To find the average for a project area, each reach between a pair of cross sections in the project area were then averaged, and because not all cross sections are spaced evenly, these were weighted by length of each cross-sectional reach.

Equation G-3

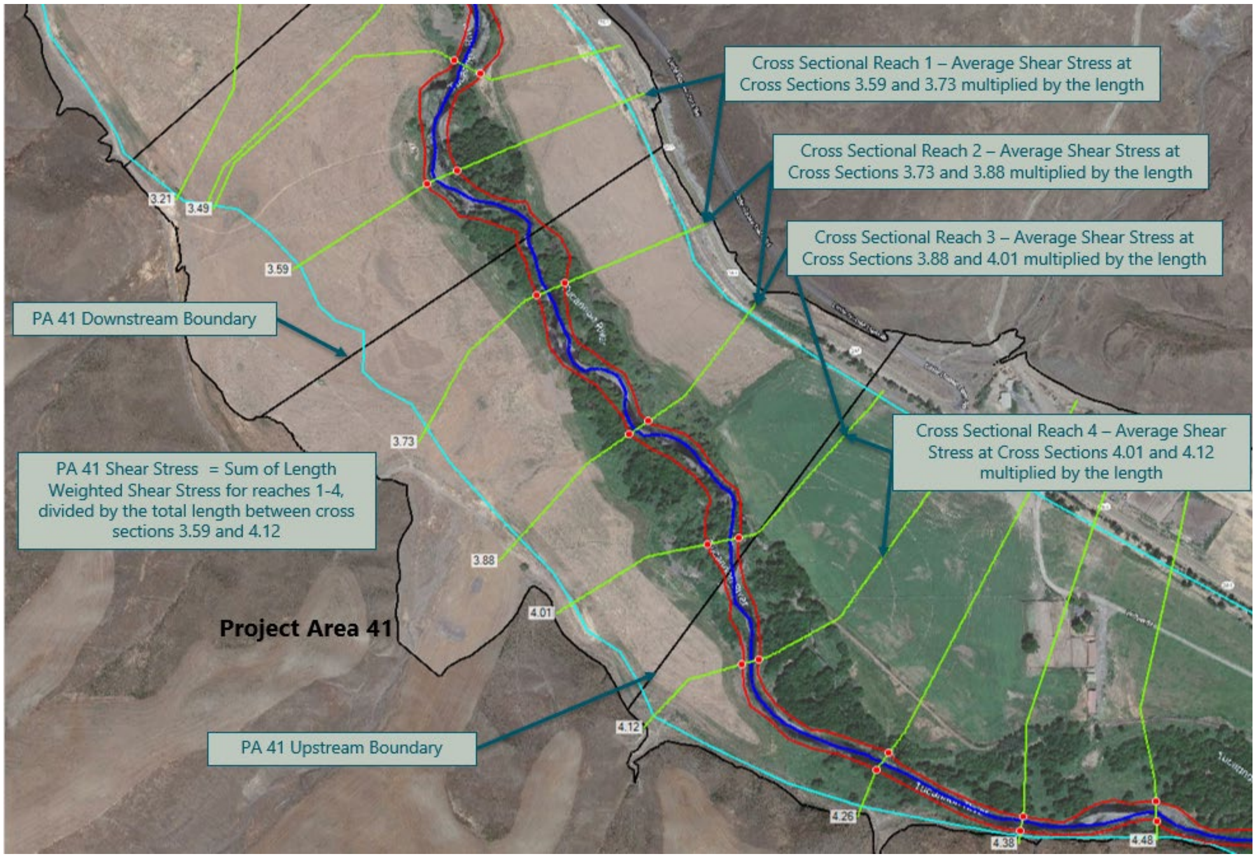
$$\tau_{a,b} = \sum_{a-1}^{b} (\tau_i + \tau_{i+1})\, L_{i,i+1} \Big/ \sum_{a-1}^{b} L_{i,i+1}$$

where:

$\tau_{a,b}$	=	The length weighted, reach average, shear stress of the project area *a,b*
i	=	The cross sections of the basin, where i=0 is the most downstream cross section in the basin and i=n is the most upstream cross section in the basin
τ_i	=	The shear stress at cross section i
$L_{i,i+1}$	=	The river length of the reach between cross sections i and $i+1$
a	=	The most downstream cross section of the project area
b	=	The most upstream cross section of the project area

Each project area takes the average from the first cross section downstream of the downstream project boundary to the cross section that exists just upstream of the upstream project boundary. This is necessary to account for all area in a project area because cross sections and project boundaries do not often coincide exactly and some portion of the first and cross-sectional reach would be excluded from the analysis. This has the effect of slightly more of the river length being factored into each project area average. However, since the upstream and downstream conditions do have some effect on the transport capacity of the reach, this possibly serves to make this reach estimate of shear stress more accurate. The final result is a model result-based shear stress value for each project area, which will be referred to as the modeled shear stress. This process of calculation is visually described in Figure G-3, which is taken from a different project where this same analysis was used (Anchor QEA 2020).

