Appendix E – EDT Products

Description of EDT Level 2 Environmental Attributes

Code	Correlate	Definition	Index Value 0	Index Value 1	Index Value 2	Index Value 3	Index Value 4
Alka	Alkalinity	Alkalinity, or acid neutralizing capacity (ANC), measured as milliequivalents per liter or mg/l of either HCO3 or CaCO3.	Very low (average value typically would be 0-5 mg/l)	Moderately low (average value typically would be 5-10 mg/l)	Moderately high (average value typically would be 10-40 mg/l)	High (average value typically would be 40-100 mg/l)	Very high (average value typically would be 100-300 mg/l)
BdScour	Bed scour	Average depth of bed scour in salmonid spawning areas (i.e., in pool-tailouts and small cobble-gravel riffles) during the annual peak flow event over approximately a 10-year period. The range of annual scour depth over the period could vary substantially. Particle sizes of substrate modified from Platts et al. (1983) based on information in Gordon et a. (1991): gravel (0.2 to 2.9 inch diameter), small cobble (2.9 to 5 inch diameter), large cobble (5 to 11.9 inch diameter), boulder (>11.9 inch diameter).	Average depth of scour >0 cm and <2 cm	Average depth of scour >2 cm and <10 cm	Average depth of scour >10 cm and <18 cm	Average depth of scour >18 cm and <24 cm	Average depth of scour >24 cm and <40 cm

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Code	Correlate	Definition	Index Value 0	Index Value 1	Index Value 2	Index Value 3	Index Value 4
BenComRch	Benthos diversity and production	Measure of the diversity and production of the benthic macroinvertebrate community. Three types of measures are given (choose one): a simple EPT count, Benthic Index of Biological Integrity (B-IBI)—a multimetric approach (Karr and Chu 1999), or a multivariate approach using the BORIS (Benthic evaluation of ORegon RIverS) model (Canale 1999). B-IBI rating definitions from Morley (2000) as modified from Karr et al. (1986). BORIS score definitions based on ODEQ protocols, after Barbour et al. (1994).	(1) Simple EPT index -- Macroinvertebrates abundant; multiple species of families Emphemeroptera, Plecoptera, and Trichoptera are present. OR (2) B-IBI (10 metrics) -- >=45Comparable to least disturbed reference condition; overall high taxa diversity, particularly of mayflies, stoneflies, caddisflies, long-lived clinger, and intolerant taxa. Relative abundance of predators high. OR (3) BORIS score -- Minimal impairment in benthic community — <1 standard deviation from the reference mean AND considered "ideal or good watershed and stream condition for reference condition."	(1) Simple EPT index -- Intermediate OR (2) B-IBI (10 metrics) -- >=37 and <45.Slightly divergent from least disturbed condition; absence of some long-lived and intolerant taxa; slight decline in richness of mayflies, stoneflies, and caddisflies; proportion of tolerant taxa increases. OR (3) BORIS score -- Minimal impairment in benthic community — <1 standard deviation from the reference mean AND considered "marginal watershed and stream condition for reference condition."	(1) Simple EPT index -- Macroinvertebrates common or abundant but 1-2 families among Emphemeroptera, Plecoptera, and Trichoptera are not present. OR (2) B-IBI (10 metrics) -- >=27 and <37.Total taxa reduced—particularly intolerant, long-lived, stonefly, and clinger taxa. Relative abundance of predator declines; proportion of tolerant taxa continues to increase. OR (3) BORIS score -- Moderate impairment in benthic community — >1 and <2 standard deviations from the reference mean.	(1) Simple EPT index -- Intermediate. OR (2) B-IBI (10 metrics) -- >=17 and <27.Overall taxa diversity depressed; proportion of predators greatly reduced as is long-lived taxa richness; few stoneflies or intolerant taxa present; dominance by three most abundant taxa often very high. OR (3) BORIS score -- Severe impairment in benthic community —>2 and <2.5 standard deviations from the reference mean.	(1) Simple EPT index -- Macroinvertebrates are present only at extremely low densities and/or biomass. OR (2) B-IBI (10 metrics) -- <17.Overall taxa diversity very low and dominated by a few highly tolerant taxa; mayfly, stonefly, caddisfly, clinger, long-lived and intolerant taxa largely absent. Relative abundance of predators very low. OR (3) BORIS score -- Extremely severe impairment in benthic community—>2.5 standard deviations from the reference mean.
ChLngth	Channel length	Length of the primary channel contained with the stream reach -- Note: this attribute will not be given by a categories but rather will be a point estimate. Length of channel is given for the main channel only--multiple channels do not add length.					

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Code	Correlate	Definition	Index Value 0	Index Value 1	Index Value 2	Index Value 3	Index Value 4
WidthMx	Channel width - month maximum width (ft)	Average width of the wetted channel during peak flow month (average monthly conditions). If the stream is braided or contains multiple channels, then the width would represent the sum of the wetted widths along a transect that extends across all channels. Note: Categories are not to be used for calculation of wetted surface area; categories here are used to designate relative stream size.	< 15 ft	> 15 ft and < 60 ft	> 60 ft and < 100 ft	> 100 ft and 360 ft	> 360 ft
WidthMn	Channel width - month minimum width (ft)	Average width of the wetted channel. If the stream is braided or contains multiple channels, then the width would represent the sum of the wetted widths along a transect that extends across all channels. Note: Categories are not to be used for calculation of wetted surface area; categories here are used to designate relative stream size.	< 15 ft	> 15 ft and < 60 ft	> 60 ft and < 100 ft	> 100 ft and 360 ft	> 360 ft

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Code	Correlate	Definition	Index Value 0	Index Value 1	Index Value 2	Index Value 3	Index Value 4
ConfineHdro	Confinement – Hydromodifica -tions	The extent that man-made structures within or adjacent to the stream channel constrict flow (as at bridges) or restrict flow access to the stream's floodplain (due to streamside roads, revetments, diking or levees) or the extent that the channel has been ditched or channelized, or has undergone significant streambed degradation due to channel incision/entrenchment (associated with the process called "headcutting"). Flow access to the floodplain can be partially or wholly cutoff due to channel incision. Note: Setback levees are to be treated differently than narrow-channel or riverfront levees--consider the extent of the setback and its effect on flow and bed dynamics and micro-habitat features along the stream margin in reach to arrive at rating conclusion. Reference condition for this attribute is the natural, undeveloped state.	The stream channel within the reach is essentially fully connected to its floodplain. Very minor structures may exist in the reach that do not result in flow constriction or restriction. Note: this describes both a natural condition within a naturally unconfined channel as well as the natural condition within a canyon.	Some portion of the stream channel, though less than 10% (of the sum of lengths of both banks), is disconnected from its floodplain along one or both banks due to man-made structures or ditching.	More than 10% and less than 40% of the entire length of the stream channel (sum of lengths of both banks) within the reach is disconnected from its floodplain along one or both banks due to man-made structures or ditching.	More than 40% and less than 80% of the entire length of the stream channel (sum of lengths of both banks) within the reach is disconnected from its floodplain along one or both banks due to man-made structures or ditching.	Greater than 80% of the entire length of the stream channel (sum of lengths of both banks) within the reach is disconnected from its floodplain along one or both banks due to man-made structures or ditching.

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Code	Correlate	Definition	Index Value 0	Index Value 1	Index Value 2	Index Value 3	Index Value 4
Confine	Confinement - natural	The extent that the valley floodplain of the reach is confined by natural features. It is determined as the ratio between the width of the valley floodplain and the bankful channel width. Note: this attribute addresses the natural (pristine) state of valley confinement only.	Reach mostly unconfined by natural features -- Average valley width > 4 channel widths.	Reach comprised approximately equally of unconfined and moderately confined sections.	Reach mostly moderately confined by natural features -- Average valley width 2 - 4 channel widths.	Reach comprised approximately equally of moderately confined and confined sections.	Reach mostly confined by natural features -- Average valley width < 2 channel widths.
DisOxy	Dissolved oxygen	Average dissolved oxygen within the water column for the specified time interval.	> 8 mg/L (allows for all biological functions for salmonids without impairment at temperatures ranging from 0-25 C)	> 6 mg/L and < 8 mg/L (causes initial stress symptoms for some salmonids at temperatures ranging from 0-25 C)	> 4 and < 6 mg/L (stress increased, biological function impaired)	> 3 and < 4 mg/L (growth, food conversion efficiency, swimming performance adversely affected)	< 3 mg/L
Emb	Embeddedness	The extent that larger cobbles or gravel are surrounded by or covered by fine sediment, such as sands, silts, and clays. Embeddedness is determined by examining the extent (as an average %) that cobble and gravel particles on the substrate surface are buried by fine sediments. This attribute only applies to riffle and tailout habitat units and only where cobble or gravel substrates occur.	< 10% of surface covered by fine sediment	> 10 and < 25 % covered by fine sediment	> 25 and < 50 % covered by fine sediment	> 50 and < 90 % covered by fine sediment	> 90% covered by fine sediment

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Code	Correlate	Definition	Index Value 0	Index Value 1	Index Value 2	Index Value 3	Index Value 4
FnSedi	Fine sediment	Percentage of fine sediment within salmonid spawning substrates, located in pool-tailouts, glides, and small cobble-gravel riffles. Definition of "fine sediment" here depends on the particle size of primary concern in the watershed of interest. In areas where sand size particles are not of major interest, as they are in the Idaho Batholith, the effect of fine sediment on egg to fry survival is primarily associated with particles <1mm (e.g., as measured by particles <0.85 mm). Sand size particles (e.g., <6 mm) can be the principal concern when excessive accumulations occur in the upper stratum of the stream bed (Kondolf 2000). See guidelines on possible benefits accrued due to gravel cleaning by spawning salmonids.	Particle sizes <0.85 mm: < 6% OR Particle sizes <6.3 mm: <10%	Particle sizes <0.85 mm: > 6% and < 11% OR Particle sizes <6.3 mm: >10% and <25%	Particle sizes <0.85 mm: > 11% and < 18% OR Particle sizes <6.3 mm: >25% and <40%	Particle sizes <0.85 mm: > 18% and < 30% OR Particle sizes <6.3 mm: >40% and <60%	Particle sizes <0.85 mm: > 30% fines OR Particle sizes <6.3 mm: >60%
FshComRch	Fish community richness	Measure of the richness of the fish community (no. of fish taxa, i.e., species).	2 or fewer fish taxa	3-7 fish taxa	8-17 fish taxa	18-25 fish taxa	> 25 fish taxa

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FshPath	Fish pathogens	The presence of pathogenic organisms (relative abundance and species present) having potential for affecting survival of stream fishes.	No historic or recent fish stocking in drainage and no known incidences of whirling disease, C. shasta, IHN, or IPN	Historic fish stocking, but no fish stocking records within the past decade, or sockeye population currently existing in drainage, or known incidents of viruses among kokanee populations within the watershed.	On-going periodic, frequent, or annual fish stocking in drainage or known viral incidents within sockeye, chinook, or steelhead populations in the watershed.	Operating hatchery within the reach or in the reach immediately downstream or upstream	Known presence of whirling disease or C. shasta within the watershed.
FSpIntro	Fish species introductions	Measure of the richness of the fish community (no. of fish taxa). Taxa here refers to species.	No non-native species reported or known to be in the sub-drainage of interest.	1-2 non-native species reported or known to be in the sub-drainage of interest.	3-7 non-native species reported or known to be in the sub-drainage of interest.	8-14 non-native species reported or known to be in the sub-drainage of interest.	15 or more non-native species reported or known to be in the sub-drainage of interest.

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FlwHigh	Flow - change in average annual peak flow	The extent of relative change in average peak annual discharge compared to an undisturbed watershed of comparable size, geology, orientation, topography, and geography (or as would have existed in the pristine state). Evidence of change in peak flow can be empirical where sufficiently long data series exists, can be based on indicator metrics (such as T_{Qmean}, see Konrad [2000]), or inferred from patterns corresponding to watershed development. Relative change in peak annual discharge here is based on changes in the peak annual flow expected on average once every two years (Q_{2yr}).	Peak annual flows expected to be strongly reduced relative to an undisturbed watershed of similar size, geology, orientation, topography, and geography (or the pristine state for the watershed of interest); OR >40% and <100% decrease in Q_{2yr} based on a long time series (~40 yrs or longer with at least 20 yrs pertaining to a watershed development state) or as known by regulated flow levels. This condition is associated with flow regulation or water diversion projects.	Peak annual flows expected to be moderately reduced relative to an undisturbed watershed of similar size, geology, orientation, topography, and geography (or the pristine state for the watershed of interest); OR >20% and <40% decrease in Q_{2yr} based on a long time series (~40 yrs or longer with at least 20 yrs pertaining to a watershed development state) or as known by regulated flow levels. This condition is associated with flow regulation or water diversion projects.	Peak annual flows expected to be comparable to an undisturbed watershed of similar size, geology, orientation, topography, and geography (or the pristine state for the watershed of interest); OR <20% change in Q_{2yr} based on a long time series (~40 yrs or longer with at least 20 yrs pertaining to a watershed development state); OR <5% reduction in average T_{Qmean} compared to the undeveloped watershed state.	Peak annual flows expected to be moderately increased relative to an undisturbed watershed of similar size, geology, orientation, topography, and geography (or the pristine state for the watershed of interest); OR >20% and <40% increase in Q_{2yr} based on a long time series (~40 yrs or longer with at least 20 yrs pertaining to a watershed development state); OR >5% and <15% reduction in average T_{Qmean} compared to the undeveloped watershed state. This condition exemplified in some forested watersheds with high road density that experience significant rain on snow events, as the North Fork Stillaguamish River (Pess et al. *in review*). Note: many managed forested watersheds in the Pacific Northwest exhibit slight, if any, increases in peak annual flows since logging commenced (see Ziemer and Lisle 1998).	Peak annual flows expected to be strongly increased relative to an undisturbed watershed of similar size, geology, orientation, topography, and geography (or the pristine state for the watershed of interest); OR >40% and <110%+ increase in Q_{2yr} based on a long time series (~40 yrs or longer with at least 20 yrs pertaining to a watershed development state); OR >15% and <45% reduction in average T_{Qmean} compared to the undeveloped watershed state. This condition exemplified in watersheds with significant urbanization (e.g., >20%).

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FlwLow	Flow - change in average annual low flow	The extent of relative change in average daily flow during the normal low flow period compared to an undisturbed watershed of comparable size, geology, and flow regime (or as would have existed in the pristine state). Evidence of change in low flow can be empirically-based where sufficiently long data series exists, or known through flow regulation practices, or inferred from patterns corresponding to watershed development. Note: low flows are not systematically reduced in relation to watershed development, even in urban streams (Konrad 2000). Factors affecting low flow are often not obvious in many watersheds, except in clear cases of flow diversion and regulation.	Average daily low flows expected to be strongly increased compared to an undisturbed watershed of similar size, geology, and flow regime (or the pristine state for the watershed of interest); OR >75% increase in the 45 or 60-day consecutive lowest average daily flow on a sufficiently long time series (~40 yrs or longer with at least 20 yrs pertaining to a watershed development state) or as known through flow regulation.	Average daily low flows expected to be moderately increased compared to an undisturbed watershed of similar size, geology, and flow regime (or the pristine state for the watershed of interest); OR >20% and <75% increase in the 45 or 60-day consecutive lowest average daily flow on a sufficiently long time series (~40 yrs or longer with at least 20 yrs pertaining to a watershed development state) or as known through flow regulation.	Average daily low flows expected to be comparable to an undisturbed watershed of similar size, geology, and flow regime (or the pristine state for the watershed of interest); OR <20% change in the 45 or 60-day consecutive lowest average daily flow on a sufficiently long time series (~40 yrs or longer with at least 20 yrs pertaining to a watershed development state).	Average daily low flows expected to be moderately reduced compared to an undisturbed watershed of similar size, geology, and flow regime (or the pristine state for the watershed of interest); OR >20% and <50% reduction in the 45 or 60-day consecutive lowest average daily flow on a sufficiently long time series (~40 yrs or longer with at least 20 yrs pertaining to a watershed development state) or as known through flow regulation.	Average daily low flows expected to be severely reduced compared to an undisturbed watershed of similar size, geology, and flow regime (or the pristine state for the watershed of interest); OR >50% and <=100% reduction in the 45 or 60-day consecutive lowest average daily flow on a sufficiently long time series (~40 yrs or longer with at least 20 yrs pertaining to a watershed development state) or as known through flow regulation.

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FlwDielVar	Flow - Intra daily (diel) variation	Average diel variation in flow level during a season or month. This attribute is informative for rivers with hydroelectric projects or in heavily urbanized drainages where storm runoff causes rapid changes in flow.	Essentially no variation in discharge during an average 24-hr period during season or month. This characterizes conditions not influenced by flow ramping or accelerated storm runoff. This rating also would apply to small suburban-urbanized drainages with impervious surfaces of <10% in high rainfall climates (e.g., Puget Lowlands) and with little or no flow detention systems in place.	Slight to low variation in flow stage during an average 24-hr period during season or month. This pattern typical of routine (everyday) slight to low ramping condition associated with flow regulation, averaging <2 inches change in stage per hour. This condition has both slight to low rates of change in flow and high frequency with which it occurs. This rating also would apply to small suburban-urbanized drainages with impervious surfaces of ~10-25% in high rainfall climates (e.g., Puget Lowlands) and with little or no flow detention systems in place.	Low to moderate variation in flow stage during an average 24-hr period during season or month. This pattern typical of routine (everyday) low to moderate ramping condition associated with flow regulation, averaging >2 inches and <6 inches change in stage per hour. This condition has both moderate to high rates of change in flow and high frequency with which it occurs. This rating also would apply to small suburban- urbanized drainages with impervious surfaces of ~25-40% in high rainfall climates (e.g., Puget Lowlands) and with little or no flow detention systems in place.	Moderate to high variation in flow stage during an average 24-hr period during season or month. This pattern typical of routine (everyday) moderate to high ramping condition associated with flow regulation, averaging between 6 inches to 12 inches change in stage per hour. This condition has both moderate to high rates of change in flow and high frequency with which it occurs. This rating also would apply to small suburban to urbanized drainages with impervious surfaces of ~40-50% in high rainfall climates (e.g., Puget Lowlands) and with little or no flow detention systems in place.	Extreme variation in flow stage during an average 24-hr period during season or month. This pattern typical of routine (everyday) extreme ramping condition associated with flow regulation, averaging between 12 inches to 24 inches change in stage per hour. This condition is both extreme in the rate of change in flow and the frequency with which it occurs. This rating would apply to small, heavily urbanized drainages with impervious surfaces of 50-80% in high rainfall climates (e.g., Puget Lowlands) and with little or no flow detention systems in place.