Figure G-3
Calculation of Length Weighted Reach Average Shear Stress



The average energy grade slope was calculated using the same array of cross sections, all of those that fall within the project area, as well as the cross sections immediately upstream and downstream. The energy grade elevation at each cross section at the upstream and downstream ends of the project area was differenced and divided by the total length to determine the energy grade slope for the project area.

This process was repeated for each distinct river included in the prioritization and listed in Table G-1. Distinct regression equations were found using Excel for each of the reaches and are listed in Table G-1. These equations were used to find the predicted shear for each project area. Finally, predicted shear was subtracted from modeled shear to find the excess transport capacity shown in Equation G-4 and as defined in the Geomorphic Assessment. Table G-4 lists the energy grade slope, modeled shear stress, predicted shear stress, and excess transport capacity for each project area.

Equation G-4

$$\text{ETC} = \tau_m - \tau_p$$

where:

ETC	=	Excess transport capacity
τ_m	=	Modeled shear stress
τ_p	=	Predicted shear stress

1.5 References

Anchor QEA, 2020. *Tucannon River Geomorphic Assessment and Habitat Prioritization.* Prepared for Columbia Conservation District, Draft In Review to be released September 2020.

USACE (U.S. Army Corps of Engineers), 2016. *HEC-RAS River Analysis System Hydraulic Reference Manual*. Version 5.0. CPD-69. February 2016. Available at: https://www.hec.usace.army.mil/software/hec-ras/documentation/HEC-RAS%205.0%20Reference%20Manual.pdf.

Wilcock, P.R., 2001. Toward a practical method for estimating sediment-transport rates in gravel-bed rivers. *Earth Surface Processes and Landforms* 26(13): 1395-1408.

Tables

Table G-4

Project Area Excess Transport Capacity Factors

Project Area	Max Discharge (cfs)	River Length (mi)	Length to US XS (mi)	Avg. Modeled Shear (psf)	Energy Grade Elevation (ft)	Avg. Energy Grade Slope (ft/ft)	Predicted Shear (psf)	ETC	Basin Rank
MS-1	2430	0.99	0.13	0.7571875	1024.46	0.003495333	0.8180053	-0.0608178	38
MS-2	2260	1.5	0.12	0.768641975	1057.54	0.004288253	0.909780792	-0.1411388	49
MS-3	2260	1.74	0.12	0.829408602	1093.98	0.003898868	0.865834419	-0.0364258	33
MS-4	2260	2.86	0.13	0.802274247	1154.49	0.004081154	0.886657683	-0.0843834	44
MS-5	2260	1.5	0.12	0.786296296	1190.45	0.004478816	0.930588584	-0.1442923	51
MS-6	2250	1.57	0.07	0.999695122	1227.92	0.004522358	0.935282963	0.0644122	19
MS-7	2050	1.42	0.12	0.975649351	1260.23	0.00435975	0.917638674	0.0580107	Not Ranked
MS-8	2050	0.74	0.13	1.087816092	1280.48	0.005041797	0.989697307	0.0981188	Not Ranked
MS-9	2050	1.25	0.12	1.007846715	1314.79	0.005214554	1.007192296	0.0006544	31
MS-10	1850	1.37	0.12	1.364463087	1355.66	0.005533099	1.038737085	0.325726	1
MS-11	1850	0.87	0.12	1.153434343	1383.16	0.005758341	1.060518867	0.0929155	12
MS-12	1850	1.24	0.12	1.165919118	1420.73	0.005897672	1.07378839	0.0921307	13
MS-13	1850	0.74	0.11	1.228	1446.27	0.006446078	1.124611102	0.1033889	11
MS-14	1850	1.62	0.12	0.984942529	1504.95	0.006764847	1.153200704	-0.1682582	52
MS-15	1850	1.37	0.12	1.279060403	1548.66	0.006127974	1.095396309	0.1836641	6
MS-16	1850	2.45	0.16	1.281417625	1645.54	0.007313073	1.200897949	0.0805197	Not Ranked
MS-17	1610	0.53	0	1.091981132	1673.25	0.009902087	1.405934884	-0.3139538	Not Ranked
C-1	441	0.96	0.12	0.707407407	1242.71	0.003470469	0.736156529	-0.0287491	Not Ranked
C-2	441	1.21	0.13	1.05119403	1291.3	0.007674695	1.081173266	-0.0299792	Not Ranked
C-3	441	1.24	0.13	1.316131387	1355.74	0.009916224	1.224026264	0.0921051	14
C-4	417	1.87	0.12	1.542487437	1471.9	0.011732907	1.327924393	0.214563	5
C-5	415	0.74	0.13	1.460114943	1522.37	0.013764803	1.434717903	0.025397	25
C-6	415	1	0.12	1.463705357	1595.47	0.014167343	1.454886724	0.0088186	29
C-7	415	0.99	0	1.281818182	1677.76	0.015742654	1.531105274	-0.2492871	54
NF-1	1200	0.48	0.12	1.626916667	1697.66	0.008671086	1.584222417	0.0426942	21
NF-2	1200	0.73	0.12	1.558941176	1738.48	0.01040107	1.636356416	-0.0774152	43
NF-3	1200	1.22	0.12	1.648208955	1807.39	0.010744573	1.646910447	0.0012985	30
NF-4	1200	0.97	0.12	1.952293578	1867.71	0.011858841	1.681616811	0.2706768	3
NF-5	1200	0.65	0.04	1.725797101	1906.92	0.013529315	1.735022381	-0.0092253	32
NF-6	727	1.26	0.13	1.687374101	2012.49	0.015798725	1.810303637	-0.1229295	46
NF-7	727	0.87	0.12	2.010808081	2089.49	0.016921105	1.848733956	0.1620741	8
NF-8	727	1.36	0.12	1.519662162	2213.15	0.017438319	1.866716927	-0.3470548	55