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FlwIntraAnn	Flow - intra-annual flow pattern	The average extent of intra-annual flow variation during the wet season -- a measure of a stream's "flashiness" during storm runoff. Flashiness is correlated with % total impervious area and road density, but is attenuated as drainage area increases. Evidence for change can be empirically derived using flow data (e.g., using the metric T_{Qmean}, see Konrad [2000]), or inferred from patterns corresponding to watershed development.	Storm runoff response (rates of change in flow) expected to be slowed greatly relative to an undisturbed watershed of similar size, geology, orientation, topography, and geography (or the pristine state for the watershed of interest); OR >15% increase in average T_{Qmean} compared to the undeveloped watershed state or as known by regulated flow levels. This condition is associated with flow regulation.	Storm runoff response (rates of change in flow) expected to be moderately slower relative to an undisturbed watershed of similar size, geology, orientation, topography, and geography (or the pristine state for the watershed of interest); OR >5% and <15% increase in average T_{Qmean} compared to the undeveloped watershed state or as known by regulated flow levels. This condition is associated with flow regulation.	Storm runoff response (rates of change in flow) comparable to an undisturbed watershed of similar size, geology, orientation, topography, and geography (or the pristine state for the watershed of interest); OR <5% reduction in average T_{Qmean} compared to the undeveloped watershed state.	Storm runoff response (rates of change in flow) expected to be moderately increased relative to an undisturbed watershed of similar size, geology, orientation, topography, and geography (or the pristine state for the watershed of interest); OR >5% and <15% reduction in average T_{Qmean} compared to the undeveloped watershed state. This condition exemplified in some managed forested watersheds with high road density, likely most evident in small drainages.	Storm runoff response (rates of change in flow) expected to be strongly increased relative to an undisturbed watershed of similar size, geology, orientation, topography, and geography (or the pristine state for the watershed of interest); OR >15% and <45% reduction in average T_{Qmean} compared to the undeveloped watershed state. This condition exemplified in watersheds with significant urbanization.
Grad	Gradient	Average gradient of the main channel of the reach over its entire length. Note: Categorical levels are shown here but values are required to be input as point estimates for each reach.	0 - 0.1%	>0.10% and <0.5%	>0.5% and <1%	>1% and <2%	>2% and <4%
HbBckPls	Habitat type - backwater pools	Percentage of the wetted channel surface area comprising backwater pools.	0 - <0.25% of wetted surface area encompasses this habitat type	>0.25% and <5% of wetted surface area encompasses this habitat type	>5% and <25% of wetted surface area encompasses this habitat type	>25% and <50% of wetted surface area encompasses this habitat type	>50% of wetted surface area encompasses this habitat type

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HbBvrPnds	Habitat type - beaver ponds	Percentage of the wetted channel surface area comprising beaver ponds. Note: these are pools located in the main or side channels, not part of off-channel habitat.	0 - <0.25% of wetted surface area encompasses this habitat type	>0.25% and <5% of wetted surface area encompasses this habitat type	>5% and <25% of wetted surface area encompasses this habitat type	>25% and <50% of wetted surface area encompasses this habitat type	>50% of wetted surface area encompasses this habitat type
HbGlide	Habitat type - glide	Percentage of the wetted channel surface area comprising glides. Note: There is a general lack of consensus regarding the definition of glides (Hawkins et al. 1993), despite a commonly held view that it remains important to recognize a habitat type that is intermediate between pool and riffle. The definition applied here is from the ODFW habitat survey manual (Moore et al. 1997): an area with generally uniform depth and flow with no surface turbulence, generally in reaches of <1% gradient. Glides may have some small scour areas but are distinguished from pools by their overall homogeneity and lack of structure. They are generally deeper than riffles with few major flow obstructions and low habitat complexity.	0 - <0.25% of wetted surface area encompasses this habitat type	>0.25% and <5% of wetted surface area encompasses this habitat type	>5% and <25% of wetted surface area encompasses this habitat type	>25% and <50% of wetted surface area encompasses this habitat type	>50% of wetted surface area encompasses this habitat type

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HbLrgCbl	Habitat type - large cobble/boulder riffles	Percentage of the wetted channel surface area comprising large cobble/boulder riffles. Particle sizes of substrate modified from Platts et al. (1983) based on information in Gordon et a. (1991): gravel (0.2 to 2.9 inch diameter), small cobble (2.9 to 5 inch diameter), large cobble (5 to 11.9 inch diameter), boulder (>11.9 inch diameter).	0 - <0.25% of wetted surface area encompasses this habitat type	>0.25% and <5% of wetted surface area encompasses this habitat type	>5% and <25% of wetted surface area encompasses this habitat type	>25% and <50% of wetted surface area encompasses this habitat type	>50% of wetted surface area encompasses this habitat type
HbOfChFctr	Habitat type - off-channel habitat factor	A multiplier used to estimate the amount of off-channel habitat based on the wetted surface area of the all combined in-channel habitat.	No off-channel habitat present	>0 X and < 0.05 X	>0.05 X and < 0.25 X	>0.25 X and < 0.5 X	>0.5 X
HbPlTails	Habitat type - pool tailouts.	Percentage of the wetted channel surface area comprising pool tailouts.	0 - <0.25% of wetted surface area encompasses this habitat type	>0.25% and <5% of wetted surface area encompasses this habitat type	>5% and <25% of wetted surface area encompasses this habitat type	>25% and <50% of wetted surface area encompasses this habitat type	>50% of wetted surface area encompasses this habitat type
HbPls	Habitat type - primary pools	Percentage of the wetted channel surface area comprising pools, excluding beaver ponds	0 - <0.25% of wetted surface area encompasses this habitat type	>0.25% and <5% of wetted surface area encompasses this habitat type	>5% and <25% of wetted surface area encompasses this habitat type	>25% and <50% of wetted surface area encompasses this habitat type	>50% of wetted surface area encompasses this habitat type

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HbSmlCbl	Habitat type - small cobble/gravel riffles	Percentage of the wetted channel surface area comprising small cobble/gravel riffles. Particle sizes of substrate modified from Platts et al. (1983) based on information in Gordon et a. (1991): gravel (0.2 to 2.9 inch diameter), small cobble (2.9 to 5 inch diameter), large cobble (5 to 11.9 inch diameter), boulder (>11.9 inch diameter).	0 - <0.25% of wetted surface area encompasses this habitat type	>0.25% and <5% of wetted surface area encompasses this habitat type	>5% and <25% of wetted surface area encompasses this habitat type	>25% and <50% of wetted surface area encompasses this habitat type	>50% of wetted surface area encompasses this habitat type
Harass	Harassment	The relative extent of poaching and/or harassment of fish within the stream reach.	Reach is distant from human population centers, no road access or no local concentration of human activity.	Reach is distant from human population centers, but with partial road access or little local concentration of human activity.	Reach is near human population center, but has limited public access (through roads or boat launching sites).	Extensive road and/or boat access to the reach with localized concentrations of human activity.	Reach is near human population center or has extensive recreational activities, and has extensive road access and/or opportunities for boat access.
HatFOutp	Hatchery fish outplants	The magnitude of hatchery fish outplants made into the drainage over the past 10 years. Note: Enter specific hatchery release numbers if the data input tool allows. "Drainage" here is defined loosely as being approximately the size that encompasses the spawning distribution of recognized populations in the watershed.	No stocking records in the past decade.	No more than two instances of fish releases in the past decade in the drainage.	Fish releases made into the drainage every 1-3 years at isolated locations within the drainage.	Fish releases made at multiple sites in the drainage, but only in 1-3 years during the past decade. When the species released is the same as focus species, chance for some superimposition can occur here.	Fish releases made every 1-3 years and at multiple sites in the drainage. When the species released is the same as focus species, superimposition can occur here.

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HydroRegime Natural	Hydrologic regime - natural	The natural flow regime within the reach of interest. Flow regime typically refers to the seasonal pattern of flow over a year; here it is inferred by identification of flow sources. This applies to an unregulated river or to the pre-regulation state of a regulated river.	Groundwater-source-dominated; strongly buffered peak flows (as in a springbrook or in river like the Metolius in central Oregon)	Spring snowmelt dominated, non-glacial; temporally consistent and moderate peak and low flows	Rain-on-snow transitional; consistent spring peak and low flows with inconsistent and flashy winter or early spring rain-on-snow peaks	Rainfall-dominated; flashy winter and early spring peaks, consistently low summer flows and variable spring and fall flows.	Glacial runoff system; high, turbid low flows, generally buffered peak flows except with occasional outburst floods and infrequent rain-on-snow events
HydroRegime Reg	Hydrologic regime - regulated	The change in the natural hydrograph caused by the operation of flow regulation facilities (e.g., hydroelectric, flood storage, domestic water supply, recreation, or irrigation supply) in a watershed. Definition does not take into account daily flow fluctuations (See Flow-Intra-daily variation attribute).	No artificial flow regulation occurs upstream to affect hydrograph.	Project operations have not changed median flows between months or season as the project is operated as a run-of-river facility, or project storage is < 15 days of the annual mean daily flow of the river.	Project operations have not changed median flows between months or season as the project is operated as a run-of-river facility, or project storage is > 15 and < 30-days of the annual mean daily flow of the river.	Project operations have resulted in a measurable shift in median flows between months or seasons. The project provides limited flood control during periods of high run-off (winter or spring). The project's reservoir is operated each year to store more than 30 but less than 60-days of the annual mean daily flow of the river.	Project operations have resulted in a major shift in median flows between months or seasons. The project is operated to provide significant flood control during high run-off periods (winter or spring). The project's reservoir is operated each year to store more than 60-days of the annual mean daily flow of the river.
Icing	Icing	Average extent (magnitude and frequency) of icing events over a 10-year period. Icing events can have severe effects on the biota and the physical structure of the stream in the short-term. It is recognized that icing events can under some conditions have long-term beneficial effects to habitat structure.	Anchor ice and icing events do not occur.	Some anchor ice may occur infrequently, having little or no impact to physical structure of stream, in-stream structure, and stream banks/bed.	Likelihood for some anchor ice and/or icing events is moderate to high each year and effects on stream, in-stream structure, and stream banks/beds is considered low to moderate.	Likelihood for anchor ice and/or icing events is high each year, having effects on stream, in-stream structure, and stream banks/beds that differ widely within the reach--from low to high across the reach.	Likelihood of severe anchor ice or overbank ice jams is high each year, having major and extensive effects on stream, in-stream structure, and stream banks across the reach.

Description of EDT Level 2 Environmental Attributes

Code	Correlate	Definition	Index Value 0	Index Value 1	Index Value 2	Index Value 3	Index Value 4
MetWatCol	Metals - in water column	The extent of dissolved heavy metals within the water column.	No toxicity expected due to dissolved heavy metals to salmonids under prolonged exposure (1 month exposure assumed).	May exert some low level chronic toxicity to salmonids (1 month exposure assumed).	Consistently chronic toxicity expected to salmonids(1 month exposure assumed).	Usually acutely toxic to salmonids (1 month exposure assumed).	Always acutely toxic to salmonids (1 month exposure assumed).
MetSedSls	Metals/Pollutants - in sediments/soils	The extent of heavy metals and miscellaneous toxic pollutants within the stream sediments and/or soils adjacent to the stream channel.	Metals/pollutants at natural (background) levels with no or negligible effects on benthic dwelling organisms or riparian vegetation (under continual exposure).	Deposition of metals/pollutants in low concentrations such that some stress symptoms occur to benthic dwelling organisms or riparian vegetation root/shoot growth is impaired (under continual exposure).	Stress symptoms increased or biological functions moderately impaired to benthic dwelling organisms; or few areas within the riparian zone present where no vegetation exists (slickens); ecotonal to these areas occupied only by tolerant species; horizons containing metals/pollutant concentrations influencing root growth and composition are common within the riparian corridor.	Growth, food conversion, reproduction, or mobility of benthic organisms severely affected; or large areas of the riparian zone devoid of vegetation; ecotonal areas occupied only by metals/pollutant-tolerant species; few areas in the riparian zones which are unaffected.	Metals/pollutant concentrations in sediments/soils are lethal to large numbers of the benthic species and/or riparian zone is practically devoid of vegetation.
MscToxWat	Miscellaneous toxic pollutants - water column	The extent of miscellaneous toxic pollantants (other than heavy metals) within the water column.	No substances present that may periodically be at or near chronic toxicity levels to salmonids.	One substance present that may only periodically rise to near chronic toxicity levels (may exert some chronic toxicity) to salmonids.	More than one substance present that may periodically rise to near chronic toxicity levels or one substance present > chronic threshold and < acute threshold (consistently chronic toxicity) to salmonids.	One or more substances present > acute toxicity threshold but < 3X acute toxicity threshold (usually acutely toxic) to salmonids.	One or more substances present with > 3X acute toxicity (always acutely toxic) to salmonids.

Description of EDT Level 2 Environmental Attributes

Code	Correlate	Definition	Index Value 0	Index Value 1	Index Value 2	Index Value 3	Index Value 4
NutEnrch	Nutrient enrichment	The extent of nutrient enrichment (most often by either nitrogen or phosporous or both) from anthropogenic activities. Nitrogen and phosphorous are the primary macro-nutrients that enrich streams and cause build ups of algae. These conditions, in addition to leading to other adverse conditions, such as low DO can be indicative of conditions that are unhealthy for salmonids. Note: care needs to be applied when considering periphyton composition since relatively large mats of green filamentous algae can occur in Pacific Northwest streams with no nutrient enrichment when exposed to sunlight.	Unenriched streams (corresponding to benthic chlorophyll *a* values 0.5-3 mg/m2). Nutrient levels typical of oligotrophic conditions (small supply of nutrients, low production of organic matter, low rates of decomposition, and high DO). No enrichment is occurring nor is suspected. Green filamentous algae may be present at certain times of year, particularly in unshaded areas.	Very small amount of enrichment suspected to be occurring through land use activities (corresponding to benthic chlorophyll *a* values 3-20 mg/m2). Green filamentous algae present in summer months in unshaded reaches.	Nutrient levels typical of oligotrophic conditions (small supply of nutrients, low production of organic matter, low rates of decomposition, and high DO). Some enrichment known to be occurring (corresponding to benthic chlorophyll *a* values 20-60 mg/m2), often associated with failing skeptics tanks or runoff from areas of heavy fertilizer usage. Dense mats of green or brown filamentous algae present in summer months.	Euthrophic (abundant nutrients associated with high level of primary production, frequently resulting in oxygen depletion).Very obvious enrichment of reach is occurring from point sources or numerous non-point sources (corresponding to benthic chlorophyll *a* values 60-600 mg/m2). Large, dense mats of green or brown filamentous algae will be present during summer months.	Super enrichment of reach is strongly evident. Known, major point sources of organic waste inputs, such as runoff from large feedlot operation, wash water from farm products processing, or significant sewage facilities with inadequate treatment (corresponding to benthic chlorophyll *a* values 600-1200 mg/m2). In most severe cases, filamentous bacteria abundant, associated with low D.O. and hydrogen sulfide. In less severe cases, large dense mats of green or brown filamentous algae generally cover the substrate.
Obstr	Obstructions to fish migration	Obstructions to fish passage by physical barriers (not dewatered channels or hinderances to migration caused by pollutants or lack of oxygen). Note: Rating here is used as a flag in the database. The nature of the obstruction is required to be defined more carefully in a follow-up form.	None documented or inferred.	One or barriers to juvenile migrants at certain flow levels.	One or barriers to juvenile migrants at all flow levels.	One or barriers to juvenile migrants at all flow levels and barrier(s) to adult migration at certain flow levels.	One or more barriers to all fish migration at all flow levels.

Description of EDT Level 2 Environmental Attributes

Code	Correlate	Definition	Index Value 0	Index Value 1	Index Value 2	Index Value 3	Index Value 4
PredRisk	Predation risk	Level of predation risk on fish species due to presence of top level carnivores or unusual concentrations of other fish eating species. This is a classification of per-capita predation risk, in terms of the likelihood, magnitude and frequency of exposure to potential predators (assuming other habitat factors are constant). NOTE: This attribute is being updated to distinguish risk posed to small bodied fish (<10 in) from that to large bodied fish (>10 in).	Many or most native predators are depressed or rare, none are greatly increased over natural levels, and there is expected a significant numerical survival advantage to fish as a result compared to historical predator abundance.	Some native predators are moderately depressed, none are greatly increased over natural levels, and there is expected some small to moderate numerical survival advantage to fish as a result compared to historical predator abundance.	Diversity and per-capita abundance of predators exists so that predation risk is at near-natural level and distribution.	Moderate increase in population density or moderately concentrated population of predator species exists due to artifacts of human alteration of the environment (e.g., top-down food web effects, habitat manipulations) compared to historical condition.	Excessive population density or concentrated population of predator species exists due to artifacts of human alteration of the environment (e.g., top-down food web effects, habitat manipulations) compared to historic condition.
RipFunc	Riparian function	A measure of riparian function that has been altered within the reach.	Strong linkages with no anthropogenic influences.	>75-90% of functional attributes present (overbank flows, vegetated streambanks, groundwater interactions typically present).	50-75% functional attribute rating- significant loss of riparian functioning- minor channel incision, diminished riparian vegetation structure and inputs etc.	25-50% similarity to natural conditions in functional attributes- many linkages between the stream and its floodplain are severed.	< 25% functional attribute rating: complete severing of floodplain-stream linkages

Description of EDT Level 2 Environmental Attributes

Code	Correlate	Definition	Index Value 0	Index Value 1	Index Value 2	Index Value 3	Index Value 4
SalmCarcass	Salmon Carcasses	Relative abundance of anadromous salmonid carcasses within watershed that can serve as nutrient sources for juvenile salmonid production and other organisms. Relative abundance is expressed here as the density of salmon carcasses within subdrainages (or areas) of the watershed, such as the lower mainstem vs the upper mainstem, or in mainstem areas vs major tributary drainages.	Super abundant -- average number of carcasses per mile of main channel habitat (within an appropriately designated area) >800.	Very abundant -- average number of carcasses per mile of main channel habitat (within an appropriately designated area) >400 and < 800.	Moderately abundant -- average number of carcasses per mile of main channel habitat (within an appropriately designated area) >200 and < 400.	Not abundant -- average number of carcasses per mile of main channel habitat (within an appropriately designated area) >25 and <200.	Very few or none -- average number of carcasses per mile of main channel habitat (within an appropriately designated area) <25.
TmpMonMx	Temperature - daily maximum (by month)	Maximum water temperatures within the stream reach during a month.	Warmest day < 10 C	Warmest day>10 C and <16 C	> 1 d with warmest day 22-25 C or 1-12 d with >16 C	> 1 d with warmest day 25-27.5 C or > 4 d (non-consecutive) with warmest day 22-25 C or >12 d with >16 C	> 1 d with warmest day 27.5 C or 3 d (consecutive) >25 C or >24 d with >21 C
TmpMonMn	Temperature - daily minimum (by month)	Minimum water temperatures within the stream reach during a month.	Coldest day >4 C	< 7 d with <4 C and minimum >1 C	1 to 7 d < 1 C	8 to 15 days < 1 C	> 15 winter days < 1 C
TmpSptVar	Temperature - spatial variation	The extent of water temperature variation within the reach as influenced by inputs of groundwater.	Groundwater discharge into surface waters is the major source of flow in reach.	Abundant sites of groundwater discharge into surface waters.	Intermittent sites of groundwater discharge into surface waters and total quantity of groundwater discharge not a major source of flow in reach.	Infrequent sites of groundwater discharge into surface waters and total quantity of groundwater discharge not a major source of flow in reach.	No evidence of concentrated groundwater inputs.

Description of EDT Level 2 Environmental Attributes

Code	Correlate	Definition	Index Value 0	Index Value 1	Index Value 2	Index Value 3	Index Value 4
Turb	Turbidity	The severity of suspended sediment (SS) episodes within the stream reach. (Note: this attribute, which was originally called turbidity and still retains that name for continuity, is more correctly thought of as SS, which affects turbidity.) SS is sometimes characterized using turbidity but is more accurately described through suspended solids, hence the latter is to be used in rating this attribute. Turbidity is an optical property of water where suspended, including very fine particles such as clays and colloids, and some dissolved materials cause light to be scattered; it is expressed typically in nephelometric turbidity units (NTU). Suspended solids represents the actual measure of mineral and organic particles transported in the water column, either expressed as total suspended solids (TSS) or suspended sediment concentration (SSC)—both as mg/l. Technically, turbidity is not SS but the two are usually well correlated. If only NTUs are available, an approximation of SS can be obtained through relationships that correlate the two. The metric applied here is the Scale of Severity (SEV) Index taken from Newcombe and Jensen (1996), derived from: SEV = a + b(lnX) + c(lnY) , where, X = duration in hours, Y = mg/l, a = 1.0642 , b = 0.6068, and c = 0.7384. Duration is the number of hours out of month (with highest SS typically) when that concentration or higher normally occurs. Concentration would be represented by grab samples reported by USGS. See rating guidelines.	SEV Index <= 4.5 Clear with infrequent (short duration-- several days per year) concentrations of low concentrations (< 50 mg/l) of suspended sediment. No adverse effects on biota of these low doses.	SEV Index >4.5 and <= 7.5 Occasional episodes (days) of low to moderate concentrations (<500 mg/L), though very short duration episodes (hours) may occur with of higher concentrations (500 to 1000). These concentrations are always sublethal to juvenile and adult salmonids-though some behavioral modification may occur.	SEV Index >7.5 and <= 10.5 Occasional episodes of moderate to relatively high concentrations (>500 and <1000 mg/L), though shorter duration episodes (<1 week) may occur with higher concentrations (1000-5000 mg/L). The higher concentrations stated can be expected to result in major behavioral modification, severe stress, severely reduced forage success and direct mortality.	SEV Index >10.5 and <= 12.5 On-going or occasional episodes (periodic events annually lasting weeks at a time) of high concentrations of suspended sediment (>5000 and <10000 mg/L), or shorter duration episodes lasting hours or days of higher concentrations. These conditions result in direct, high mortality rates.	SEV Index >12.5 Extended periods (month) of very high concentrations (>10000 mg/L). These represent the most extreme severe conditions encountered and result in very high mortality of fish species.

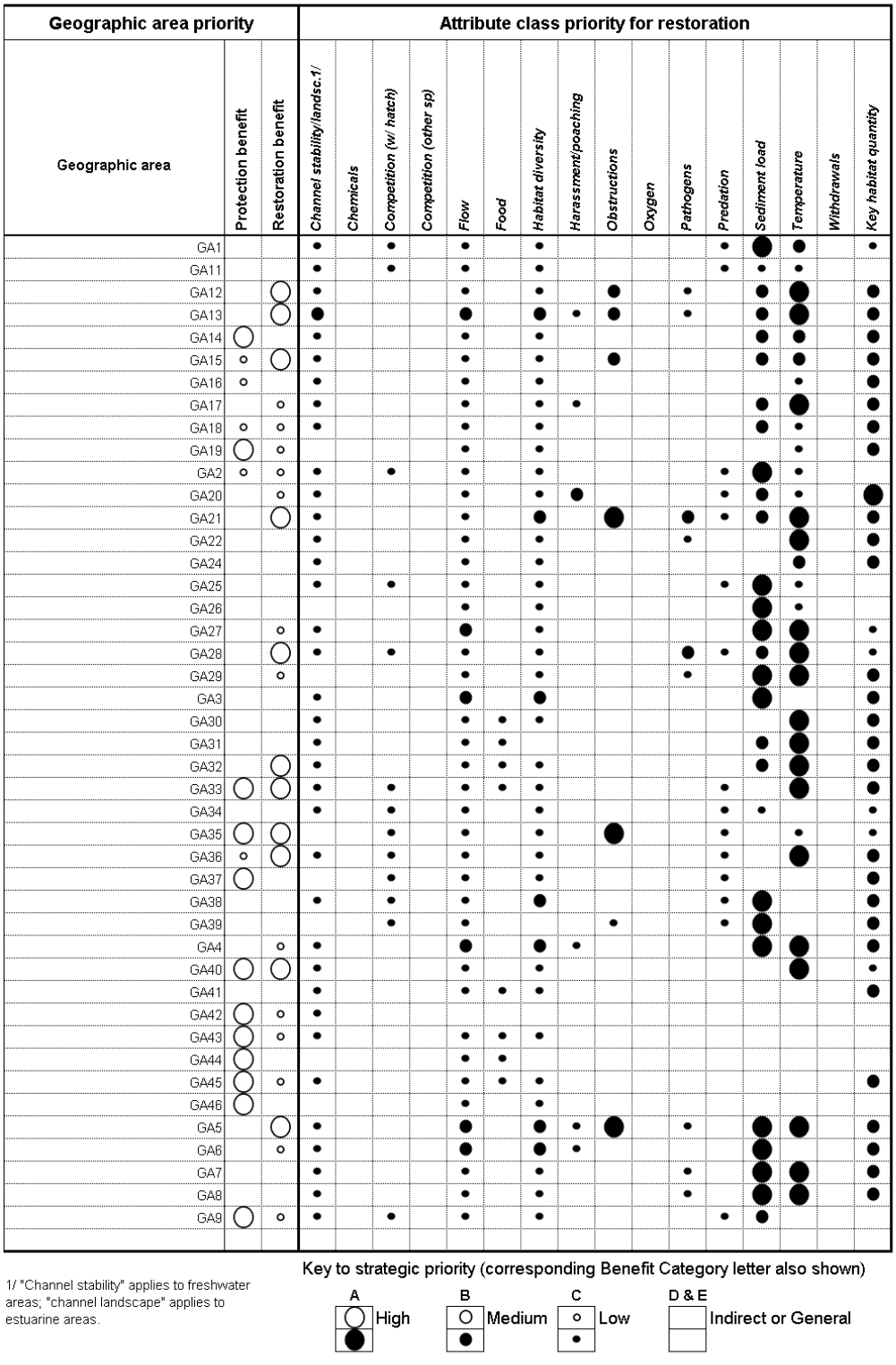
Description of EDT Level 2 Environmental Attributes

Code	Correlate	Definition	Index Value 0	Index Value 1	Index Value 2	Index Value 3	Index Value 4
Wdrwl	Water withdrawals	The number and relative size of water withdrawals in the stream reach.	No withdrawals.	Very minor water withdrawals with or without screening (entrainment probability considered very low).	Several of significant water withdrawals along reach though all sites known or believed to be screened with effective screening devices. (Note: one site that withdraws substantial portion of flow without screening falls into this category.)	Several sites of significant water withdrawals along reach without screening or screening believed to be ineffective. (Note: one site that withdraws substantial portion of flow without screening falls into this category.)	Frequent sites of significant water withdrawals along reach without screening or screening believed to be ineffective.

Description of EDT Level 2 Environmental Attributes

Code	Correlate	Definition	Index Value 0	Index Value 1	Index Value 2	Index Value 3	Index Value 4
WdDeb	Wood	The amount of wood (large woody debris or LWD) within the reach. Dimensions of what constitutes LWD are defined here as pieces >0.1 m diameter and >2 m in length. Numbers and volumes of LWD corresponding to index levels are based on Peterson et al. (1992), May et al. (1997), Hyatt and Naiman (2001), and Collins et al. (2002). Note: channel widths here refer to average wetted width during the high flow month (< bank full), consistent with the metric used to define high flow channel width. Ranges for index values are based on LWD pieces/CW and presence of jams (on larger channels). Reference to "large" pieces in index values uses the standard TFW definition as those > 50 cm diameter at midpoint.	A complex mixture of single large pieces and accumulations consisting of all sizes, decay classes, and species origins; cross-channel jams are present where appropriate vegetation and channel conditions facilitate their existence; large wood pieces are a dominant influence on channel diversity (e.g., pools, gravel bars, and mid-channel islands) where channel gradient and flow allow such influences. Density of LWD (pieces per channel width CW) consistent with the following: channel width <25 ft -- 3-10 pieces/CW, 25-50 ft -- 3-10 pieces/CW, 50-150 ft -- 7-30 pieces/CW , 150-400 ft -- 20-50 pieces/CW in conjunction with large jams in areas where accumulations might occur, >400 ft -- 15-37 pieces/CW in conjunction with large jams in areas where accumulations might occur.	Complex array of large wood pieces but fewer cross channel bars and fewer pieces of sound large wood due to less recruitment than index level 1; influences of large wood and jams are a prevalent influence on channel morphology where channel gradient and flow allow such influences. Density of LWD (pieces per channel width CW) consistent with the following: channel width <25 ft -- 2-3 pieces/CW, 25-50 ft -- 2-4 pieces/CW, 50-150 ft -- 3-7 pieces/CW , 150-400 ft -- 10-20 pieces/CW (excluding large jams) in conjunction with large jams in areas where accumulations might occur, >400 ft -- 8-15 pieces/CW (excluding large jams) in conjunction with large jams in areas where accumulations might occur.	Few pieces of large wood and their lengths are reduced and decay classes older due to less recruitment than in index level 1; small debris jams poorly anchored in place; large wood habitat and channel features of large wood origin are uncommon where channel gradient and flow allow such influences. Density of LWD (pieces per channel width CW) consistent with the following: channel width <25 ft -- 1-2 pieces/CW, 25-50 ft -- 1-2 pieces/CW, 50-150 ft -- 1-3 pieces/CW , 150-400 ft -- 10-20 pieces/CW without large jams in areas where accumulations might occur, >400 ft -- 8-15 pieces/CW without large jams in areas where accumulations might occur.	Large pieces of wood rare and the natural function of wood pieces limited due to diminished quantities, sizes, decay classes and the capacity of the riparian streambank vegetation to retain pieces where channel gradient and flow allow such influences. Density of LWD (pieces per channel width CW) consistent with the following: channel width <25 ft -- 0.33-1 pieces/CW, 25-50 ft -- 0.33-1 pieces/CW, 50-150 ft -- 0.33-1 pieces/CW , 150-400 ft -- 3-10 pieces/CW without large jams in areas where accumulations might occur, >400 ft -- 2-8 pieces/CW without large jams in areas where accumulations might occur.	Pieces of LWD rare. Density of LWD (pieces per channel width CW) consistent with the following: channel width <25 ft -- <0.33 pieces/CW, 25-50 ft -- <0.33 pieces/CW, 50-150 ft -- <0.33 pieces/CW , 150-400 ft -- <3 pieces/CW with accumulations where they might occur, >400 ft -- <2 pieces/CW with no accumulations where they might occur.

Umatilla Summer Steelhead
Protection and Restoration Strategic Priority Summary



Umatilla Spring Chinook
Protection and Restoration Strategic Priority Summary

Geographic area priority			Attribute class priority for restoration																	
Geographic area	Protection benefit	Restoration benefit	*Channel stability/landsc.1/*	*Chemicals*	*Competition (w/ hatch)*	*Competition (other sp)*	*Flow*	*Food*	*Habitat diversity*	*Harassment/poaching*	*Obstructions*	*Oxygen*	*Pathogens*	*Predation*	*Sediment load*	*Temperature*	*Withdrawals*	*Key habitat quantity*
GA1	C	C	B				B		B					B	A	B		B
GA11	C	C	B				B		B		B			B	B	B		
GA12	C	A	B				A		A				B		B	A		B
GA13		A	A				A		A	B			B		B	A		B
GA17	A	A	B				A		B	B					B	A		A
GA18	A	C	B				B		B									B
GA2	C	C	B				B		B		A			B	A	B		B
GA20	A	A	B				B	B	B	A					B			A
GA21		A	B				B	B	B				B		B	A		B
GA24	A	A	B				B		B				B		B	A		B
GA25	A	A	A		B		A	B	A	B			B	B	A	A		
GA28	A	A	B				B		B				B	B	B	A		B
GA3			B				A		A						A			B
GA31	A	C	B				B	B	B						B	A		B
GA32	C	C	B				B	B	B						B	A		B
GA33	A	A	B		B		B	B	B					B		A		B
GA35	A	A	B		B		B	B	B					B		B		B
GA40	A	A	B				B		B							A		B
GA42	A	C							B									
GA43	A	C	B				B	B	B									
GA46	A	C					B	B	B									
GA9	A	A	B				B		B		B			B	A	B		

1/ "Channel stability" applies to freshwater areas; "channel landscape" applies to estuarine areas.

Key to strategic priority (corresponding Benefit Category letter also shown)

A High B Medium C Low D & E Indirect or General

Umatilla Fall Chinook
Protection and Restoration Strategic Priority Summary

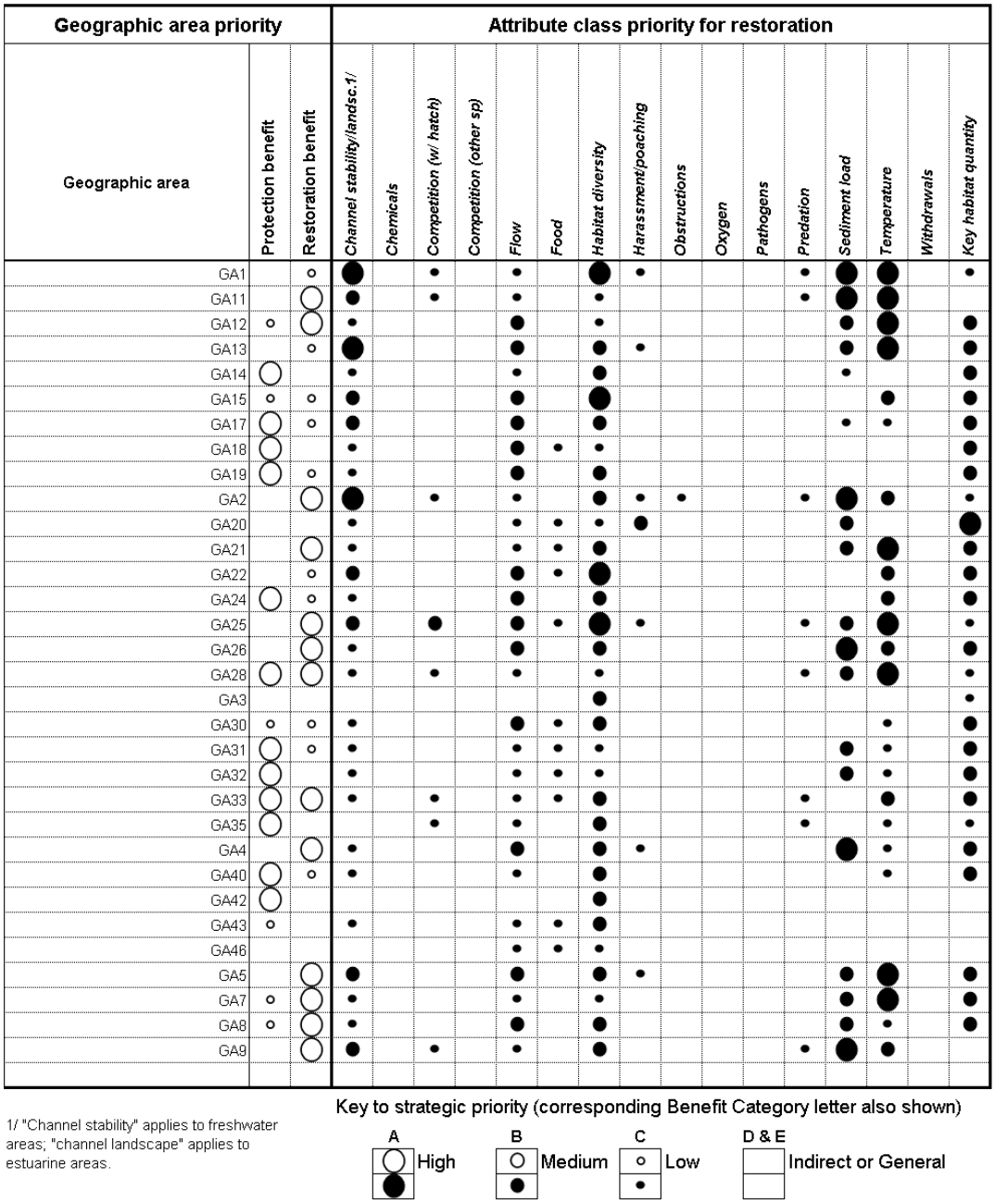
Geographic area priority			Attribute class priority for restoration																
Geographic area	Protection benefit	Restoration benefit	*Channel stability/landsc.1/*	*Chemicals*	*Competition (w/ hatch)*	*Competition (other sp)*	*Flow*	*Food*	*Habitat diversity*	*Harassment/poaching*	*Obstructions*	*Oxygen*	*Pathogens*	*Predation*	*Sediment load*	*Temperature*	*Withdrawals*	*Key habitat quantity*
GA1		A	B				C		B	C			C	C	A	B		C
GA11	A	A	B				C		C				C	C	A	B		
GA12	A	A	C				B		B				C		B	B		B
GA2	A	A	B				C		C	C	B		C	C	A	B		C
GA20	A	A	C				C	C	B	B					B			A
GA21	A	A	C				C	C	B				C		B	A		B
GA25	A	A	C				B	C	B	C			C	C	A	A		
GA28	A	A	C				C		C				C	C	C	B		C
GA3	A	A	C				B		A						B	C		B
GA33	A	A	C		C		C	C	B					C		B		B
GA40	A	A	C				C		B							C		B
GA9	A	A	B				C		B					C	B	B		

1/ "Channel stability" applies to freshwater areas; "channel landscape" applies to estuarine areas.

Key to strategic priority (corresponding Benefit Category letter also shown)

A High B Medium C Low D & E Indirect or General

Umatilla Coho
Protection and Restoration Strategic Priority Summary



DRAFT: Limiting Factors for Umatilla R.

Mobrand Biometrics, Inc. May 17, 2004

Geographic Area 1

Description: GA1 consists of four reaches in the Umatilla River from its confluence with the Columbia River to Thirteenmile Dam. This geographic area includes Brownell Dam.

Limiting Factors: Table 1 depicts the protection and restoration ranks and benefits and survival factors for all four species in GA1. Survival factors define the impact of habitat conditions on the survival of life stages in the Geographic Area. Survival factors in Table 1 are defined within EDT to be composed of one or more measurable attributes of the environment in Table 2.

GA1 has a relatively low protection rank and indirect or general protection benefit for all four species, as indicated in Table 1 (indicated by small or no circles under Protection Benefit and Restoration Benefit in Table 1). Restoration of GA1 is most important for fall Chinook salmon, with a restoration rank of 4 out of 12 geographic areas and a medium restoration benefit.

Sediment load is the most limiting survival factor for all four species (Table 1), attributed to increased embeddedness and fine sediment (Table 2). Fall Chinook salmon productivity is impacted by fine sediment and embeddedness, primarily to the egg incubation and fry colonization life stages. While Table 1 indicates that all four species are limited by sediment load, fall Chinook salmon are the most impacted because they spawn in GA1. The survival of the other species is impacted at a low level by sediment load at the 0-age inactive and 0,1-age inactive life stages. As shown in Table 1, coho and fall Chinook salmon survival is limited to a higher degree by Channel Stability (caused by decreased Riparian Function in Table 2), Habitat Diversity (caused by decreased amounts of large wood and decreased Riparian Function in Table 2) and Temperature (caused by increased maximum temperature in Table 2). Decreased habitat diversity and key habitat quantity in GA1 impacts the productivity of the rearing life stages for all species and prespawning holding for fall Chinook salmon, coho and summer steelhead trout. Increased maximum daily temperatures have reduced productivity for all species (Table 2). The degraded temperature conditions have had a low to high impact on survival, with the least effect on spring Chinook salmon survival and the greatest impact on coho survival (Table 1). The productivity of each of the four species is also depressed by the presence of exotic fish species, harassment, and hatchery outplants.

Key habitat quantity has been reduced to a low extent for all species (Table 1). This can be attributed to channelization and a reduction in the minimum wetted width of the river in GA1 (Table 2).

Table 1. Protection and restoration strategic priority summary for Umatilla subbasin GA1.

Area ranks show the rank for an area out of the total areas appropriate for each population. Benefit shows the Protection and Restoration benefit relative to the total benefits across the Umatilla basin for the population. Survival Factors show the relative

Geographic Area Description	Species	RANK		BENEFIT		SURVIVAL FACTORS													
		Protection Rank	Restoration Rank	Protection benefit	Restoration benefit	Flow	Channel stability/landsc	Habitat diversity	Key habitat quantity	Obstructions	Withdrawals	Sediment load	Oxygen	Chemicals	Temperature	Food	Competition (w/ hatch)	Competition (other sp)	Predation	Pathogens	Harassment/poaching
Umatilla R from confluence with Columbia to Thirteenmile Dam	COHO	24/32	12/32			●	⬤	⬤	●			⬤			⬤		●		●		●
	FACH	11/12	4/12		○	●	⬤	⬤	●			⬤			⬤				●	●	●
	SPCH	14/22	18/22			●	●	●	●			⬤			●				●		
	SUST	19/44	23/44			●	●	●	●			⬤			⬤		●		●		

A ○ / ⬤ High — B ○ / ⬤ Medium — C ○ / ● Low — D & E Indirect or General

contribution of each EDT survival factor to the Restoration Benefit.

Table 2. Change in productivity by ecological attribute for coho, fall Chinook salmon, and spring Chinook salmon and steelhead trout in Umatilla subbasin GA1. Environmental

Species	Hydrologic Characteristics						Stream Corridor Structure																										Water Quality									Biological Community								
	Flow Variation				Hydro. Regime		Channel Morphometry				Confinement		Habitat Type								Obstructions		Riparian and Channel Integrity			Sediment Type			Chemistry						Temperature Variation			Community Effects									
	Flow High	Flow Low	Flow diel variation	Flow intraannual variation	HydroRegimeNatural	HydroRegimeReg	Reach length	Maximum width	Minimum width	Gradient	Confine natural	Confine anthropogenic	Pool	Pool tailout	Backwater pool	Beaver pond	Glide	Small cobble riffle	Large cobble riffle	Off-channel habitat	Obstructions	Withdrawals	Bed Scour	Icing	Riparian Function	Woody Debris	Embeddedness	Fine Sediment	Turbidity	Alkalinity	Dissolved oxygen	Metals/pollutants sediment	Metals in water	Misc. toxins	Nutrient enrichment	Temperature maximum	Temperature minimum	Temp. spatial variation	Fish Comm Richness	Fish pathogens	Fish species introduced	Harassment	Hatchery outplants	Predation risk	Salmon carcasses	Benthic Comm Richness
COHO																																													
FACH																																													
SPCH																																													
SUST																																													

Legend:
FACH fall chinook salmon
SPCH spring chinook salmon
SUST summer steelhead trout
Reduction in productivity >or =0.0005
Reduction in productivity between 0.0005 and 0.00005
Reduction in productivity between 0.00005 and 0.000005
Reduction in productivity < or =0.000005

attributes are measurable qualities of the environment that are used in EDT to define the Survival Factors in

Geographic Area 2
Description: GA2 consists of eight Umatilla River reaches from Thirteenmile Dam to the confluence of Butter Creek, including Thirteenmile Dam and Boyd's Diversion Dam.
Limiting Factors: Table 3 depicts the protection and restoration ranks and benefits and survival factors for all four species in GA2. Survival factors define the impact of habitat conditions on the survival of life stages in the Geographic Area. Survival factors in Table 3 are defined within EDT to be composed of one or more measurable attributes of the environment in Table 4.
GA2 has a moderate protection rank for summer steelhead trout (12 out of 44 areas relevant to the population) and spring Chinook salmon (11 out of 22 areas relevant to the population) (Table 3). Protecting GA2 ranks low for coho salmon (21 out of 32) and fall Chinook salmon (10 out of 12). Summer steelhead trout have a low protection benefit for GA2, while the other three species would indirectly benefit from protecting GA2. The restoration benefit is high for coho (ranked 3 out of 32) and fall Chinook salmon (ranked 3 out of 12), with a medium restoration benefit. Summer steelhead trout (18 out of 44) and spring Chinook salmon (11 out of 22) would indirectly benefit from restoring GA2. Sediment Load (Table 3), attributed to increased embeddedness and fine sediment (Table 4), is the most limiting survival factor for all four species (Table 3). Fall Chinook salmon productivity is impacted by fine sediment and embeddedness, primarily to the egg incubation and fry colonization life stages. Temperature, Channel Stability, and Habitat Diversity, and are limiting to all three species to varying degrees. High maximum daily temperatures (Table 4) reduce the survival of coho and fall Chinook salmon more so than the other two species. Channel Stability, attributed to decreased Riparian Function and increased bed scour in Table 4, is highly limiting to coho salmon; spring and fall Chinook salmon and summer steelhead trout are affected to a lesser degree. Decreased amounts of large wood and impaired Riparian Function (Table 4) influence Habitat Diversity, which is moderately limiting to coho salmon in GA2. Flow, Key Habitat Quantity, and Predation are limiting at a low level. Flow limitations are attributed to increased high flows, decreased low flows and increased intra-annual variation (Table 4). Key Habitat Quantity (Table 3) is influenced by anthropogenic confinement and reduced minimum wetted widths (Table 4). Competition with hatchery fish reduces the survival of coho salmon and summer steelhead trout. Coho and fall Chinook salmon are also impacted by harassment.

Table 3. Protection and restoration strategic priority summary for Umatilla subbasin GA2.
Area ranks show the rank for an area out of the total areas appropriate for each population. Benefit shows the Protection and Restoration benefit relative to the total benefits across the Umatilla basin for the population. Survival Factors show the relative contribution of each EDT survival factor to the Restoration Benefit.

Geographic Area	Species	RANK		BENEFIT		SURVIVAL FACTORS													
		Protection Rank	Restoration Rank	Protection benefit	Restoration benefit	Flow	Channel stability/landsc	Habitat diversity	Key habitat quantity	Obstructions	Withdrawals	Sediment load	Oxygen	Chemicals	Temperature	Food	Competition (w/ hatch)	Competition (other sp)	Predation	Pathogens	Harassment/poaching
Umatilla R from Thirteenmile Dam to Butter Cr	COHO	21/32	3/32		○	•	●	●	•	•		●			●		•		•		•
	FACH	10/12	3/12		○	•	●	•	•	●		●			●				•	•	•
	SPCH	11/22	11/22			•	•	•	•	●		●			•				•		
	SUST	12/44	18/44	○		•	•	•				●			•		•		•		

A High B Medium C Low D & E Indirect or General

Table 4. Measurable environmental attributes contributing to Survival Factors in Umatilla area GA2 for coho, fall Chinook salmon, spring Chinook salmon and summer steelhead trout. Environmental attributes are measurable qualities of the environment that are used in EDT to define the Survival Factors in Table 3.