Table G-4
Project Area Excess Transport Capacity Factors

Project Area	Max Discharge (cfs)	River Length (mi)	Length to US XS (mi)	Avg. Modeled Shear (psf)	Energy Grade Elevation (ft)	Avg. Energy Grade Slope (ft/ft)	Predicted Shear (psf)	ETC	Basin Rank
NF-9	727	0.49	0.13	2.078145161	2258.09	0.017039345	1.8528297	0.2253155	4
NF-10	727	1.36	0.13	1.888724832	2401.46	0.019929581	1.955816385	-0.0670916	39
NF-11	607	0.74	0.13	2.05137931	2486.23	0.021270899	2.005536878	0.0458424	20
NF-12	607	0.75	0.12	1.898678161	2568.78	0.020940003	1.993154901	-0.0944767	45
NF-13	607	1.23	0.13	1.939448529	2707.49	0.021526849	2.015167198	-0.0757187	42
NF-14	467	0.74	0.13	2.013218391	2802.77	0.024749652	2.140458667	-0.1272403	48
NF-15	467	0.99	0.06	2.435904762	2943.33	0.028728355	2.305933416	0.1299713	10
NF-16	467	1.46	0	2.574006849	3185.32	0.031391397	2.423776931	0.1502299	9
WF-1	578	0.74	0.12	1.210406977	1961.38	0.012079369	1.194300851	0.0161061	26
WF-2	542	1.24	0.12	1.290441176	2049.2	0.013458111	1.261504391	0.0289368	24
WF-3	542	1.1	0.03	1.228938053	2125.69	0.015888978	1.372187423	-0.1432494	50
WF-4	349	0.86	0.13	1.666868687	2224.59	0.021395776	1.595399596	0.0714691	17
WF-5	349	0.74	0.13	1.485	2302.94	0.019799286	1.533950379	-0.0489504	37
WF-6	349	0.87	0.13	1.57195	2405.37	0.020518939	1.56194158	0.0100084	28
WF-7	349	1.07	0.13	1.733208333	2519.28	0.020503472	1.56134512	0.1718632	7
WF-8	349	0.62	0.12	1.708986486	2604.75	0.025882985	1.756912371	-0.0479259	36
WF-9	349	0.61	0	1.873278689	2703.21	0.030570045	1.911440512	-0.0381618	34
RF-1	257	0.72	0.11	1.385542169	2207.15	0.016735122	1.299328831	0.0862133	15
RF-2	233	0.58	0.12	1.3735	2269.08	0.020224567	1.446978058	-0.0734781	41
RF-3	233	0.67	0.12	1.484177215	2346.71	0.022902282	1.552922843	-0.0687456	40
RF-4	233	0.49	0	2.029387755	2436.22	0.034597248	1.963216033	0.0661717	18
SF-1	624	0.66	0.13	1.294493671	1705.29	0.00911728	1.26341675	0.0310769	23
SF-2	612	1.37	0.12	1.220637584	1785.69	0.0111717	1.259827473	-0.0391899	35
SF-3	612	1.24	0.12	1.543088235	1864.77	0.012122605	1.258387517	0.2847007	2
SF-4	612	1.36	0.13	1.132684564	1954.41	0.012207647	1.258264365	-0.1255798	47
SF-5	594	1.37	0.12	1.289966443	2039.95	0.012009355	1.258552883	0.0314136	22
SF-6	594	0.62	0.13	1.0558	2080.71	0.01225	1.258203356	-0.2024034	53
SF-7	530	1.24	0.13	1.26770073	2167.38	0.013247899	1.256824641	0.0108761	27
SF-8	530	1	0.12	1.333794643	2239.17	0.013441897	1.256568872	0.0772258	16