Species	Hydrologic Characteristics						Stream Corridor Structure																								Water Quality									Biological Community									
	Flow Variation				Hydro. Regime		Channel Morphometry				Confinement		Habitat Type										Obstructions		Riparian and Channel Integrity				Sediment Type			Chemistry							Temperature Variation			Community Effects								
	Flow High	Flow Low	Flow diel variation	Flow intraannual variation	HydroRegimeNatural	HydroRegimeReg	Reach length	Maximum width	Minimum width	Gradient	Confine natural	Confine anthropogenic	Pool	Pool tailout	Backwater pool	Beaver pond	Glide	Small cobble riffle	Large cobble riffle	Off-channel habitat	Obstructions	Withdrawals	Bed Scour	Icing	Riparian Function	Woody Debris	Embeddedness	Fine Sediment	Turbidity	Alkalinity	Dissolved oxygen	Metals/pollutants sediment	Metals in water	Misc. toxins	Nutrient enrichment	Temperature maximum	Temperature minimum	Temp. spatial variation	Fish Comm Richness	Fish pathogens	Fish species introduced	Harassment	Hatchery outplants	Predation risk	Salmon carcasses	Benthic Comm Richness
COHO																																													
FACH																																													
SPCH																																													
SUST																																													

Legend:
FACH fall chinook salmon
SPCH spring chinook salmon
SUST summer steelhead trout
Reduction in productivity >or =0.0005
Reduction in productivity between 0.0005 and 0.00005
Reduction in productivity between 0.00005 and 0.000005
Reduction in productivity < or =0.000005

Geographic Area 3
Description: GA3 consists of the North Hermiston Drain from its confluence with the Umatilla River to Umatilla River Road.
Limiting Factors: Table 5 depicts the protection and restoration ranks and benefits and survival factors for all four species in GA3. Survival factors define the impact of habitat conditions on the survival of life stages in the Geographic Area. Survival factors in Table 5 are defined within EDT to be composed of one or more measurable attributes of the environment in Table 6.
GA3 has a moderate to low protection rank for each of the species, with indirect protection benefits, as indicated by the lack of circles under Protection Benefit (Table 5). GA3 has low restoration ranks for Coho salmon (ranked 25 out of 32), fall Chinook salmon (ranked 10 out of 12), spring Chinook salmon (ranked 19 out of 22), and summer steelhead trout (ranked 33 out of 44). Restoring GA3 would provide indirect or general benefits to each species (Table 5).
Sediment Load (Table 5), attributed to increased embeddedness (Table 6), is the most limiting survival factor for all species except coho salmon (Table 5). Fall Chinook salmon productivity is impacted by fine sediment and embeddedness, primarily to the egg incubation and fry colonization life stages. Habitat Diversity, Flow, and Channel Stability are limiting to fall and spring Chinook salmon and summer steelhead trout to varying degrees. Decreased amounts of large wood and impaired Riparian Function (Table 6) influence Habitat Diversity, which is highly limiting to fall and spring Chinook salmon in GA3. Flow limitations are attributed to increased high flows, decreased low flows and increased intra-annual variation (Table 6). Channel Stability, attributed to decreased Riparian Function in Table 6, affects the survival of these three species to a lesser degree. Flow, Key Habitat Quantity, and Predation are limiting at a low level. Key habitat quantity has been reduced to a low extent for all species (Table 5). This can be attributed to channelization in GA3 (Table 6). High maximum daily temperatures (Table 6) further reduce the survival of fall Chinook salmon.

Table 5. Protection and restoration strategic priority summary for Umatilla subbasin GA3.
Area ranks show the rank for an area out of the total areas appropriate for each population. Benefit shows the Protection and Restoration benefit relative to the total benefits across the Umatilla basin for the population. Survival Factors show the relative contribution of each EDT survival factor to the Restoration Benefit.

Geographic Area	Species	RANK		BENEFIT		SURVIVAL FACTORS															
		Protection Rank	Restoration Rank	Protection benefit	Restoration benefit	Flow	Channel stability/landsc	Habitat diversity	Key habitat quantity	Obstructions	Withdrawals	Sediment load	Oxygen	Chemicals	Temperature	Food	Competition (w/ hatch)	Competition (other sp)	Predation	Pathogens	Harassment/poaching
NH Drain from confluence with Umatilla R to Umatilla R Rd	COHO	19/32	25/32					●	•												
	FACH	9/12	10/12			●	•	●	●			●			•						
	SPCH	16/22	19/22			●	•	●	●			●									
	SUST	31/44	33/44			●	•	●	●			●									

A High B Medium C Low D&E Indirect or General

Table 6. Measurable environmental attributes contributing to Survival Factors in Umatilla area GA3 for coho, fall Chinook salmon, spring Chinook salmon and summer steelhead trout. Environmental attributes are measurable qualities of the environment that are used in EDT to define the Survival Factors in Table 5.

Species	Hydrologic Characteristics						Stream Corridor Structure																								Water Quality									Biological Community								
	Flow Variation				Hydro. Regime		Channel Morphometry				Confinement	Habitat Type								Obstructions		Riparian and Channel Integrity			Sediment Type			Chemistry						Temperature Variation			Community Effects								
	Flow High	Flow Low	Flow diel variation	Flow intraannual variation	HydroRegimeNatural	HydroRegimeReg	Reach length	Maximum width	Minimum width	Gradient	Confine natural	Confine anthropogenic	Pool	Pool tailout	Backwater pool	Beaver pond	Glide	Small cobble riffle	Large cobble riffle	Off-channel habitat	Obstructions	Withdrawals	Bed Scour	Icing	Riparian Function	Woody Debris	Embeddedness	Fine Sediment	Turbidity	Alkalinity	Dissolved oxygen	Metals/pollutants sediment	Metals in water	Misc. toxins	Nutrient enrichment	Temperature maximum	Temperature minimum	Temp. spatial variation	Fish Comm Richness	Fish pathogens	Fish species introduced	Harassment	Hatchery outplants	Predation risk	Salmon carcasses	Benthic Comm Richness
COHO												■													■	■																			
FACH	■											■													■	■	■									■									
SPCH	■											■													■	■									■						■			
SUST	■											■	■												■	■	■								■						■			

Legend:
FACH fall chinook salmon
SPCH spring chinook salmon
SUST summer steelhead trout
■ Reduction in productivity >or =0.0005
■ Reduction in productivity between 0.0005 and 0.00005
■ Reduction in productivity between 0.00005 and 0.000005
Reduction in productivity < or =0.000005

Geographic Area 4
Description: GA4 consists of four reaches in Butter Creek from its confluence with the Umatilla River to the Madison diversion at section line 25/30. This geographic area includes an obstruction reach for the Interstate 84 crossing, which allows fish passage. Butter Creek supports coho salmon and summer steelhead trout.
Limiting Factors: Table 7 depicts the protection and restoration ranks and benefits and survival factors for all four species in GA4. Survival factors define the impact of habitat conditions on the survival of life stages in the Geographic Area. Survival factors in Table 7 are defined within EDT to be composed of one or more measurable attributes of the environment in Table 8.
GA4 has a relatively low to moderate protection rank and indirect or general protection benefit for both species (indicated in Table 7 by small or no circles under Protection Benefit). GA4 has a moderately high restoration rank for coho salmon (7 out of 32), with a low restoration benefit. Restoring GA4 would have an indirect or general benefit to summer steelhead trout, ranked 15 out of 44 geographic areas.
As shown in Table 7, survival is limited to a high degree by Sediment Load (attributed to increased embeddedness and fine sediments in Table 8), followed by Temperature (caused by increased maximum daily temperature in Table 8). Flow (caused by increased high flows, decreased low flows and increased intra-annual variation in Table 8), and Habitat Diversity (caused by decreased amounts of large wood, Riparian Function and pool/beaver pond habitat in Table 8) have a medium impact on survival of coho salmon and steelhead trout in GA4. In addition to changes in habitat quality, the overall reduction in Key Habitat Quantity (caused by anthropogenic confinement and reduced low flows in Table 8) moderately limits the survival of both species. Channel Stability and Harassment are limiting to both species to a lesser degree. Channel Stability (Table 7) is influenced by decreased Riparian Function (Table 8).

Table 7. Protection and restoration strategic priority summary for Umatilla subbasin GA4.
Area ranks show the rank for an area out of the total areas appropriate for each population. Benefit shows the Protection and Restoration benefit relative to the total benefits across the Umatilla basin for the population. Survival Factors show the relative

Geographic Area	Species	RANK		BENEFIT		SURVIVAL FACTORS														
		Protection Rank	Restoration Rank	Protection benefit	Restoration benefit	Flow	Channel stability/landsc	Habitat diversity	Key habitat quantity	Obstructions	Withdrawals	Sediment load	Oxygen	Chemicals	Temperature	Food	Competition (w/ hatch)	Competition (other sp)	Predation	Pathogens	Harassment/poaching
Butter Cr from confluence with Umatilla R to Madison diversion at section line 25/30	COHO	21/32	7/32		○	●	•	●	●			●			•						•
	FACH	--	--																		
	SPCH	--	--																		
	SUST	37/44	15/44			●	•	●	●			●			●						•

A ● High
B ○ ● Medium
C ○ • Low
D & E Indirect or General

contribution of each EDT survival factor to the Restoration Benefit.

Table 8. Change in productivity by ecological attribute for coho, fall Chinook salmon, and spring Chinook salmon and steelhead trout in Umatilla subbasin GA4. Environmental attributes are measurable qualities of the environment that are used in EDT to define the Survival Factors in Table 7.

Species	Hydrologic Characteristics						Stream Corridor Structure																										Water Quality									Biological Community								
	Flow Variation				Hydro. Regime		Channel Morphometry				Confinement		Habitat Type										Obstructions		Riparian and Channel Integrity			Sediment Type				Chemistry							Temperature Variation			Community Effects								
	Flow High	Flow Low	Flow diel variation	Flow intraannual variation	HydroRegimeNatural	HydroRegimeReg	Reach length	Maximum width	Minimum width	Gradient	Confine natural	Confine anthropogenic	Pool	Pool tailout	Backwater pool	Beaver pond	Glide	Small cobble riffle	Large cobble riffle	Off-channel habitat	Obstructions	Withdrawals	Bed Scour	Icing	Riparian Function	Woody Debris	Embeddedness	Fine Sediment	Turbidity	Alkalinity	Dissolved oxygen	Metals/pollutants sediment	Metals in water	Misc. toxins	Nutrient enrichment	Temperature maximum	Temperature minimum	Temp. spatial variation	Fish Comm Richness	Fish pathogens	Fish species introduced	Harassment	Hatchery outplants	Predation risk	Salmon carcasses	Benthic Comm Richness
COHO																																													
FACH																																													
SPCH																																													
SUST																																													

Legend:
FACH fall chinook salmon
SPCH spring chinook salmon
SUST summer steelhead trout
Reduction in productivity >or =0.0005
Reduction in productivity between 0.0005 and 0.00005
Reduction in productivity between 0.00005 and 0.000005
Reduction in productivity < or =0.000005

Geographic Area 5
Description: GA5 consists of Butter Creek from the Madison diversion at section line 25/30 to East Fork Butter Creek. This geographic area includes 5 reaches, one of which is the Madison Diversion. Butter Creek supports coho salmon and summer steelhead trout.
Limiting Factors: Table 9 depicts the protection and restoration ranks and benefits and survival factors for both species in GA5. Survival factors define the impact of habitat conditions on the survival of life stages in the Geographic Area. Survival factors in Table 9 are defined within EDT to be composed of one or more measurable attributes of the environment in Table 10.
GA5 has a relatively low to moderate protection rank and indirect or general protection benefit for both species (indicated in Table 9 by blank cells under Protection Benefit and Restoration Benefit). GA5 has a high restoration benefit and rank for coho (1 out of 32) and summer steelhead trout (2 out of 44).
As shown in Table 9, coho salmon and summer steelhead trout survival is limited to a high degree by Temperature (due to increased maximum temperature in Table 10) and Sediment Load (caused by increased embeddedness and fine sediments in Table 10). Flow (caused by increased high flows, decreased low flows and increased intra-annual variation in Table 10), Channel Stability (caused by decreased Riparian Function in Table 10), and Habitat Diversity (caused by decreased amounts of large wood and Riparian Function and limited pool/beaver pond habitat in Table 10) have a medium impact on survival of coho and steelhead trout in GA5. In addition to changes in habitat quality, the overall reduction in Key Habitat Quantity (caused by anthropogenic confinement and reduced low flows in Table 10) further limits the survival of both species. The productivity of coho salmon and summer steelhead trout is also depressed by harassment. Madison Diversion is a barrier to migrating adult summer steelhead trout.

Table 9. Protection and restoration strategic priority summary for Umatilla subbasin GA5.Area ranks show the rank for an area out of the total areas appropriate for each population. Benefit shows the Protection and Restoration benefit relative to the total benefits across the Umatilla basin for the population. Survival Factors show the relative contribution of each EDT survival factor to the Restoration Benefit.

Geographic Area	Species	RANK		BENEFIT		SURVIVAL FACTORS														
		Protection Rank	Restoration Rank	Protection benefit	Restoration benefit	Flow	Channel stability/landsc	Habitat diversity	Key habitat quantity	Obstructions	Withdrawals	Sediment load	Oxygen	Chemicals	Temperature	Food	Competition (w/ hatch)	Competition (other sp)	Predation	Pathogens	Harassment/poaching
Butter Cr from Madison diversion at section line 25/30 to EF Butter Cr	COHO	16/32	1/32		○	●	●	●	●			●			●						•
	FACH	--	--																		
	SPCH	--	--																		
	SUST	35/44	2/44		○	●	•	●	●	●		●			●					•	•

A ○ ● High
B ○ ● Medium
C ○ • Low
D & E Indirect or General

Table 10. Change in productivity by ecological attribute for coho, fall Chinook salmon, and spring Chinook salmon and steelhead trout in Umatilla subbasin GA5. Environmental attributes are measurable qualities of the environment that are used in EDT to define the

Species	Hydrologic Characteristics						Stream Corridor Structure																										Water Quality										Biological Community									
	Flow Variation				Hydro. Regime		Channel Morphometry				Confinement		Habitat Type										Obstructions		Riparian and Channel Integrity			Sediment Type			Chemistry							Temperature Variation			Community Effects									
	Flow High	Flow Low	Flow diel variation	Flow intraannual variation	HydroRegimeNatural	HydroRegimeReg	Reach length	Maximum width	Minimum width	Gradient	Confine natural	Confine anthropogenic	Pool	Pool tailout	Backwater pool	Beaver pond	Glide	Small cobble riffle	Large cobble riffle	Off-channel habitat	Obstructions	Withdrawals	Bed Scour	Icing	Riparian Function	Woody Debris	Embeddedness	Fine Sediment	Turbidity	Alkalinity	Dissolved oxygen	Metals/pollutants sediment	Metals in water	Misc. toxins	Nutrient enrichment	Temperature maximum	Temperature minimum	Temp. spatial variation	Fish Comm Richness	Fish pathogens	Fish species introduced	Harassment	Hatchery outplants	Predation risk	Salmon carcasses	Benthic Comm Richness
COHO																																														
FACH																																														
SPCH																																														
SUST																																														

Legend:
FACH fall chinook salmon
SPCH spring chinook salmon
SUST summer steelhead trout
Reduction in productivity >or =0.0005
Reduction in productivity between 0.0005 and 0.00005
Reduction in productivity between 0.00005 and 0.000005
Reduction in productivity < or =0.000005

Survival Factors in Table 9.

Geographic Area 6
Description: GA6 consists of one reach in Little Butter Creek from its confluence with Butter Creek to the headwaters at 4,400-ft elevation. Little Butter Creek only supports summer steelhead trout.
Limiting Factors: Table 11 depicts the protection and restoration ranks and benefits and survival factors for summer steelhead trout in GA6. Survival factors define the impact of habitat conditions on the survival of life stages in the Geographic Area. Survival factors in Table 11 are defined within EDT to be composed of one or more measurable attributes of the environment in Table 12.
GA6 has a moderate protection rank (27 out of 44) and restoration rank (16 out of 44), with an indirect or general protection and restoration benefits, as indicated in Table 11. Sediment load is the most limiting survival factor for summer steelhead trout in GA6(Table 11), attributed to increased embeddedness and fine sediment (Table 12). Sediment Load reduces survival during the egg incubation, fry colonization and 0,1-age active rearing life stages. Flow (caused by increased high flows, decreased low flows and increased intra-annual variation in Table 12), Habitat Diversity (caused by decreased amounts of large wood and Riparian Function and limited pool/beaver pond habitat in Table 12) and the overall reduction in Key Habitat Quantity (caused by anthropogenic confinement and reduced low flows in Table 12) have a medium impact on survival of summer steelhead trout in GA6. The current condition of Key Habitat Quantity is most limiting for 0-age active rearing and prespawning holding life stages, followed by fry colonization and 1-age active rearing. As shown in Table 11, the productivity of summer steelhead trout is also depressed by Channel Stability (attributed to decreased Riparian Function in Table 12) and harassment to a lesser extent.

Table 11. Protection and restoration strategic priority summary for Umatilla subbasin GA6.Area ranks show the rank for an area out of the total areas appropriate for each population. Benefit shows the Protection and Restoration benefit relative to the total benefits across the Umatilla basin for the population. Survival Factors show the relative contribution of each EDT survival factor to the Restoration Benefit.

Geographic Area	Species	RANK		BENEFIT		SURVIVAL FACTORS														
		Protection Rank	Restoration Rank	Protection benefit	Restoration benefit	Flow	Channel stability/landsc	Habitat diversity	Key habitat quantity	Obstructions	Withdrawals	Sediment load	Oxygen	Chemicals	Temperature	Food	Competition (w/ hatch)	Competition (other sp)	Predation	Pathogens	Harassment/poaching
Little Butter Cr from mainstem Butter Cr to headwaters at 4,400-ft level	COHO	--	--																	
	FACH	--	--																	
	SPCH	--	--																	
	SUST	27/44	16/44			●	•	●	●			●								•

A High B Medium C Low D & E Indirect or General

Table 12. Change in productivity by ecological attribute for coho, fall Chinook salmon, and spring Chinook salmon and steelhead trout in Umatilla subbasin GA6. Environmental attributes are measurable qualities of the environment that are used in EDT to define the

Species	Hydrologic Characteristics						Stream Corridor Structure																								Water Quality									Biological Community								
	Flow Variation				Hydro. Regime		Channel Morphometry				Confinement		Habitat Type								Obstructions		Riparian and Channel Integrity				Sediment Type				Chemistry						Temperature Variation			Community Effects								
	Flow High	Flow Low	Flow diel variation	Flow intraannual variation	HydroRegimeNatural	HydroRegimeReg	Reach length	Maximum width	Minimum width	Gradient	Confine natural	Confine anthropogenic	Pool	Pool tailout	Backwater pool	Beaver pond	Glide	Small cobble riffle	Large cobble riffle	Off-channel habitat	Obstructions	Withdrawals	Bed Scour	Icing	Riparian Function	Woody Debris	Embeddedness	Fine Sediment	Turbidity	Alkalinity	Dissolved oxygen	Metals/pollutants sediment	Metals in water	Misc. toxins	Nutrient enrichment	Temperature maximum	Temperature minimum	Temp. spatial variation	Fish Comm Richness	Fish pathogens	Fish species introduced	Harassment	Hatchery outplants	Predation risk	Salmon carcasses	Benthic Comm Richness
COHO																																													
FACH																																													
SPCH																																													
SUST																																													

Legend:
FACH fall chinook salmon
SPCH spring chinook salmon
SUST summer steelhead trout
Reduction in productivity >or =0.0005
Reduction in productivity between 0.0005 and 0.00005
Reduction in productivity between 0.00005 and 0.000005
Reduction in productivity < or =0.000005

Survival Factors in

Geographic Area 7
Description: GA7 consists of four reaches in East Fork Butter Creek from its confluence with Butter Creek to the forks at the southeast edge of the Big Pot. This geographic area also includes Tunnel and Buckhorn creeks, each of which have one reach. East Fork Butter Creek supports coho salmon and summer steelhead trout. Tunnel and Buckhorn creeks only support summer steelhead trout.
Limiting Factors: Table 13 depicts the protection and restoration ranks and benefits and survival factors for both species in GA7. Survival factors define the impact of habitat conditions on the survival of life stages in the Geographic Area. Survival factors in Table 13 are defined within EDT to be composed of one or more measurable attributes of the environment in Table 14.
GA7 has a relatively low to moderate protection rank for summer steelhead trout (36 out of 44) and coho (13 out of 32), with indirect or general protection benefit for both species (indicated in Table 13 by the lack of circles under Protection Benefit). GA7 has a high restoration rank for coho (5 out of 32) and a low restoration benefit (indicated in Table 13 by a small circle under Restoration Benefit). The restoration benefit to summer steelhead trout is indirect or general, with a restoration rank of 25 out of 44 geographic areas.
As shown in Table 13, coho salmon and summer steelhead trout survival is limited to a high degree by Temperature (caused by increased maximum temperature in Table 14) and Sediment Load (caused by increased embeddedness and fine sediments in Table 14). In addition to changes in habitat quality, the overall reduction in Key Habitat Quantity (caused by anthropogenic confinement and reduced low flows in Table 14) moderately limits the survival of both species. Flow (caused by increased high flows, decreased low flows and increased intra-annual variation in Table 14), Channel Stability (caused by decreased Riparian Function in Table 14), and Habitat Diversity (caused by decreased amounts of large wood and Riparian Function and limited pool/beaver pond habitat in Table 14) have a low impact on survival of coho and steelhead trout in GA7.
Temperature and Pathogens are not limiting to the survival of summer steelhead trout in Tunnel and Buckhorn creeks.

Table 13. Protection and restoration strategic priority summary for Umatilla subbasin GA7.Area ranks show the rank for an area out of the total areas appropriate for each population. Benefit shows the Protection and Restoration benefit relative to the total benefits across the Umatilla basin for the population. Survival Factors show the relative contribution of each EDT survival factor to the Restoration Benefit.

Geographic Area	Species	RANK		BENEFIT		SURVIVAL FACTORS													
		Protection Rank	Restoration Rank	Protection benefit	Restoration benefit	Flow	Channel stability/landsc	Habitat diversity	Key habitat quantity	Obstructions	Withdrawals	Sediment load	Oxygen	Chemicals	Temperature	Food	Competition (w/ hatch)	Competition (other sp)	Predation	Pathogens	Harassment/poaching
EF Butter Cr from confluence with mainstem to forks at SE edge of The Big Pot, including Tunnel and Buckhorn creeks	COHO	13/32	5/32		○	•	•	•	●			●			●						
	FACH	--	--																		
	SPCH	--	--																		
	SUST	36/44	25/44			•	•	•	●			●			●					•	

A ○ ● High
B ○ ● Medium
C ○ • Low
D & E Indirect or General

Table 14. Change in productivity by ecological attribute for coho, fall Chinook salmon, and spring Chinook salmon and steelhead trout in Umatilla subbasin GA7. Environmental attributes are measurable qualities of the environment that are used in EDT to define the Survival Factors in Table 13.

Species	Hydrologic Characteristics						Stream Corridor Structure																											Water Quality										Biological Community									
	Flow Variation				Hydro. Regime		Channel Morphometry				Confinement		Habitat Type										Obstructions		Riparian and Channel Integrity				Sediment Type			Chemistry							Temperature Variation			Community Effects									
	Flow High	Flow Low	Flow diel variation	Flow intraannual variation	HydroRegimeNatural	HydroRegimeReg	Reach length	Maximum width	Minimum width	Gradient	Confine natural	Confine anthropogenic	Pool	Pool tailout	Backwater pool	Beaver pond	Glide	Small cobble riffle	Large cobble riffle	Off-channel habitat	Obstructions	Withdrawals	Bed Scour	Icing	Riparian Function	Woody Debris	Embeddedness	Fine Sediment	Turbidity	Alkalinity	Dissolved oxygen	Metals/pollutants sediment	Metals in water	Misc. toxins	Nutrient enrichment	Temperature maximum	Temperature minimum	Temp. spatial variation	Fish Comm Richness	Fish pathogens	Fish species introduced	Harassment	Hatchery outplants	Predation risk	Salmon carcasses	Benthic Comm Richness
COHO																																															
FACH																																															
SPCH																																															
SUST																																															

Legend:
FACH fall chinook salmon
SPCH spring chinook salmon
SUST summer steelhead trout
Reduction in productivity >or =0.0005
Reduction in productivity between 0.0005 and 0.00005
Reduction in productivity between 0.00005 and 0.000005
Reduction in productivity < or =0.000005

Geographic Area 8

Description: GA8 consists of nine reaches in Butter Creek from East Fork Butter Creek to 4,160 ft elevation, including Spring Hollow, Johnson, and Swale creeks. Mainstem Butter Creek supports coho salmon and summer steelhead trout; coho salmon do not inhabit the tributaries.

Limiting Factors: Table 15 depicts the protection and restoration ranks and benefits and survival factors for both species in GA8. Survival factors define the impact of habitat conditions on the survival of life stages in the Geographic Area. Survival factors in Table 15 are defined within EDT to be composed of one or more measurable attributes of the environment in Table 16.

GA8 has a relatively low to moderate protection rank for summer steelhead trout (34 out of 44) and coho salmon (11 out of 32), with indirect or general protection benefits for both species (indicated in Table 15 by the lack of circles under Protection Benefit). GA8 has a high restoration rank for coho salmon (3 out of 32) and a medium restoration benefit (indicated in Table 15 by a medium circle under Restoration Benefit). The restoration benefit to summer steelhead trout is indirect or general, with a restoration rank of 21 out of 44 geographic areas.

As shown in Table 15, coho salmon and summer steelhead trout survival in GA8 is predominantly limited by Sediment Load (due to increased embeddedness in Table 16) and Temperature (attributed to increased maximum temperature in Table 16). In addition to changes in habitat quality, the overall reduction in Key Habitat Quantity (caused by anthropogenic confinement and reduced low flows in Table 16) moderately limits the survival of both species. Summer steelhead trout are most impacted by limited habitat for prespawning holding. Key Habitat Quantity is limiting to coho salmon during prespawning holding, 0-age active rearing, and fry colonization life stages. Flow (caused by increased high flows, decreased low flows and increased intra-annual variation in Table 16), Channel Stability (caused by decreased Riparian Function in Table 16), and Habitat Diversity (caused by decreased amounts of large wood and Riparian Function and limited pool habitat in Table 16) have a low to moderate impact on survival of coho salmon and low impact on summer steelhead trout survival in GA8. Temperature and Pathogens are not limiting to summer steelhead trout in Swale Creek

Table 15. Protection and restoration strategic priority summary for Umatilla subbasin GA8. Area ranks show the rank for an area out of the total areas appropriate for each population. Benefit shows the Protection and Restoration benefit relative to the total benefits across the Umatilla basin for the population. Survival Factors show the relative contribution of each EDT survival factor to the Restoration Benefit.

Geographic Area	Species	RANK		BENEFIT		SURVIVAL FACTORS														
		Protection Rank	Restoration Rank	Protection benefit	Restoration benefit	Flow	Channel stability/landsc	Habitat diversity	Key habitat quantity	Obstructions	Withdrawals	Sediment load	Oxygen	Chemicals	Temperature	Food	Competition (w/ hatch)	Competition (other sp)	Predation	Pathogens	Harassment/poaching
Butter Cr from EF Butter Cr to 4,160-ft level, including Spring Hollow, Johnson and Swale creeks	COHO	11/32	3/32		○	●	•	●	●			●			•						
	FACH	--	--																		
	SPCH	--	--																		
	SUST	34/44	21/44			•	•	•	●			●			●					•	

A ○ ● High
B ○ ● Medium
C ○ • Low
D & E Indirect or General

Table 16. Change in productivity by ecological attribute for coho, fall Chinook salmon, and spring Chinook salmon and steelhead trout in Umatilla subbasin GA8. Environmental attributes are measurable qualities of the environment that are used in EDT to define the

Species	Hydrologic Characteristics						Stream Corridor Structure																									Water Quality										Biological Community									
	Flow Variation				Hydro. Regime		Channel Morphometry				Confinement		Habitat Type								Obstructions		Riparian and Channel Integrity			Sediment Type			Chemistry							Temperature Variation			Community Effects									Benthic Comm Richness
	Flow High	Flow Low	Flow diel variation	Flow intraannual variation	HydroRegimeNatural	HydroRegimeReg	Reach length	Maximum width	Minimum width	Gradient	Confine natural	Confine anthropogenic	Pool	Pool tailout	Backwater pool	Beaver pond	Glide	Small cobble riffle	Large cobble riffle	Off-channel habitat	Obstructions	Withdrawals	Bed Scour	Icing	Riparian Function	Woody Debris	Embeddedness	Fine Sediment	Turbidity	Alkalinity	Dissolved oxygen	Metals/pollutants sediment	Metals in water	Misc. toxins	Nutrient enrichment	Temperature maximum	Temperature minimum	Temp. spatial variation	Fish Comm Richness	Fish pathogens	Fish species introduced	Harassment	Hatchery outplants	Predation risk	Salmon carcasses	
COHO																																														
FACH																																														
SPCH																																														
SUST																																														

Legend:
FACH fall chinook salmon
SPCH spring chinook salmon
SUST summer steelhead trout
Reduction in productivity >or =0.0005
Reduction in productivity between 0.0005 and 0.00005
Reduction in productivity between 0.00005 and 0.000005
Reduction in productivity < or =0.000005

Survival Factors in Table 15.

Geographic Area 9
Description: GA9 consists of 15 reaches in the mainstem Umatilla River from Butter Creek to McKay Creek, excluding the portion between Westland and Furnish dams. This geographic area includes Maxwell, Dillon, Furnish and Taylor Diversion dams. Fall Chinook salmon and coho salmon spawn within GA9.
Limiting Factors: Table 17 depicts the protection and restoration ranks and benefits and survival factors for all four species in GA9. Survival factors define the impact of habitat conditions on the survival of life stages in the Geographic Area. Survival factors in Table 17 are defined within EDT to be composed of one or more measurable attributes of the environment in Table 18.
Of the four species, GA9 has the highest protection rank for spring Chinook salmon (5 out of 22 geographic areas). GA9 has a moderate protection rank for summer steelhead trout (10 out of 44) and coho salmon (17 out of 32). The protection rank for fall Chinook salmon is low (8 out of 12). The protection benefit is low for fall Chinook salmon, spring Chinook salmon and summer steelhead trout, and is indirect or general for coho salmon (indicated by small or no circles under Protection Benefit in Table 17). Restoration of GA9 is most important for fall Chinook salmon, with a restoration rank of 1 out of 12 geographic areas and coho salmon (2 out of 32), with a corresponding high Restoration Benefit. The restoration benefit for spring Chinook salmon and summer steelhead trout is indirect or general, as depicted by the lack of circles under Restoration Benefit in Table 17.
Sediment Load is the most limiting survival factor for all four species (Table 17), attributed to increased embeddedness and fine sediment (Table 18). Fall Chinook salmon productivity is impacted by fine sediment and embeddedness, primarily to the egg incubation and fry colonization life stages. As shown in Table 17, Channel Stability (attributed to decreased Riparian Function in Table 18), Habitat Diversity (caused by decreased amounts of large wood and decreased Riparian Function in Table 18) and Temperature (caused by increased maximum temperature in Table 18) are degraded from a low to moderate extent. Coho salmon and fall Chinook salmon survival is impacted by these three survival factors more so than spring Chinook salmon and summer steelhead trout. Decreased habitat diversity and key habitat quantity in GA9 impacts the productivity of the rearing life stages for all species and prespawning holding for fall Chinook salmon, coho salmon and summer steelhead trout. Increased maximum daily temperatures have reduced productivity for all species (Table 18). Flow, attributed to increased high flows, decreased low flows and increased intra-annual variation, and Predation slightly impact the survival of all four species. The productivity of each of the four species is also depressed by the presence of exotic fish species, harassment, and hatchery outplants, with the most pronounced effect on coho salmon and summer steelhead trout. Maxwell Dam is a partial barrier to 1-age migrant coho salmon. Dillon Dam is a partial barrier to 1-age migrant coho and spring Chinook salmon and summer steelhead trout, as well as migrating adult spring Chinook salmon.

Table 17. Protection and restoration strategic priority summary for Umatilla subbasin GA9.Area ranks show the rank for an area out of the total areas appropriate for each population. Benefit shows the Protection and Restoration benefit relative to the total benefits across the Umatilla basin for the population. Survival Factors show the relative contribution of each EDT survival factor to the Restoration Benefit.

Geographic Area	Species	RANK		BENEFIT		SURVIVAL FACTORS																
		Protection Rank	Restoration Rank	Protection benefit	Restoration benefit	Flow	Channel stability/landsc	Habitat diversity	Key habitat quantity	Obstructions	Withdrawals	Sediment load	Oxygen	Chemicals	Temperature	Food	Competition (w/ hatch)	Competition (other sp)	Predation	Pathogens	Harassment/poaching
Umatilla R from Butter Cr to McKay Cr	COHO	17/32	2/32		◯ (A)	• (C)	● (B)	● (B)				● (A)			● (B)		• (C)		• (C)		
	FACH	8/12	1/12	○ (C)	◯ (A)	• (C)	● (B)	● (B)				● (A)			● (B)				• (C)		
	SPCH	5/22	10/22	○ (C)		• (C)	• (C)	• (C)		• (C)		● (B)			• (C)				• (C)		
	SUST	10/44	15/44	○ (C)		• (C)	• (C)	• (C)				● (B)					• (C)		• (C)		

Legend:
- A: ◯ / ● High
- B: ○ / ● Medium
- C: ○ / • Low
- D & E: (empty) Indirect or General

Table 18. Change in productivity by ecological attribute for coho, fall Chinook salmon, and spring Chinook salmon and steelhead trout in Umatilla subbasin GA9. Environmental attributes are measurable qualities of the environment that are used in EDT to define the Survival Factors in Table 17.

(Cell shading: D = dark, M = medium, L = light, blank = white; see legend.)

Species	Hydrologic Characteristics						Stream Corridor Structure					
	Flow Variation				Hydro. Reg-ime		Channel Morphometry				Confinement	
	Flow High	Flow Low	Flow diel variation	Flow intraannual variation	HydroRegimeNatural	HydroRegimeReg	Reach length	Maximum width	Minimum width	Gradient	Confine natural	Confine anthropogenic
COHO	M	L		M					M			D
FACH	M	D		M								D
SPCH	M	D		M								D
SUST	L	D		L						L		D

Species	Stream Corridor Structure																
	Habitat Type								Obstructions		Riparian and Channel Integrity				Sediment Type		
	Pool	Pool tailout	Backwater pool	Beaver pond	Glide	Small cobble riffle	Large cobble riffle	Off-channel habitat	Obstructions	Withdrawals	Bed Scour	Icing	Riparian Function	Woody Debris	Embeddedness	Fine Sediment	Turbidity
COHO				L					L		M		D	D	M	D	
FACH			M	D					M		D		D	D	D	D	
SPCH				L					M		M		D	D	M		
SUST	L		L	M					L		L		D	D	M		

Species	Water Quality									Biological Community							
	Chemistry						Temper-ature Variation			Community Effects							
	Alkalinity	Dissolved oxygen	Metals/pollutants sediment	Metals in water	Misc. toxins	Nutrient enrichment	Temperature maximum	Temperature minimum	Temp. spatial variation	Fish Comm Richness	Fish pathogens	Fish species introduced	Harassment	Hatchery outplants	Predation risk	Salmon carcasses	Benthic Comm Richness
COHO							D					D	M	D		M	
FACH							D					D	M	D		D	
SPCH							D					D	M	D		M	
SUST							D					D	D	D			

Legend:
FACH fall chinook salmon
SPCH spring chinook salmon
SUST summer steelhead trout
D (dark): Reduction in productivity >or =0.0005
M (medium): Reduction in productivity between 0.0005 and 0.00005
L (light): Reduction in productivity between 0.00005 and 0.000005
(white): Reduction in productivity < or =0.000005

Geographic Area 10

Table 19. Protection and restoration strategic priority summary for Umatilla subbasin GA10.Area ranks show the rank for an area out of the total areas appropriate for each population. Benefit shows the Protection and Restoration benefit relative to the total benefits across the Umatilla basin for the population. Survival Factors show the relative contribution of each EDT survival factor to the Restoration Benefit.

Table 20. Change in productivity by ecological attribute for coho, fall Chinook salmon, and spring Chinook salmon and steelhead trout in Umatilla subbasin GA10. Environmental attributes are measurable qualities of the environment that are used in EDT to define the Survival Factors in Table 19.

Geographic Area 11
Description: GA11 consists of four reaches in the Umatilla River from Westland Dam to Furnish Dam, including Westland Dam.
Limiting Factors: Table 21 depicts the protection and restoration ranks and benefits and survival factors for all four species in GA11. Survival factors define the impact of habitat conditions on the survival of life stages in the Geographic Area. Survival factors in Table 21 are defined within EDT to be composed of one or more measurable attributes of the environment in Table 22.
GA11 has a moderate to low protection rank for all four species, with an indirect or general protection benefit (indicated by the lack of circles under Protection Benefit in Table 21). Restoration of GA11 is most important for fall Chinook salmon, with a restoration rank of 5 out of 12 geographic areas. The restoration rank is moderate to low for the other three species. GA11 has a low Restoration Benefit for fall Chinook and coho salmon, as depicted by the small circles under Restoration Benefit in Table 21.
In general, Sediment Load, attributed to increased embeddedness and fine sediment (Table 22), and Temperature (due to increased maximum daily temperature in Table 22) are the most limiting survival factors in GA11 (Table 21). As shown in Table 21, Channel Stability (caused by decreased Riparian Function in Table 22), Habitat Diversity (caused by decreased amounts of large wood, Riparian Function, and pool habitat in Table 22) and Flow, attributed to increased high flows, decreased low flows and increased intra-annual variation, contribute to a low to moderate decrease in survival for all species. Coho and fall Chinook salmon survival is impacted by Channel Stability more so than spring Chinook salmon and summer steelhead trout. Predation has a low negative impact on the survival of all four species. The productivity of each of the four species is also depressed by the presence of exotic fish species, harassment, and hatchery outplants, with the most pronounced effect on coho and summer steelhead trout. Pathogens further limit the survival of fall Chinook salmon (Table 21).

Table 21. Protection and restoration strategic priority summary for Umatilla subbasin GA11.Area ranks show the rank for an area out of the total areas appropriate for each population. Benefit shows the Protection and Restoration benefit relative to the total benefits across the Umatilla basin for the population. Survival Factors show the relative contribution of each EDT survival factor to the Restoration Benefit.

Geographic Area	Species	RANK		BENEFIT		SURVIVAL FACTORS															
		Protection Rank	Restoration Rank	Protection benefit	Restoration benefit	Flow	Channel stability/landsc	Habitat diversity	Key habitat quantity	Obstructions	Withdrawals	Sediment load	Oxygen	Chemicals	Temperature	Food	Competition (w/ hatch)	Competition (other sp)	Predation	Pathogens	Harassment/poaching
Umatilla R from Westland Dam to Furnish Dam	COHO	22/32	10/32		○ (Low)	• (Low)	● (Medium)	• (Low)				● (High)			● (High)		• (Low)		• (Low)		
	FACH	9/12	5/12		○ (Low)	• (Low)	● (Medium)	• (Low)				● (High)			● (Medium)				• (Low)	• (Low)	
	SPCH	12/22	15/22			• (Low)	• (Low)	• (Low)		• (Low)		• (Low)			● (Medium)				• (Low)		
	SUST	29/44	32/44			• (Low)	• (Low)	• (Low)				• (Low)			• (Low)		• (Low)		• (Low)		

A	B	C	D & E
○ ● High	○ ● Medium	○ • Low	Indirect or General

Table 22. Change in productivity by ecological attribute for coho, fall Chinook salmon, and spring Chinook salmon and steelhead trout in Umatilla subbasin GA11. Environmental attributes are measurable qualities of the environment that are used in EDT to define the Survival Factors in Table 21.

Hydrologic Characteristics

Species	Flow Variation: Flow High	Flow Low	Flow diel variation	Flow intraannual variation	Hydro. Regime: HydroRegimeNatural	HydroRegimeReg
COHO	light grey			light grey		
FACH	medium grey			light grey		
SPCH	light grey					
SUST		dark grey				

Stream Corridor Structure

Species	Channel Morphometry: Reach length	Maximum width	Minimum width	Gradient	Confinement: Confine natural	Confine anthropogenic	Habitat Type: Pool	Pool tailout	Backwater pool	Beaver pond	Glide	Small cobble riffle	Large cobble riffle	Off-channel habitat	Obstructions: Obstructions	Withdrawals	Riparian and Channel Integrity: Bed Scour	Icing	Riparian Function	Woody Debris	Sediment Type: Embeddedness	Fine Sediment	Turbidity
COHO						medium grey											light grey		medium grey	medium grey		medium grey	
FACH				medium grey		medium grey	medium grey								medium grey		medium grey		medium grey	medium grey		medium grey	
SPCH				light grey		medium grey	medium grey								medium grey		light grey		medium grey	medium grey	light grey		
SUST						medium grey													medium grey	medium grey			

Water Quality

Species	Chemistry: Alkalinity	Dissolved oxygen	Metals/pollutants sediment	Metals in water	Misc. toxins	Nutrient enrichment	Temperature Variation: Temperature maximum	Temperature minimum	Temp. spatial variation
COHO							dark grey		
FACH							dark grey		
SPCH							dark grey		
SUST							dark grey		

Biological Community

Species	Community Effects: Fish Comm Richness	Fish pathogens	Fish species introduced	Harassment	Hatchery outplants	Predation risk	Salmon carcasses	Benthic Comm Richness
COHO			medium grey	medium grey	dark grey		light grey	
FACH			medium grey	medium grey	medium grey		light grey	
SPCH			dark grey	medium grey	dark grey			
SUST			medium grey	medium grey	medium grey			

Legend:
FACH fall chinook salmon
SPCH spring chinook salmon
SUST summer steelhead trout
(dark grey) Reduction in productivity >or =0.0005
(medium grey) Reduction in productivity between 0.0005 and 0.00005
(light grey) Reduction in productivity between 0.00005 and 0.000005
(white) Reduction in productivity < or =0.000005

Geographic Area 12

Description: GA12 consists of ten reaches in Birch Creek from its confluence with the Umatilla River to the confluence of the East and West forks, and Stewart (two reaches) and Ray (one reach) creeks. This geographic area includes Whitney Dam, and Straughan, Hummel and Weinke diversion dams. Spring and fall Chinook salmon only occur within mainstem Birch Creek, while coho salmon and summer steelhead trout inhabit the entire geographic area.

Limiting Factors: Table 23 depicts the protection and restoration ranks and benefits and survival factors for all four species in GA12. Survival factors define the impact of habitat conditions on the survival of life stages in the Geographic Area. Survival factors in Table 23 are defined within EDT to be composed of one or more measurable attributes of the environment in Table 24.

GA12 has a moderate to low protection rank and indirect or general protection benefit for all four species except fall Chinook salmon, as indicated in Table 23 (indicated by medium or no circles under Protection Benefit and Restoration Benefit in Table 23). Restoration of GA12 ranks high for summer steelhead trout (1 out of 44) and spring Chinook salmon (3 out of 22). The restoration benefit to spring Chinook salmon and coho salmon is low. Fall Chinook salmon would indirectly benefit from restoration of GA12.