Notes:
cfs: cubic foot per second
ETC: excess transport capacity
ft: foot/feet
mi: mile
psf: pound per square foot
US XS: upstream cross section

Figures

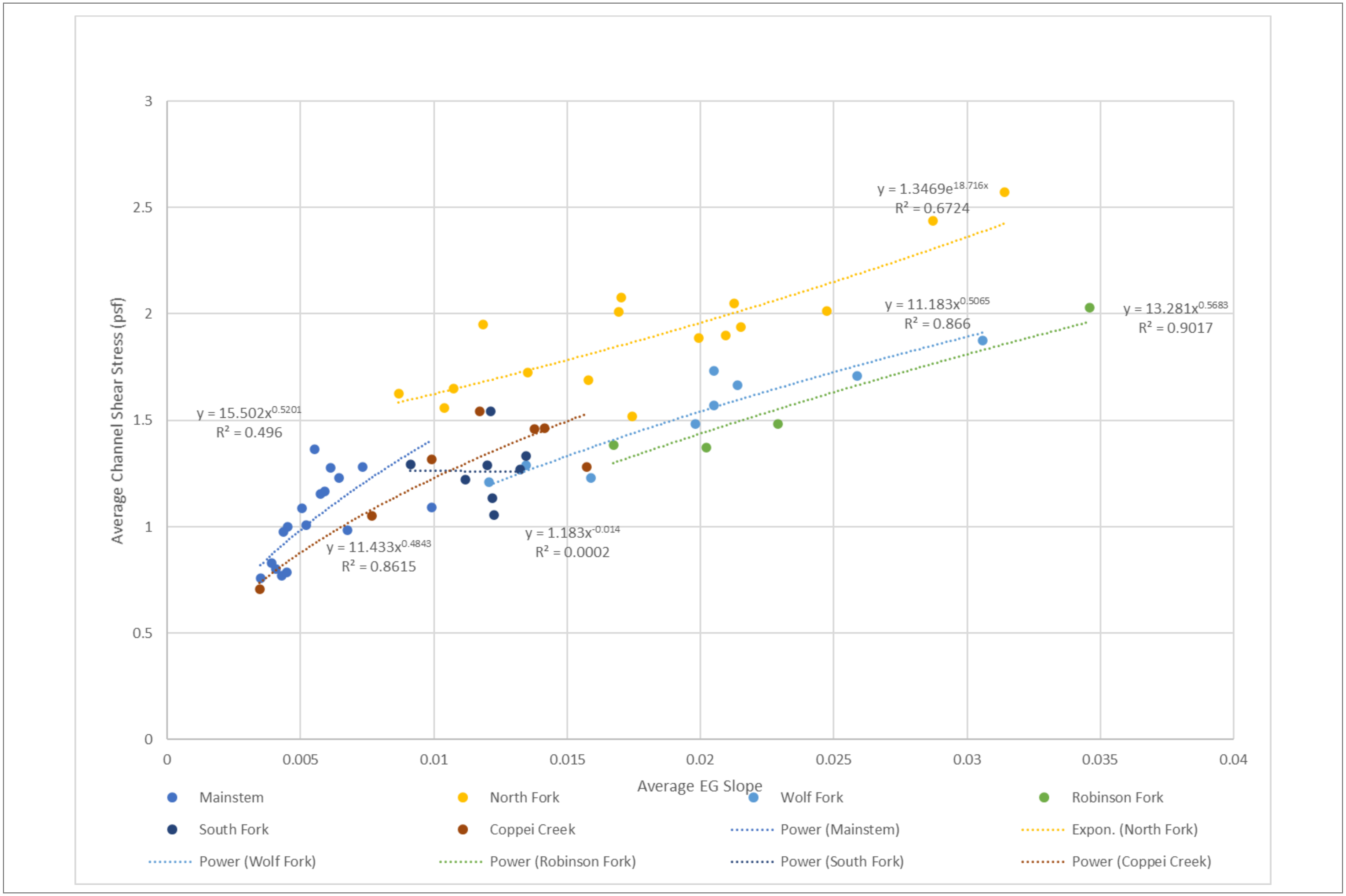


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Figure G-1
2-year Excess Transport Capacity River Regressions
Geomorphic Assessment and Restoration Prioritization
Upper Touchet Basin Habitat Restoration