Temperature, due to increased maximum temperature (Table 24) is the most limiting survival factor for all four species (Table 23). Sediment Load, Key Habitat Quantity, Flow and Habitat Diversity moderately limit the survival of all four species. Sediment Load limitations are attributed to increased fine sediment (Table 24). Key Habitat Quantity is impacted by channelization and a reduction in the minimum wetted width (Table 24). Flow affects survival by increased high flows, decreased low flows and increased intra-annual variation (Table 24). Decreased amounts of large wood, Riparian Function, and pool/beaver pond habitat (Table 24), all of which contribute to Habitat Diversity have reduced productivities. As shown in Table 23, fall and spring Chinook salmon survival is limited to a higher degree than coho salmon and summer steelhead trout by Habitat Diversity. Channel Stability (caused by decreased Riparian Function in Table 24) and Pathogens reduce survival to a lesser extent. The productivity of each of the four species is also depressed by the presence of exotic fish species, harassment, and reduced salmon carcasses.

Table 23. Protection and restoration strategic priority summary for Umatilla subbasin GA12.Area ranks show the rank for an area out of the total areas appropriate for each population. Benefit shows the Protection and Restoration benefit relative to the total benefits across the Umatilla basin for the population. Survival Factors show the relative contribution of each EDT survival factor to the Restoration Benefit.

Geographic Area	Species	RANK		BENEFIT		SURVIVAL FACTORS														
		Protection Rank	Restoration Rank	Protection benefit	Restoration benefit	Flow	Channel stability/landsc	Habitat diversity	Key habitat quantity	Obstructions	Withdrawals	Sediment load	Oxygen	Chemicals	Temperature	Food	Competition (w/ hatch)	Competition (other sp)	Predation	Pathogens	Harassment/poaching
Birch Cr from confluence with Umatilla R to confluence of WF and EF Birch Crs, including Stewart and Ray creeks	COHO	14/32	8/32		○	●	•	•	●			●			●					•	
	FACH	7/12	6/12	○		●	•	●	●			●			●					•	
	SPCH	15/22	3/22		○	●	•	●	●			●			●					•	
	SUST	20/44	1/44		◯	•	•	•	●	●		●			●					•	

A ◯/● High B ○/● Medium C ○/• Low D & E Indirect or General

Table 24. Change in productivity by ecological attribute for coho, fall Chinook salmon, and spring Chinook salmon and steelhead trout in Umatilla subbasin GA12. Environmental attributes are measurable qualities of the environment that are used in EDT to define the Survival Factors in Table 23.

Species	Hydrologic Characteristics						Stream Corridor Structure																										Water Quality									Biological Community										
	Flow Variation				Hydro. Regime		Channel Morphometry				Confinement		Habitat Type										Obstructions		Riparian and Channel Integrity				Sediment Type				Chemistry								Temperature Variation			Community Effects									
	Flow High	Flow Low	Flow diel variation	Flow intraannual variation	HydroRegimeNatural	HydroRegimeReg	Reach length	Maximum width	Minimum width	Gradient	Confine natural	Confine anthropogenic	Pool	Pool tailout	Backwater pool	Beaver pond	Glide	Small cobble riffle	Large cobble riffle	Off-channel habitat	Obstructions	Withdrawals	Bed Scour	Icing	Riparian Function	Woody Debris	Embeddedness	Fine Sediment	Turbidity	Alkalinity	Dissolved oxygen	Metals/pollutants sediment	Metals in water	Misc. toxins	Nutrient enrichment	Temperature maximum	Temperature minimum	Temp. spatial variation	Fish Comm Richness	Fish pathogens	Fish species introduced	Harassment	Hatchery outplants	Predation risk	Salmon carcasses	Benthic Comm Richness
COHO																																															
FACH																																															
SPCH																																															
SUST																																															

Legend:
FACH fall chinook salmon
SPCH spring chinook salmon
SUST summer steelhead trout
Reduction in productivity >or =0.0005
Reduction in productivity between 0.0005 and 0.00005
Reduction in productivity between 0.00005 and 0.000005
Reduction in productivity < or =0.000005

Geographic Area 13

Description: GA13 consists of six reaches in West Fork Birch Creek from its confluence with mainstem Birch Creek to Bear Creek, including Hoeft diversion. This geographic area supports coho and spring Chinook salmon and summer steelhead trout.

Limiting Factors: Table 25 depicts the protection and restoration ranks and benefits and survival factors for all four species in GA13. Survival factors define the impact of habitat conditions on the survival of life stages in the Geographic Area. Survival factors in Table 25 are defined within EDT to be composed of one or more measurable attributes of the environment in Table 26.

GA13 has a moderate to low protection rank and indirect or general protection benefit for all three species, as indicated in Table 25 by the lack of circles under Protection Benefit. Restoration of GA13 ranks medium for summer steelhead trout (8 out of 44) and low for spring Chinook salmon (10 out of 22) and coho salmon (15 out of 32). The restoration benefit to all three species is indirect or general (Table 25).

Temperature, due to increased maximum temperature (Table 26), is the most limiting survival factor for all four species (Table 25). Channel Stability, Habitat Diversity, Flow, Sediment Load, and Key Habitat Quantity moderately limit the survival of all three species. Channel Stability (caused by decreased Riparian Function in Table 26) has a higher impact on coho salmon survival and a moderate impact to the survival of spring Chinook salmon and summer steelhead trout. Decreased amounts of large wood, Riparian Function, and pool habitat (Table 26), all of which contribute to Habitat Diversity, have reduced productivities. As shown in Table 25, spring Chinook salmon survival is limited to a higher degree by Habitat Diversity. Flow affects survival by increased high flows, decreased low flows and increased intra-annual variation (Table 26). Sediment Load limitations are attributed to increased fine sediment (Table 26). Key Habitat Quantity is impacted by channelization, as depicted in Table 26. Pathogens contribute to a slight decrease in survival of spring Chinook salmon and summer steelhead trout. The productivity of each of the three species is also depressed by harassment. Hoeft is a partial barrier to adult summer steelhead trout.

Table 25. Protection and restoration strategic priority summary for Umatilla subbasin GA13. Area ranks show the rank for an area out of the total areas appropriate for each population. Benefit shows the Protection and Restoration benefit relative to the total benefits across the Umatilla basin for the population. Survival Factors show the relative contribution of each EDT

Geographic Area	Species	RANK		BENEFIT		SURVIVAL FACTORS															
		Protection Rank	Restoration Rank	Protection benefit	Restoration benefit	Flow	Channel stability/landsc	Habitat diversity	Key habitat quantity	Obstructions	Withdrawals	Sediment load	Oxygen	Chemicals	Temperature	Food	Competition (w/ hatch)	Competition (other sp)	Predation	Pathogens	Harassment/poaching
WF Birch Cr from confluence with mainstem to Bear Cr	COHO	20/32	15/32			●	●	●	●			●			●						•
	FACH	--	--																		
	SPCH	18/22	10/22			●	●	●	●			●			●					•	•
	SUST	32/44	8/44			●	●	●	●	●		●			●					•	•

A High B Medium C Low D & E Indirect or General

Table 26. Change in productivity by ecological attribute for coho, fall Chinook salmon, and spring Chinook salmon and steelhead trout in Umatilla subbasin GA13. Environmental attributes are measurable qualities of the environment that are used in EDT to define the Survival Factors in

Species	Hydrologic Characteristics						Stream Corridor Structure																						Water Quality										Biological Community									
	Flow Variation				Hydro. Regime		Channel Morphometry				Confinement		Habitat Type								Obstructions		Riparian and Channel Integrity				Sediment Type			Chemistry							Temperature Variation			Community Effects								
	Flow High	Flow Low	Flow diel variation	Flow intraannual variation	HydroRegimeNatural	HydroRegimeReg	Reach length	Maximum width	Minimum width	Gradient	Confine natural	Confine anthropogenic	Pool	Pool tailout	Backwater pool	Beaver pond	Glide	Small cobble riffle	Large cobble riffle	Off-channel habitat	Obstructions	Withdrawals	Bed Scour	Icing	Riparian Function	Woody Debris	Embeddedness	Fine Sediment	Turbidity	Alkalinity	Dissolved oxygen	Metals/pollutants sediment	Metals in water	Misc. toxins	Nutrient enrichment	Temperature maximum	Temperature minimum	Temp. spatial variation	Fish Comm Richness	Fish pathogens	Fish species introduced	Harassment	Hatchery outplants	Predation risk	Salmon carcasses	Benthic Comm Richness
COHO																																													
FACH																																													
SPCH																																													
SUST																																													

Legend:
FACH fall chinook salmon
SPCH spring chinook salmon
SUST summer steelhead trout
Reduction in productivity >or =0.0005
Reduction in productivity between 0.0005 and 0.00005
Reduction in productivity between 0.00005 and 0.000005
Reduction in productivity < or =0.000005

Geographic Area 14
Description: GA14 consists of two reaches in Bear Creek from its confluence with West Fork Birch Creek to the forks just inside section 36. This geographic area also includes Owings Creek (two reaches) and Willow Spring Canyon (one reach). Bear Creek supports coho salmon and summer steelhead trout; Owings and Willow Spring Canyon creeks only support summer steelhead trout.
Limiting Factors: Table 27 depicts the protection and restoration ranks and benefits and survival factors for both species in GA14. Survival factors define the impact of habitat conditions on the survival of life stages in the Geographic Area. Survival factors in Table 27 are defined within EDT to be composed of one or more measurable attributes of the environment in Table 28.
GA14 has a high protection rank for coho salmon (2 out of 32), with a medium protection benefit (indicated in Table 27 by a medium circle under Protection Benefit). The GA14 protection rank for summer steelhead trout is 9 out of 44 geographic areas, with a low protection benefit. For both species, the restoration rank of GA14 is moderate and the restoration benefit is indirect or general, as indicated in Table 27 by the lack of circles under Restoration Benefit.
Table 27 indicates that habitat quality and quantity is limiting the survival of both species at a medium to indirect level. Coho salmon and summer steelhead trout survival is primarily limited by Key Habitat Quantity (caused by anthropogenic confinement and reduced low flows in Table 28), followed by Sediment Load (due to increased fine sediment in Table 28), Habitat Diversity (caused by decreased amounts of large wood and Riparian Function in Table 28) and Temperature (attributed to increased maximum daily temperature in Table 28). Flow (caused by increased high flows, decreased low flows and increased intra-annual variation in Table 28) and Channel Stability (caused by decreased Riparian Function in Table 28) have a low impact on survival of both species in GA14.
In Owings Creek and Willow Spring Canyon, Sediment Load and Temperature are the most limiting factors to the egg incubation life stage. Key Habitat Quantity is most limiting to the prespawning holding life stage.

Table 27. Protection and restoration strategic priority summary for Umatilla subbasin GA14.Area ranks show the rank for an area out of the total areas appropriate for each population. Benefit shows the Protection and Restoration benefit relative to the total benefits across the Umatilla basin for the population. Survival Factors show the relative contribution of each EDT survival factor to the Restoration Benefit.

Geographic Area	Species	RANK: Protection Rank	RANK: Restoration Rank	BENEFIT: Protection benefit	BENEFIT: Restoration benefit	Flow	Channel stability/landsc	Habitat diversity	Key habitat quantity	Obstructions	Withdrawals	Sediment load	Oxygen	Chemicals	Temperature	Food	Competition (w/ hatch)	Competition (other sp)	Predation	Pathogens	Harassment/poaching
Bear Cr from confluence with WF Birch to forks just inside section 36 line, including Owings Cr and Willow Spr Canyon	COHO	2/32	19/32	○		•	•	●	●			•									
	FACH	--	--																		
	SPCH	--	--																		
	SUST	9/44	19/44	∘		•	•	•	●			●			●						

A	B	C	D & E
◯ / ⬤ High	○ / ● Medium	∘ / • Low	Indirect or General

Table 28. Change in productivity by ecological attribute for coho, fall Chinook salmon, and spring Chinook salmon and steelhead trout in Umatilla subbasin GA14. Environmental attributes are measurable qualities of the environment that are used in EDT to define the Survival Factors in

Hydrologic Characteristics

Species	Flow Variation: Flow High	Flow Low	Flow diel variation	Flow intraannual variation	Hydro. Regime: HydroRegimeNatural	HydroRegimeReg
COHO	light shade			light shade		
FACH						
SPCH						
SUST	light shade	light shade		light shade		

Stream Corridor Structure

Species	Channel Morphometry: Reach length	Maximum width	Minimum width	Gradient	Confinement: Confine natural	Confine anthropogenic	Habitat Type: Pool	Pool tailout	Backwater pool	Beaver pond	Glide	Small cobble riffle	Large cobble riffle	Off-channel habitat	Obstructions: Obstructions	Withdrawals	Riparian and Channel Integrity: Bed Scour	Icing	Riparian Function	Woody Debris	Sediment Type: Embeddedness	Fine Sediment	Turbidity
COHO						light shade													light shade	medium shade		light shade	
FACH																							
SPCH																							
SUST						medium shade											light shade		medium shade	medium shade			

Water Quality

Species	Chemistry: Alkalinity	Dissolved oxygen	Metals/pollutants sediment	Metals in water	Misc. toxins	Nutrient enrichment	Temperature Variation: Temperature maximum	Temperature minimum	Temp. spatial variation
COHO							light shade		
FACH									
SPCH									
SUST							medium shade		

Biological Community

Species	Community Effects: Fish Comm Richness	Fish pathogens	Fish species introduced	Harassment	Hatchery outplants	Predation risk	Salmon carcasses	Benthic Comm Richness
COHO								
FACH								
SPCH								
SUST								

Legend:
FACH fall chinook salmon
SPCH spring chinook salmon
SUST summer steelhead trout
(dark shade) Reduction in productivity >or =0.0005
(medium shade) Reduction in productivity between 0.0005 and 0.00005
(light shade) Reduction in productivity between 0.00005 and 0.000005
(white) Reduction in productivity < or =0.000005

Geographic Area 15

Description: GA15 consists of eight reaches inWest Fork Birch Creek from Bear Creek to an elevation of 3,000 ft. This geographic area also includes Bridge (three reaches) and Stanley (one reach) creeks. Three obstruction reaches occur within GA15: Low Diversion, Yellow Jacket Road culvert, and Hascall Diversion. GA15 supports summer steelhead trout throughout; coho salmon do not inhabit Bridge and Stanley creeks.

Limiting Factors: Table 29 depicts the protection and restoration ranks and benefits and survival factors for both species in GA15. Survival factors define the impact of habitat conditions on the survival of life stages in the Geographic Area. Survival factors in Table 29 are defined within EDT to be composed of one or more measurable attributes of the environment in Table 30.

GA15 has a moderate protection rank for coho (12 out of 32) with an indirect or general protection benefit (indicated in Table 29 by the lack of circles under Protection Benefit). The protection benefit of GA15 for summer steelhead trout is low, with a rank of 14 out of 44 geographic areas. GA15 has a high restoration rank for summer steelhead trout (6 out of 44) and a medium restoration benefit (indicated in Table 29 by a medium circle under Restoration Benefit). The restoration benefit to coho is indirect or general, with a restoration rank of 13 out of 32 geographic areas. Both the protection and restoration of GA15 has a higher benefit to summer steelhead trout than coho salmon.

As shown in Table 29, coho salmon and summer steelhead trout survival is moderately impacted by Temperature (due to increased maximum temperature in Table 30), Key Habitat Quantity (caused by anthropogenic confinement and reduced low flows in Table 30), and Habitat Diversity (attributed to decreased amounts of large wood and Riparian Function and limited pool habitat in Table 30). Sediment Load (caused by increased embeddedness in Table 30) moderately limits the survival of summer steelhead trout. Flow (caused by increased high flows, decreased low flows and increased intra-annual variation in Table 30) and Channel Stability (caused by decreased Riparian Function in Table 30) have a low (summer steelhead trout) to moderate (coho salmon) impact on survival in GA15.

Table 29. Protection and restoration strategic priority summary for Umatilla subbasin GA15.Area ranks show the rank for an area out of the total areas appropriate for each population. Benefit shows the Protection and Restoration benefit relative to the total benefits across the Umatilla basin for the population. Survival Factors show the relative contribution of each EDT survival factor to the Restoration Benefit.

Geographic Area	Species	RANK		BENEFIT		SURVIVAL FACTORS															
		Protection Rank	Restoration Rank	Protection benefit	Restoration benefit	Flow	Channel stability/landsc	Habitat diversity	Key habitat quantity	Obstructions	Withdrawals	Sediment load	Oxygen	Chemicals	Temperature	Food	Competition (w/ hatch)	Competition (other sp)	Predation	Pathogens	Harassment/poaching
WF Birch Cr from Bear Cr to 3,000-ft level, including Bridge and Stanley Creeks	COHO	12/32	13/32			●	●	●	●						●						
	FACH	--	--																		
	SPCH	--	--																		
	SUST	14/44	6/44	○	○	•	•	•	●	●		●			●						

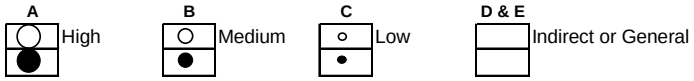


Table 30. Change in productivity by ecological attribute for coho, fall Chinook salmon, and spring Chinook salmon and summer steelhead trout in Umatilla subbasin GA15. Environmental attributes are measurable qualities of the environment that are used in EDT to define the Survival Factors in Table 29.

Geographic Area 16

Description: GA16 consists of three reaches West Fork Birch Creek from an elevation of 3,000 ft to the headwater forks at section line 13/24. West Fork Birch Creek only supports summer steelhead trout. This geographic area also includes an impassable waterfall.

Limiting Factors: Table 31 depicts the protection and restoration ranks and benefits and survival factors for summer steelhead trout in GA16. Survival factors define the impact of habitat conditions on the survival of life stages in the Geographic Area. Survival factors in Table 31 are defined within EDT to be composed of one or more measurable attributes of the environment in Table 32.

GA16 has a moderate protection rank (15 out of 44) and low restoration rank (29 out of 44). The protection benefit of GA16 for summer steelhead trout is low while the restoration benefit is indirect or general, as indicated in Table 31 by small or no circles under Protection Benefit and Restoration Benefit, respectively.

Key Habitat Quantity (Table 31) is the most limiting survival factor for summer steelhead trout, attributed to anthropogenic confinement as indicated in Table 32. Flow (caused by increased high flows and intra-annual variation in Table 32), Channel Stability (due to decreased Riparian Function in Table 32), Habitat Diversity (caused by decreased amounts of large wood and Riparian Function in Table 32) and Temperature (caused by increased maximum daily temperature in Table 30) have a low impact on survival of steelhead trout in GA16.

Species	Hydrologic Characteristics						Stream Corridor Structure																								Water Quality										Biological Community								
	Flow Variation				Hydro. Regime		Channel Morphometry				Confinement		Habitat Type										Obstructions		Riparian and Channel Integrity				Sediment Type				Chemistry							Temperature Variation			Community Effects								
	Flow High	Flow Low	Flow diel variation	Flow intraannual variation	HydroRegimeNatural	HydroRegimeReg	Reach length	Maximum width	Minimum width	Gradient	Confine natural	Confine anthropogenic	Pool	Pool tailout	Backwater pool	Beaver pond	Glide	Small cobble riffle	Large cobble riffle	Off-channel habitat	Obstructions	Withdrawals	Bed Scour	Icing	Riparian Function	Woody Debris	Embeddedness	Fine Sediment	Turbidity	Alkalinity	Dissolved oxygen	Metals/pollutants sediment	Metals in water	Misc. toxins	Nutrient enrichment	Temperature maximum	Temperature minimum	Temp. spatial variation	Fish Comm Richness	Fish pathogens	Fish species introduced	Harassment	Hatchery outplants	Predation risk	Salmon carcasses	Benthic Comm Richness
COHO																																															
FACH																																															
SPCH																																															
SUST																																															

Legend:
FACH fall chinook salmon
SPCH spring chinook salmon
SUST summer steelhead trout
Reduction in productivity >or =0.0005
Reduction in productivity between 0.0005 and 0.00005
Reduction in productivity between 0.00005 and 0.000005
Reduction in productivity < or =0.000005

Table 31. Protection and restoration strategic priority summary for Umatilla subbasin GA16.Area ranks show the rank for an area out of the total areas appropriate for each population. Benefit shows the Protection and Restoration benefit relative to the total benefits across the Umatilla basin for the population. Survival Factors show the relative contribution of each EDT survival factor to the Restoration Benefit.

Geographic Area	Species	RANK: Protection Rank	RANK: Restoration Rank	BENEFIT: Protection benefit	BENEFIT: Restoration benefit	Flow	Channel stability/landsc	Habitat diversity	Key habitat quantity	Obstructions	Withdrawals	Sediment load	Oxygen	Chemicals	Temperature	Food	Competition (w/ hatch)	Competition (other sp)	Predation	Pathogens	Harassment/poaching
WF Birch Cr from 3,000-ft level to headwater forks at section line 13/24	COHO	--	--																		
	FACH	--	--																		
	SPCH	--	--																		
	SUST	15/44	29/44	○ (Low)		• (Low)	• (Low)	• (Low)	● (High)						• (Low)						

A: ○ ● High; B: ○ ● Medium; C: ○ • Low; D & E: Indirect or General

Table 32. Change in productivity by ecological attribute for coho, fall Chinook salmon, and spring Chinook salmon and summer steelhead trout in Umatilla subbasin GA16. Environmental attributes are measurable qualities of the environment that are used in EDT to define the Survival Factors in Table 31.

Hydrologic Characteristics (Flow Variation; Hydro. Regime)

Species	Flow High	Flow Low	Flow diel variation	Flow intraannual variation	HydroRegimeNatural	HydroRegimeReg
COHO						
FACH						
SPCH						
SUST	light gray			light gray		

Stream Corridor Structure (Channel Morphometry; Confinement; Habitat Type; Obstructions; Riparian and Channel Integrity; Sediment Type)

Species	Reach length	Maximum width	Minimum width	Gradient	Confine natural	Confine anthropogenic	Pool	Pool tailout	Backwater pool	Beaver pond	Glide	Small cobble riffle	Large cobble riffle	Off-channel habitat	Obstructions	Withdrawals	Bed Scour	Icing	Riparian Function	Woody Debris	Embeddedness	Fine Sediment	Turbidity
COHO																							
FACH																							
SPCH																							
SUST						light gray											light gray		medium gray	medium gray			

Water Quality (Chemistry; Temperature Variation)

Species	Alkalinity	Dissolved oxygen	Metals/pollutants sediment	Metals in water	Misc. toxins	Nutrient enrichment	Temperature maximum	Temperature minimum	Temp. spatial variation
COHO									
FACH									
SPCH									
SUST							light gray		

Biological Community (Community Effects)

Species	Fish Comm Richness	Fish pathogens	Fish species introduced	Harassment	Hatchery outplants	Predation risk	Salmon carcasses	Benthic Comm Richness
COHO								
FACH								
SPCH								
SUST								

Legend:
FACH fall chinook salmon
SPCH spring chinook salmon
SUST summer steelhead trout
(dark gray) Reduction in productivity >or =0.0005
(medium gray) Reduction in productivity between 0.0005 and 0.00005
(light gray) Reduction in productivity between 0.00005 and 0.000005
(white) Reduction in productivity < or =0.000005

Geographic Area 17

Description: GA17 consists of five reaches in East Fork Birch Creek from its confluence with mainstem Birch Creek to California Gulch. This geographic area supports coho and spring Chinook salmon and summer steelhead trout.

Limiting Factors: Table 33 depicts the protection and restoration ranks and benefits and survival factors for all three species in GA17. Survival factors define the impact of habitat conditions on the survival of life stages in the Geographic Area. Survival factors in Table 33 are defined within EDT to be composed of one or more measurable attributes of the environment in Table 34.

GA17 has a high protection rank for coho salmon (3 out of 32 geographic areas). The protection ranks for spring Chinook salmon (8 out of 22) and summer steelhead trout (24 out of 44) are moderate. Protecting GA17 has low benefit to coho and spring Chinook salmon and indirect or general benefits to summer steelhead trout. For all species, the restoration rank is moderate; restoring GA17 would provide indirect of general benefits to all three species.

Temperature, due to increased maximum daily temperature (Table 34), and Key Habitat Quantity, impacted by channelization and reduced minimum wetted widths, are the most limiting survival factors (Table 33). Flow, Habitat Diversity, Channel Stability and Sediment Load reduce the survival at a low to moderate degree for all three species. Flow affects survival by increased high flows, decreased low flows and increased intra-annual variation (Table 34). Decreased amounts of large wood, Riparian Function, and pool habitat (Table 34), all of which contribute to Habitat Diversity, have reduced productivities. As shown in Table 33, coho and spring Chinook salmon survival is limited to a higher degree than summer steelhead trout by Flow and Habitat Diversity. Channel Stability (caused by decreased Riparian Function in Table 34) has a moderate impact on coho salmon survival and a low impact to the survival of spring Chinook salmon and summer steelhead trout. Sediment Load limitations are attributed to increased fine sediment (Table 34). The productivity of spring Chinook salmon and summer steelhead trout is also depressed by harassment.

Table 33. Protection and restoration strategic priority summary for Umatilla subbasin GA17.Area ranks show the rank for an area out of the total areas appropriate for each population. Benefit shows the Protection and Restoration benefit relative to the total benefits across the Umatilla basin for the population. Survival Factors show the relative contribution of each EDT survival factor to the Restoration Benefit.

Geographic Area	Species	RANK		BENEFIT		SURVIVAL FACTORS														
		Protection Rank	Restoration Rank	Protection benefit	Restoration benefit	Flow	Channel stability/landsc	Habitat diversity	Key habitat quantity	Obstructions	Withdrawals	Sediment load	Oxygen	Chemicals	Temperature	Food	Competition (w/ hatch)	Competition (other sp)	Predation	Pathogens	Harassment/poaching
EF Birch Cr from mainstem to California Gulch	COHO	3/32	17/32	○		●	●	●	●			•			•						
	FACH	--	--																		
	SPCH	8/22	6/22	○		●	•	●	●			•			●						•
	SUST	24/44	14/44			•	•	•	●			●			●						•

A High — ○ / ●

B Medium — ○ / ●

C Low — ○ / •

D & E Indirect or General

Table 34. Change in productivity by ecological attribute for coho, fall Chinook salmon, and spring Chinook salmon and summer steelhead trout in Umatilla subbasin GA17. Environmental attributes are measurable qualities of the environment that are used in EDT to define the Survival Factors in Table 33.

Species	Hydrologic Characteristics						Stream Corridor Structure																									Water Quality										Biological Community									
	Flow Variation				Hydro. Regime		Channel Morphometry				Confinement		Habitat Type								Obstructions		Riparian and Channel Integrity			Sediment Type			Chemistry						Temperature Variation			Community Effects												
	Flow High	Flow Low	Flow diel variation	Flow intraannual variation	HydroRegimeNatural	HydroRegimeReg	Reach length	Maximum width	Minimum width	Gradient	Confine natural	Confine anthropogenic	Pool	Pool tailout	Backwater pool	Beaver pond	Glide	Small cobble riffle	Large cobble riffle	Off-channel habitat	Obstructions	Withdrawals	Bed Scour	Icing	Riparian Function	Woody Debris	Embeddedness	Fine Sediment	Turbidity	Alkalinity	Dissolved oxygen	Metals/pollutants sediment	Metals in water	Misc. toxins	Nutrient enrichment	Temperature maximum	Temperature minimum	Temp. spatial variation	Fish Comm Richness	Fish pathogens	Fish species introduced	Harassment	Hatchery outplants	Predation risk	Salmon carcasses	Benthic Comm Richness
COHO																																														
FACH																																														
SPCH																																														
SUST																																														

Legend:
FACH fall chinook salmon
SPCH spring chinook salmon
SUST summer steelhead trout
Reduction in productivity >or =0.0005
Reduction in productivity between 0.0005 and 0.00005
Reduction in productivity between 0.00005 and 0.000005
Reduction in productivity < or =0.000005

Geographic Area 18

Description: GA18 consists of four reaches in East Fork Birch Creek from California Gulch to Pearson Creek, including California Gulch and Johnson Creek. This geographic area supports coho and spring Chinook salmon and summer steelhead trout.

Limiting Factors: Table 35 depicts the protection and restoration ranks and benefits and survival factors for all three species in GA18. Survival factors define the impact of habitat conditions on the survival of life stages in the Geographic Area. Survival factors in Table 35 are defined within EDT to be composed of one or more measurable attributes of the environment in Table 36.

GA18 has a high protection rank for coho salmon (4 out of 32 geographic areas). The protection ranks for spring Chinook salmon (6 out of 22) and summer steelhead trout (11 out of 44) are on the high side of moderate. Protecting GA18 has low benefit to all three species (Table 35). For all species, the restoration rank is moderate to low. Restoring GA18 would provide indirect or general benefits for all species.

In accordance with the protection ranks, none of the survival factors greatly limit any of the species. Key Habitat Quantity, impacted by channelization and reduced minimum wetted widths, is the most limiting survival factor for all three species (Table 35). Flow, Habitat Diversity, and Channel Stability reduce the survival at a low to moderate degree for the three species. Flow affects survival by increased high flows, decreased low flows and increased intra-annual variation in Table 36. Decreased amounts of large wood, Riparian Function, and pool habitat (Table 36), all of which contribute to Habitat Diversity have reduced productivities. As shown in Table 35, coho and spring Chinook salmon survival is limited to a higher degree by Flow and Habitat Diversity, respectively. Channel Stability (caused by decreased Riparian Function in Table 36) has a low impact on coho, spring Chinook salmon, and steelhead trout survival. Sediment Load, attributed to increased embeddedness and fine sediment (Table 36), has a moderate impact to summer steelhead trout survival. Temperature, due to increased maximum daily temperature (Table 36), slightly impacts summer steelhead trout productivity. The productivity of coho salmon is also depressed by Food, attributed to decreased salmon carcasses.

Table 35. Protection and restoration strategic priority summary for Umatilla subbasin GA18.Area ranks show the rank for an area out of the total areas appropriate for each population. Benefit shows the Protection and Restoration benefit relative to the total benefits across the Umatilla basin for the population. Survival Factors show the relative contribution of each EDT survival factor to the Restoration Benefit.

Geographic Area	Species	RANK		BENEFIT		SURVIVAL FACTORS														
		Protection Rank	Restoration Rank	Protection benefit	Restoration benefit	Flow	Channel stability/landsc	Habitat diversity	Key habitat quantity	Obstructions	Withdrawals	Sediment load	Oxygen	Chemicals	Temperature	Food	Competition (w/ hatch)	Competition (other sp)	Predation	Pathogens	Harassment/poaching
EF Birch Cr from California Gulch to Pearson Cr, including California Gulch and Johnson Cr	COHO	4/32	21/32	○		●	•	•	●							•					
	FACH	--	--																		
	SPCH	6/22	13/22	○		•	•	●	●												
	SUST	11/44	17/44	○		•	•	•	●			●			•						

A ○ ● High
B ○ ● Medium
C ○ • Low
D & E Indirect or General

Table 36. Change in productivity by ecological attribute for coho, fall Chinook salmon, and spring Chinook salmon and summer steelhead trout in Umatilla subbasin GA18. Environmental attributes are measurable qualities of the environment that are used in EDT to define the Survival Factors in Table 35.

Species	Hydrologic Characteristics						Stream Corridor Structure																										Water Quality										Biological Community									
	Flow Variation				Hydro. Regime		Channel Morphometry				Confinement		Habitat Type								Obstructions		Riparian and Channel Integrity				Sediment Type				Chemistry						Temperature Variation				Community Effects									
	Flow High	Flow Low	Flow diel variation	Flow intraannual variation	HydroRegimeNatural	HydroRegimeReg	Reach length	Maximum width	Minimum width	Gradient	Confine natural	Confine anthropogenic	Pool	Pool tailout	Backwater pool	Beaver pond	Glide	Small cobble riffle	Large cobble riffle	Off-channel habitat	Obstructions	Withdrawals	Bed Scour	Icing	Riparian Function	Woody Debris	Embeddedness	Fine Sediment	Turbidity	Alkalinity	Dissolved oxygen	Metals/pollutants sediment	Metals in water	Misc. toxins	Nutrient enrichment	Temperature maximum	Temperature minimum	Temp. spatial variation	Fish Comm Richness	Fish pathogens	Fish species introduced	Harassment	Hatchery outplants	Predation risk	Salmon carcasses	Benthic Comm Richness
COHO																																															
FACH																																															
SPCH																																															
SUST																																															

Legend:
FACH fall chinook salmon
SPCH spring chinook salmon
SUST summer steelhead trout
Reduction in productivity >or =0.0005
Reduction in productivity between 0.0005 and 0.00005
Reduction in productivity between 0.00005 and 0.000005
Reduction in productivity < or =0.000005

Geographic Area 19

Description: GA19 consists of three reaches in East Fork Birch Creek from Pearson Creek to an elevation of 4,000 ft. This geographic area also includes Pearson (three reaches), Little Pearson (one reach), Dark Canyon (one reach), South Canyon (one reach) and Westgate (three reaches) creeks. GA19 supports summer steelhead trout throughout; coho salmon occur in East Fork Birch and Pearson creeks.

Limiting Factors: Table 37 depicts the protection and restoration ranks and benefits and survival factors for both species in GA19. Survival factors define the impact of habitat conditions on the survival of life stages in the Geographic Area. Survival factors in Table 37 are defined within EDT to be composed of one or more measurable attributes of the environment in Table 38.

GA19 has a moderate protection rank for coho (9 out of 32) with an indirect or general protection benefit (indicated in Table 37 by lack of circles under Protection Benefit). The protection benefit of GA19 for summer steelhead trout is medium, with a high protection rank of 5 out of 44 geographic areas. GA19 has a moderate restoration rank for summer steelhead trout (12 out of 44) and coho (13 out of 32), with an indirect or general restoration benefit (indicated in Table 37 by lack of circles under Restoration Benefit). As shown in Table 37, coho salmon and summer steelhead trout survival is slightly to moderately impacted by Key Habitat Quantity (caused by anthropogenic confinement, reduced low flows, and reduced minimum wetted widths in Table 38), Habitat Diversity (caused by decreased amounts of large wood, Riparian Function and pool habitat in Table 38) and Flow (caused by increased high flows, decreased low flows and increased intra-annual variation in Table 38). Key Habitat Quantity is most limiting to summer steelhead trout for prespawning holding. Temperature (attributed to increased maximum daily temperature in Table 38) has a low impact on the survival of summer steelhead trout. Coho survival in GA19 is further limited by Channel Stability (caused by decreased Riparian Function in Table 38).

Table 37. Protection and restoration strategic priority summary for Umatilla subbasin GA19.Area ranks show the rank for an area out of the total areas appropriate for each population. Benefit shows the Protection and Restoration benefit relative to the total benefits across the Umatilla basin for the population. Survival Factors show the relative contribution of each EDT survival factor to the Restoration Benefit.

Geographic Area	Species	RANK		BENEFIT		SURVIVAL FACTORS														
		Protection Rank	Restoration Rank	Protection benefit	Restoration benefit	Flow	Channel stability/landsc	Habitat diversity	Key habitat quantity	Obstructions	Withdrawals	Sediment load	Oxygen	Chemicals	Temperature	Food	Competition (w/ hatch)	Competition (other sp)	Predation	Pathogens	Harassment/poaching
EF Birch Cr from Pearson Cr to 4,000-ft level, including Pearson, Little Pearson, Dark Canyon, South Canyon and Westgate Cr	COHO	9/32	13/32			●	•	●	●											
	FACH	--	--																	
	SPCH	--	--																	
	SUST	5/44	12/44	○		•		•	●						•					

A ○ ● High
B ○ ● Medium
C ○ • Low
D & E Indirect or General

Table 38. Change in productivity by ecological attribute for coho, fall Chinook salmon, and spring Chinook salmon and summer steelhead trout in Umatilla subbasin GA19. Environmental attributes are measurable qualities of the environment that are used in EDT to define the Survival Factors in Table 37.

Species	Hydrologic Characteristics						Stream Corridor Structure																										Water Quality									Biological Community									
	Flow Variation				Hydro. Regime		Channel Morphometry				Confinement		Habitat Type								Obstructions		Riparian and Channel Integrity			Sediment Type			Chemistry							Temperature Variation			Community Effects									
	Flow High	Flow Low	Flow diel variation	Flow intraannual variation	HydroRegimeNatural	HydroRegimeReg	Reach length	Maximum width	Minimum width	Gradient	Confine natural	Confine anthropogenic	Pool	Pool tailout	Backwater pool	Beaver pond	Glide	Small cobble riffle	Large cobble riffle	Off-channel habitat	Obstructions	Withdrawals	Bed Scour	Icing	Riparian Function	Woody Debris	Embeddedness	Fine Sediment	Turbidity	Alkalinity	Dissolved oxygen	Metals/pollutants sediment	Metals in water	Misc. toxins	Nutrient enrichment	Temperature maximum	Temperature minimum	Temp. spatial variation	Fish Comm Richness	Fish pathogens	Fish species introduced	Harassment	Hatchery outplants	Predation risk	Salmon carcasses	Benthic Comm Richness
COHO																																														
FACH																																														
SPCH																																														
SUST																																														

Legend:
FACH fall chinook salmon
SPCH spring chinook salmon
SUST summer steelhead trout
Reduction in productivity >or =0.0005
Reduction in productivity between 0.0005 and 0.00005
Reduction in productivity between 0.00005 and 0.000005
Reduction in productivity < or =0.000005

Geographic Area 20
Description: GA20 consists of three reaches in McKay Creek from its confluence with the Umatilla River to McKay Dam.
Limiting Factors: Table 39 depicts the protection and restoration ranks and benefits and survival factors for all four species in GA20. Survival factors define the impact of habitat conditions on the survival of life stages in the Geographic Area. Survival factors in Table 39 are defined within EDT to be composed of one or more measurable attributes of the environment in Table 40.
GA20 has a moderate protection rank for all four species. The protection benefit is medium for fall Chinook salmon, low for spring Chinook salmon and indirect or general for coho salmon and summer steelhead trout, as indicated in Table 39. Restoration of GA20 ranks moderate for summer steelhead trout (13 out of 44) and spring Chinook salmon (8 out of 22), and low for coho salmon (22 out of 32) and fall Chinook salmon (9 out of 12). All four species would indirectly benefit from restoration of GA20.
Key Habitat Quantity, the most limiting survival factor in GA20, heavily impacts the survival of all four species (Table 39). Key Habitat Quantity is impacted by channelization and a reduction in the minimum wetted width, as depicted in Table 40. Sediment Load and Harassment moderately limit the survival of all four species. Sediment Load is attributed to increased fine sediment (Table 40). Habitat Diversity, Flow, and Channel Stability reduce the survival of each of the species at a low to moderate degree. Decreased amounts of large wood, Riparian Function, and pool habitat (Table 40), all of which contribute to Habitat Diversity have reduced productivities. As shown in Table 39, fall and spring Chinook salmon survival is limited to a higher degree by Habitat Diversity. The impact of Channel Stability is influenced by decreased Riparian Function in Table 40. The availability and diversity of food reduces coho, fall and spring Chinook salmon productivities. Increased Predation and Temperature, attributed to increased maximum temperature (Table 40), reduces the survival of summer steelhead trout to a lesser extent. The productivity of each of the four species is also depressed by the presence of exotic fish species, hatchery outplants, and reduced salmon carcasses.

Table 39. Protection and restoration strategic priority summary for Umatilla subbasin GA20.Area ranks show the rank for an area out of the total areas appropriate for each population. Benefit shows the Protection and Restoration benefit relative to the total benefits across the Umatilla basin for the population. Survival Factors show the relative contribution of each EDT survival factor to the Restoration Benefit.

Geographic Area	Species	RANK		BENEFIT		SURVIVAL FACTORS														
		Protection Rank	Restoration Rank	Protection benefit	Restoration benefit	Flow	Channel stability/landsc	Habitat diversity	Key habitat quantity	Obstructions	Withdrawals	Sediment load	Oxygen	Chemicals	Temperature	Food	Competition (w/ hatch)	Competition (other sp)	Predation	Pathogens	Harassment/poaching
McKay Cr from confluence with Umatilla R to McKay Dam	COHO	21/32	22/32			•	•	•	●			●				•					●
	FACH	5/12	9/12	○		•	•	●	●			●				•					●
	SPCH	6/22	8/22	∘		•	•	●	●			●				•					●
	SUST	21/44	13/44			•	•	•	●			●			•				•		●

A ○ ● High
B ○ ● Medium
C ∘ • Low
D & E Indirect or General

Table 40. Change in productivity by ecological attribute for coho, fall Chinook salmon, and spring Chinook salmon and summer steelhead trout in Umatilla subbasin GA20. Environmental attributes are measurable qualities of the environment that are used in EDT to define the Survival Factors in Table 39.

Species	Hydrologic Characteristics						Stream Corridor Structure																										Water Quality										Biological Community									
	Flow Variation				Hydro. Regime		Channel Morphometry				Confinement	Habitat Type									Obstructions		Riparian and Channel Integrity				Sediment Type			Chemistry						Temperature Variation			Community Effects												
	Flow High	Flow Low	Flow diel variation	Flow intraannual variation	HydroRegimeNatural	HydroRegimeReg	Reach length	Maximum width	Minimum width	Gradient	Confine natural	Confine anthropogenic	Pool	Pool tailout	Backwater pool	Beaver pond	Glide	Small cobble riffle	Large cobble riffle	Off-channel habitat	Obstructions	Withdrawals	Bed Scour	Icing	Riparian Function	Woody Debris	Embeddedness	Fine Sediment	Turbidity	Alkalinity	Dissolved oxygen	Metals/pollutants sediment	Metals in water	Misc. toxins	Nutrient enrichment	Temperature maximum	Temperature minimum	Temp. spatial variation	Fish Comm Richness	Fish pathogens	Fish species introduced	Harassment	Hatchery outplants	Predation risk	Salmon carcasses	Benthic Comm Richness
COHO																																															
FACH																																															
SPCH																																															
SUST																																															

Legend:
FACH fall chinook salmon
SPCH spring chinook salmon
SUST summer steelhead trout
Reduction in productivity >or =0.0005
Reduction in productivity between 0.0005 and 0.00005
Reduction in productivity between 0.00005 and 0.000005
Reduction in productivity < or =0.000005

Geographic Area 21

Description: GA21 consists of McKay Creek from McKay Dam to North Fork McKay Creek. Summer steelhead trout and coho, fall and spring Chinook salmon inhabit GA21.

Limiting Factors: Table 41 depicts the protection and restoration ranks and benefits and survival factors for all four species in GA21. Survival factors define the impact of habitat conditions on the survival of life stages in the Geographic Area. Survival factors in Table 41 are defined within EDT to be composed of one or more measurable attributes of the environment in Table 42.

GA21 has a high protection rank for fall Chinook salmon (4 out of 12), with a medium protection benefit (Table 41). The protection ranks for the other three species are relatively low, with general or indirect protection benefits to each. Restoration of GA21 ranks high for spring Chinook salmon (2 out of 22), with a medium protection benefit (Table 41). The restoration benefit to summer steelhead trout (ranked 7 out of 44) and coho salmon (ranked 8 out of 32) is low. Fall Chinook salmon would indirectly benefit from restoration of GA21.

Temperature, due to increased maximum daily temperatures (Table 42), is the most limiting survival factor in GA21, heavily impacting the survival of all four species (Table 41). Sediment Load, Habitat Diversity, and Key Habitat Quantity are moderately limiting to the survival of all four species. Sediment Load is limiting due to increased embeddedness and fine sediment. Decreased amounts of large wood and impaired Riparian Function, both of which contribute to Habitat Diversity, have reduced productivities. Key Habitat Quantity is impacted by channelization and a reduction in the minimum wetted width, as depicted in Table 42. Flow, Channel Stability, Food and Pathogens reduce the survival of each of the species at a low to moderate degree. The impact of Channel Stability is influenced by decreased Riparian Function (Table 42). The availability and diversity of food reduces coho, fall and spring Chinook salmon productivities. As shown in Table 41, summer steelhead trout survival is limited to a higher degree than the other species by Pathogens. The productivity of each of the four species is also depressed by the presence of exotic fish species, hatchery outplants, and reduced salmon carcasses.