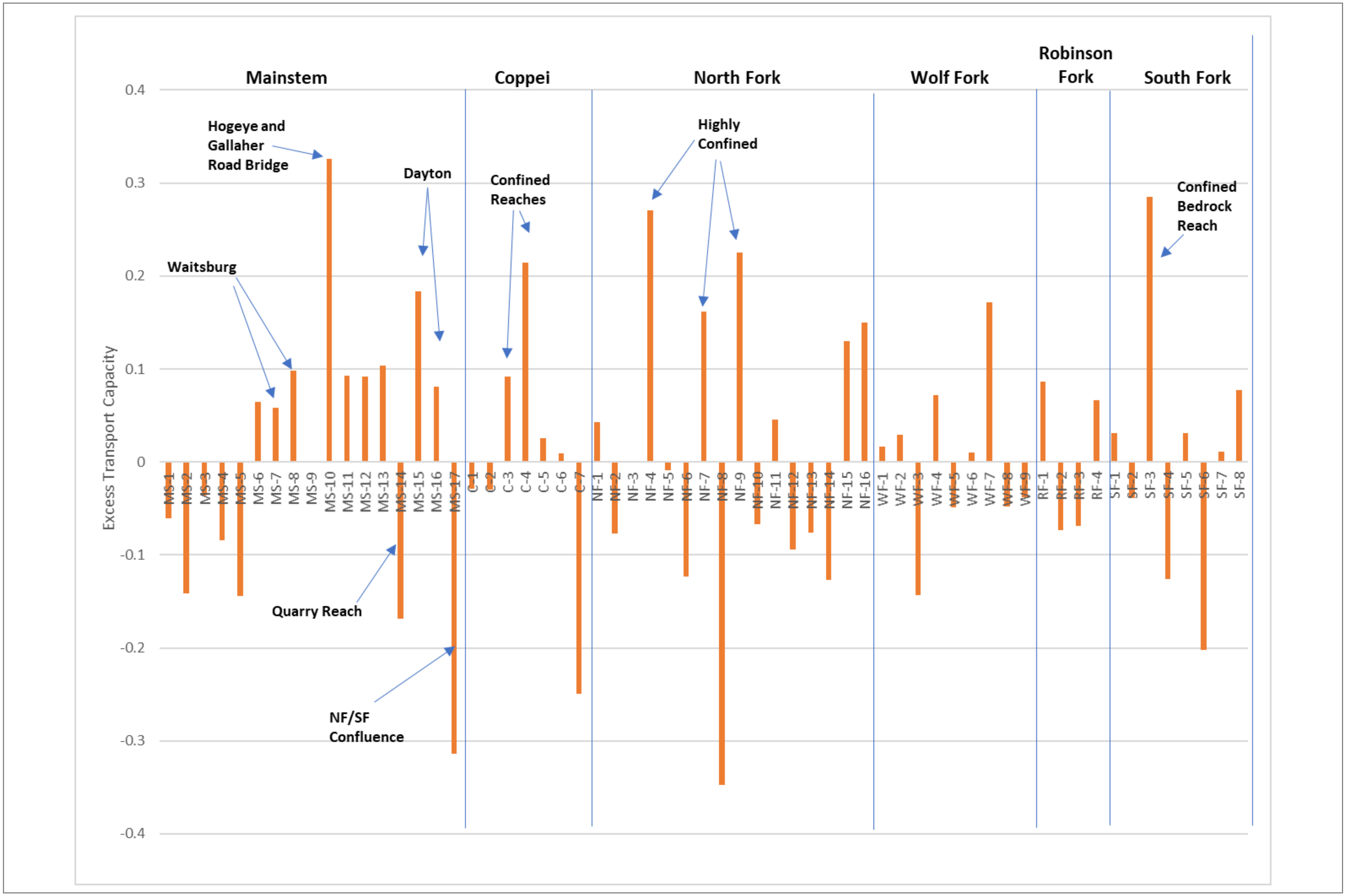

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Figure G-2
2-year Excess Transport Capacity River Regressions
Geomorphic Assessment and Restoration Prioritization
Upper Touchet Basin Habitat Restoration