Table 41. Protection and restoration strategic priority summary for Umatilla subbasin GA21.Area ranks show the rank for an area out of the total areas appropriate for each population. Benefit shows the Protection and Restoration benefit relative to the total benefits across the Umatilla basin for the population. Survival Factors show the relative contribution of each EDT survival factor to the Restoration Benefit.

Geographic Area	Species	RANK		BENEFIT		SURVIVAL FACTORS															
		Protection Rank	Restoration Rank	Protection benefit	Restoration benefit	Flow	Channel stability/landsc	Habitat diversity	Key habitat quantity	Obstructions	Withdrawals	Sediment load	Oxygen	Chemicals	Temperature	Food	Competition (w/ hatch)	Competition (other sp)	Predation	Pathogens	Harassment/poaching
McKay Cr from McKay Dam to NF McKay Cr	COHO	18/32	8/32		Low	Low	Low	Medium	Medium			Medium			High	Low					
	FACH	4/12	7/12	Medium		Low	Low	Medium	Medium			Medium			High	Low				Low	
	SPCH	17/22	2/22		Medium	Low	Low	Medium	Medium			Medium			High	Low				Low	
	SUST	38/44	7/44		Low	Low	Low	Medium	Medium	High		Medium			High				Low	Medium	

A High; B Medium; C Low; D & E Indirect or General

Table 42. Change in productivity by ecological attribute for coho, fall Chinook salmon, and spring Chinook salmon and summer steelhead trout in Umatilla subbasin GA21. Environmental attributes are measurable qualities of the environment that are used in EDT to define the Survival Factors in Table 41.

Hydrologic Characteristics

Species	Flow Variation				Hydro. Reg-ime	
	Flow High	Flow Low	Flow diel variation	Flow intraannual variation	HydroRegimeNatural	HydroRegimeReg
COHO	Light			Light		
FACH	Light			Light		
SPCH	Medium			Light		
SUST	Light	Medium		Light		

Stream Corridor Structure

Species	Channel Morphometry				Confinement		Habitat Type								Obstructions		Riparian and Channel Integrity				Sediment Type		
	Reach length	Maximum width	Minimum width	Gradient	Confine natural	Confine anthropogenic	Pool	Pool tailout	Backwater pool	Beaver pond	Glide	Small cobble riffle	Large cobble riffle	Off-channel habitat	Obstructions	Withdrawals	Bed Scour	Icing	Riparian Function	Woody Debris	Embeddedness	Fine Sediment	Turbidity
COHO						Medium											Light		Medium	Medium		Light	
FACH						Medium											Light		Medium	Medium	Light	Light	
SPCH						Medium											Light		Medium	Medium	Medium		
SUST			Medium	Light		Medium									Dark		Light		Medium	Medium			

Water Quality

Species	Chemistry						Temperature Variation		
	Alkalinity	Dissolved oxygen	Metals/pollutants sediment	Metals in water	Misc. toxins	Nutrient enrichment	Temperature maximum	Temperature minimum	Temp. spatial variation
COHO							Dark		
FACH							Dark		
SPCH							Dark		
SUST							Dark		

Biological Community

Species	Community Effects							
	Fish Comm Richness	Fish pathogens	Fish species introduced	Harassment	Hatchery outplants	Predation risk	Salmon carcasses	Benthic Comm Richness
COHO			Light		Light		Light	
FACH			Light				Light	
SPCH			Light		Light		Light	
SUST			Light		Light			

Legend:
FACH fall chinook salmon
SPCH spring chinook salmon
SUST summer steelhead trout
Dark: Reduction in productivity >or =0.0005
Medium: Reduction in productivity between 0.0005 and 0.00005
Light: Reduction in productivity between 0.00005 and 0.000005
White (blank): Reduction in productivity < or =0.000005

Geographic Area 22

Description: GA22 consists of six reaches in North Fork McKay Creek from its confluence with mainstem McKay Creek to an elevation of 3,420 ft near a power line. This geographic area also includes Calamity, Bell Cow, Lost Pin, Darr and Deadman Pass creeks, each of which has been designated one reach. GA22 supports summer steelhead trout throughout; coho salmon only occur in North Fork McKay Creek.

Limiting Factors: Table 43 depicts the protection and restoration ranks and benefits and survival factors for both species in GA22. Survival factors define the impact of habitat conditions on the survival of life stages in the Geographic Area. Survival factors in Table 43 are defined within EDT to be composed of one or more measurable attributes of the environment in Table 44.

GA22 has a low protection rank for coho salmon (20 out of 32) and summer steelhead trout (38 out of 44), with an indirect or general protection benefit for both species (indicated in Table 43 by a lack of circles under Protection Benefit). The restoration rank of GA22 is moderate for coho salmon (16 out of 32) and low for summer steelhead trout (35 out of 44), with an indirect or general restoration benefit for both species, as indicated in Table 43 by a lack of circles under Restoration Benefit.

Table 43 indicates that habitat quality and quantity is limiting the survival of both species. Coho salmon and summer steelhead trout survival is primarily limited by Temperature (caused by increased maximum daily temperature in Table 44), Key Habitat Quantity (due to anthropogenic confinement and reduced low flows in Table 44), and Habitat Diversity (attributed to decreased amounts of large wood, Riparian Function and pool habitat in Table 44). Flow (caused by increased high flows, decreased low flows and increased intra-annual variation in Table 44) and Channel Stability (caused by decreased Riparian Function in Table 44) have a moderate impact on coho salmon survival and a low impact on summer steelhead trout survival. Coho salmon survival is further depressed by Food.

Table 43. Protection and restoration strategic priority summary for Umatilla subbasin GA22.Area ranks show the rank for an area out of the total areas appropriate for each population. Benefit shows the Protection and Restoration benefit relative to the total benefits across the Umatilla basin for the population. Survival Factors show the relative contribution of each EDT survival factor to the Restoration Benefit.

		RANK		BENEFIT		SURVIVAL FACTORS																
Geographic Area	Species	Protection Rank	Restoration Rank	Protection benefit	Restoration benefit	Flow	Channel stability/landsc	Habitat diversity	Key habitat quantity	Obstructions	Withdrawals	Sediment load	Oxygen	Chemicals	Temperature	Food	Competition (w/ hatch)	Competition (other sp)	Predation	Pathogens	Harassment/poaching
NF McKay Cr from mainstem to 3,420-ft level near powerline, including Calamity, Bell Cow, Lost Pin, Darr and Deadman Pass	COHO	20/32	16/32			●	●	⬤	●						●	•					
	FACH	--	--																		
	SPCH	--	--																		
	SUST	38/44	35/44			•	•	•	●						⬤					•	

	Protection (open) / Restoration (filled)	
A	◯ / ⬤	High
B	○ / ●	Medium
C	∘ / •	Low
D & E	(empty)	Indirect or General

Table 44. Change in productivity by ecological attribute for coho, fall Chinook salmon, and spring Chinook salmon and summer steelhead trout in Umatilla subbasin GA22. Environmental attributes are measurable qualities of the environment that are used in EDT to define the Survival Factors in Table 43.

Species	Flow High	Flow Low	Flow diel variation	Flow intraannual variation	HydroRegimeNatural	HydroRegimeReg	Reach length	Maximum width	Minimum width	Gradient	Confine natural	Confine anthropogenic	Pool	Pool tailout	Backwater pool	Beaver pond	Glide	Small cobble riffle	Large cobble riffle	Off-channel habitat	Obstructions	Withdrawals	Bed Scour	Icing	Riparian Function	Woody Debris	Embeddedness	Fine Sediment	Turbidity	Alkalinity	Dissolved oxygen	Metals/pollutants sediment	Metals in water	Misc. toxins	Nutrient enrichment	Temperature maximum	Temperature minimum	Temp. spatial variation	Fish Comm Richness	Fish pathogens	Fish species introduced	Harassment	Hatchery outplants	Predation risk	Salmon carcasses	Benthic Comm Richness
(group)	Hydrologic Characteristics: Flow Variation				Hydro. Regime		Stream Corridor Structure: Channel Morphometry				Confinement		Habitat Type								Obstructions		Riparian and Channel Integrity				Sediment Type			Water Quality: Chemistry						Temperature Variation			Biological Community: Community Effects							
COHO	░			░								▒											░		▒	▒										▒										
FACH																																														
SPCH																																														
SUST	░	▒		░								▒	░										░		▒	▒										▓									░	

Legend:
FACH fall chinook salmon
SPCH spring chinook salmon
SUST summer steelhead trout
▓ Reduction in productivity >or =0.0005
▒ Reduction in productivity between 0.0005 and 0.00005
░ Reduction in productivity between 0.00005 and 0.000005
(blank) Reduction in productivity < or =0.000005

Geographic Area 24
Description: GA24, comprised of 26 reaches, includes McKay Creek from North Fork McKay Creek to Snipe Creek. This geographic area also includes the following tributaries: Sevenmile, Little Sevenmile, Wood Hollow, Lake, Little Woodhollow, Rail, Bassey, Johnson, Salt, Little Johnson and Bear creeks. GA24 supports summer steelhead trout throughout; coho salmon inhabit McKay, Wood Hollow, and John creeks. Spring Chinook salmon only occur in McKay Creek.
Limiting Factors: Table 45 depicts the protection and restoration ranks and benefits and survival factors for all four species in GA24. Survival factors define the impact of habitat conditions on the survival of life stages in the Geographic Area. Survival factors in Table 45 are defined within EDT to be composed of one or more measurable attributes of the environment in Table 46.
GA24 has a high protection rank for coho salmon, 5 out of 32 geographic areas, with a low protection benefit. The protection rank for spring Chinook salmon is moderate (9 out of 22) and low for summer steelhead trout (35 out of 44), with indirect or general protection benefits for both species, as indicated in Table 45 by the lack of circles under Protection Benefit. Restoration of GA24 ranks medium for spring Chinook salmon (6 out of 22) and coho salmon (14 out of 32). This geographic area has a low restoration rank for summer steelhead trout (35 out of 44). The restoration benefit to all three species is indirect or general (Table 45).
Temperature, due to increased maximum temperature (Table 46), is the most limiting survival factor for all three species (Table 45), with the largest impact on spring Chinook salmon survival. Key Habitat Quantity, Habitat Diversity, and Flow are slightly to moderately limiting the survival of all three species. Key Habitat Quantity is impacted by channelization as depicted in Table 46. Decreased amounts of large wood, Riparian Function, and pool habitat (Table 46), all of which contribute to Habitat Diversity have reduced productivities. As shown in Table 45, coho and spring Chinook salmon survival is limited to a higher degree by Habitat Diversity. Flow affects survival by increased high flows, decreased low flows and increased intra-annual variation in Table 46. Channel Stability, caused by decreased Riparian Function (Table 46), has a low impact on the survival of all three species. Sediment Load and fish pathogens slightly reduce the survival of spring Chinook salmon.

Table 45. Protection and restoration strategic priority summary for Umatilla subbasin GA24.Area ranks show the rank for an area out of the total areas appropriate for each population. Benefit shows the Protection and Restoration benefit relative to the total benefits across the Umatilla basin for the population. Survival Factors show the relative contribution of each EDT survival factor to the Restoration Benefit.

Geographic Area	Species	RANK		BENEFIT		SURVIVAL FACTORS															
		Protection Rank	Restoration Rank	Protection benefit	Restoration benefit	Flow	Channel stability/landsc	Habitat diversity	Key habitat quantity	Obstructions	Withdrawals	Sediment load	Oxygen	Chemicals	Temperature	Food	Competition (w/ hatch)	Competition (other sp)	Predation	Pathogens	Harassment/poaching
McKay Cr from NF McKay Cr to Snipe Cr, including Secenmile, Little Sevenmile, Wood Hollow, Lake, Little Woodhollow, Rail, Bassey, Johnson, Salt, Little Johnson and Bear creeks	COHO	5/32	14/32	∘		●	•	●	●						●						
	FACH	--	--																		
	SPCH	9/22	6/22			•	•	●	●			•			⬤					•	
	SUST	38/44	35/44			•	•	•	●						●						

A	B	C	D & E
◯ / ⬤ High	○ / ● Medium	∘ / • Low	Indirect or General

Table 46. Change in productivity by ecological attribute for coho, fall Chinook salmon, and spring Chinook salmon and summer steelhead trout in Umatilla subbasin GA24. Environmental attributes are measurable qualities of the environment that are used in EDT to define the Survival Factors in Table 45.

Species	Hydrologic Characteristics						Stream Corridor Structure					
	Flow Variation				Hydro. Reg-ime		Channel Morphometry				Confinement	
	Flow High	Flow Low	Flow diel variation	Flow intraannual variation	HydroRegimeNatural	HydroRegimeReg	Reach length	Maximum width	Minimum width	Gradient	Confine natural	Confine anthropogenic
COHO	░			░								▓
FACH												
SPCH	░			░								▓
SUST	▓	▓		▓								▓

Species	Stream Corridor Structure (cont.)																
	Habitat Type									Obstructions		Riparian and Channel Integrity			Sediment Type		
	Pool	Pool tailout	Backwater pool	Beaver pond	Glide	Small cobble riffle	Large cobble riffle	Off-channel habitat	Obstructions	Withdrawals	Bed Scour	Icing	Riparian Function	Woody Debris	Embeddedness	Fine Sediment	Turbidity
COHO											░		▓	▓			
FACH																	
SPCH											░		▓	▓			
SUST	░										▓		▓	■	░		

Species	Water Quality									Biological Community							
	Chemistry						Temper-ature Variation			Community Effects							
	Alkalinity	Dissolved oxygen	Metals/pollutants sediment	Metals in water	Misc. toxins	Nutrient enrichment	Temperature maximum	Temperature minimum	Temp. spatial variation	Fish Comm Richness	Fish pathogens	Fish species introduced	Harassment	Hatchery outplants	Predation risk	Salmon carcasses	Benthic Comm Richness
COHO							▓										
FACH																	
SPCH							■									░	
SUST							■									░	

Legend:
FACH fall chinook salmon
SPCH spring chinook salmon
SUST summer steelhead trout
■ Reduction in productivity >or =0.0005
▓ Reduction in productivity between 0.0005 and 0.00005
░ Reduction in productivity between 0.00005 and 0.000005
□ Reduction in productivity < or =0.000005

Geographic Area 25
Description: GA25 consists of the Umatilla River from McKay Creek to Mission Bridge, including Tutuilla Creek. This geographic area supports summer steelhead trout, and coho, fall and spring Chinook salmon.
Limiting Factors: Table 47 depicts the protection and restoration ranks and benefits and survival factors for all four species in GA25. Survival factors define the impact of habitat conditions on the survival of life stages in the Geographic Area. Survival factors in Table 47 are defined within EDT to be composed of one or more measurable attributes of the environment in Table 48.
GA25 has a moderate protection rank for all four species. Fall Chinook salmon have a medium protection benefit, while the other species would indirectly benefit from protecting GA25. The restoration benefit is low for coho (ranked 6 out of 32) and fall Chinook salmon (ranked 5 out of 12). Summer steelhead trout (30 out of 44) and spring Chinook salmon (7 out of 22) would indirectly benefit from restoring GA47.
Sediment Load, attributed to increased embeddedness and fine sediment (Table 48), and Temperature, due to increased daily maximum temperatures (Table 48) are the most limiting survival factors for all four species (Table 47). Fall Chinook salmon productivity is impacted by fine sediment and embeddedness, primarily to the egg incubation and fry colonization life stages. Habitat Diversity, Flow, and Channel Stability are limiting to all three species to varying degrees. Decreased amounts of large wood and impaired Riparian Function (Table 48) influence Habitat Diversity, which is highly limiting to coho and spring Chinook salmon in GA25. Flow limitations are attributed to increased high flows, decreased low flows and increased intra-annual variation (Table 48). Channel Stability, attributed to decreased Riparian Function and increased bed scour in Table 48, is moderately limiting to coho and spring Chinook salmon; summer steelhead trout and fall Chinook salmon are affected to a lesser degree. The survival of the four species is also negatively impacted by Food, Competition with hatchery fish, Predation, Pathogens and Harassment.

Table 47. Protection and restoration strategic priority summary for Umatilla subbasin GA25.Area ranks show the rank for an area out of the total areas appropriate for each population. Benefit shows the Protection and Restoration benefit relative to the total benefits across the Umatilla basin for the population. Survival Factors show the relative contribution of each EDT survival factor to the Restoration Benefit.

Geographic Area	Species	RANK		BENEFIT		SURVIVAL FACTORS														
		Protection Rank	Restoration Rank	Protection benefit	Restoration benefit	Flow	Channel stability/landsc	Habitat diversity	Key habitat quantity	Obstructions	Withdrawals	Sediment load	Oxygen	Chemicals	Temperature	Food	Competition (w/ hatch)	Competition (other sp)	Predation	Pathogens	Harassment/poaching
Umatilla R from McKay Cr to Mission Br, including Tutuilla Cr	COHO	17/32	6/32		○	●	●	●	•			●			●	•	●		•		•
	FACH	6/12	5/12	○	○	●	•	●				●			●	•			•	•	•
	SPCH	10/22	7/22			●	●	●				●			●	•	•		•	•	•
	SUST	26/44	30/44			•	•	•				●			•		•		•		

A ○ ● High
B ○ ● Medium
C ○ • Low
D & E Indirect or General

Table 48. Change in productivity by ecological attribute for coho, fall Chinook salmon, and spring Chinook salmon and summer steelhead trout in Umatilla subbasin GA25. Environmental attributes are measurable qualities of the environment that are used in EDT to define the Survival Factors in Table 47.

Species	Hydrologic Characteristics						Stream Corridor Structure																									Water Quality										Biological Community								
	Flow Variation				Hydro. Regime		Channel Morphometry				Confinement		Habitat Type								Obstructions		Riparian and Channel Integrity			Sediment Type			Chemistry						Temperature Variation			Community Effects										
	Flow High	Flow Low	Flow diel variation	Flow intraannual variation	HydroRegimeNatural	HydroRegimeReg	Reach length	Maximum width	Minimum width	Gradient	Confine natural	Confine anthropogenic	Pool	Pool tailout	Backwater pool	Beaver pond	Glide	Small cobble riffle	Large cobble riffle	Off-channel habitat	Obstructions	Withdrawals	Bed Scour	Icing	Riparian Function	Woody Debris	Embeddedness	Fine Sediment	Turbidity	Alkalinity	Dissolved oxygen	Metals/pollutants sediment	Metals in water	Misc. toxins	Nutrient enrichment	Temperature maximum	Temperature minimum	Temp. spatial variation	Fish Comm Richness	Fish pathogens	Fish species introduced	Harassment	Hatchery outplants	Predation risk	Salmon carcasses	Benthic Comm Richness
COHO																																														
FACH																																														
SPCH																																														
SUST																																														

Legend:
FACH fall chinook salmon
SPCH spring chinook salmon
SUST summer steelhead trout
Reduction in productivity >or =0.0005
Reduction in productivity between 0.0005 and 0.00005
Reduction in productivity between 0.00005 and 0.000005
Reduction in productivity < or =0.000005

Geographic Area 26

Description: GA26, composed of 25 reaches, consists of Wildhorse Creek from its confluence with the Umatilla River to the Athena Park obstruction. This geographic area also includes West Spring, Little Greasewood, Greasewood, Spring Hollow and Gerking creeks. GA26 supports coho salmon and summer steelhead trout. Coho salmon only occur in Wildhorse Creek.

Limiting Factors: Table 49 depicts the protection and restoration ranks and benefits and survival factors for both species in GA26. Survival factors define the impact of habitat conditions on the survival of life stages in the Geographic Area. Survival factors in Table 49 are defined within EDT to be composed of one or more measurable attributes of the environment in Table 50.

GA26 has a low protection rank for coho salmon (24 out of 32) and summer steelhead trout (33 out of 44), with an indirect or general protection benefit (indicated in Table 49 by lack of circles under Protection Benefit). GA26 has a moderately high restoration rank for coho salmon (8 out of 32) and a low restoration benefit (indicated in Table 49 by a small circle under Restoration Benefit). The restoration benefit to summer steelhead trout is indirect or general, with a restoration rank of 34 out of 44 geographic areas.

As indicated in Table 49, survival of both species is heavily impacted by Sediment Load, due to increased embeddedness and fine sediment, as shown in Table 50. Temperature (attributed to increased maximum daily temperature in Table 50), Flow (caused by increased high flows, decreased low flows and increased intra-annual variation in Table 50) and Habitat Diversity (caused by decreased amounts of large wood, Riparian Function and pool habitat in Table 50) moderately reduce coho salmon survival. Summer steelhead trout survival is also impacted by these three survival factors, but to a lesser degree. Key Habitat Quantity (caused by anthropogenic confinement in Table 50) and Channel Stability (impaired by decreased Riparian Function in Table 50) further limit coho salmon survival in Wildhorse Creek.

Table 49. Protection and restoration strategic priority summary for Umatilla subbasin GA26.Area ranks show the rank for an area out of the total areas appropriate for each population. Benefit shows the Protection and Restoration benefit relative to the total benefits across the Umatilla basin for the population.

Geographic Area	Species	RANK		BENEFIT		SURVIVAL FACTORS														
		Protection Rank	Restoration Rank	Protection benefit	Restoration benefit	Flow	Channel stability/landsc	Habitat diversity	Key habitat quantity	Obstructions	Withdrawals	Sediment load	Oxygen	Chemicals	Temperature	Food	Competition (w/ hatch)	Competition (other sp)	Predation	Pathogens	Harassment/poaching
Wildhorse Cr from confluence with Umatilla R to Athena City Park obstruction, including W Spring, Little Greasewood, Greasewood, Spring Hollow and Gerking creeks	COHO	24/32	8/32		○	●	•	●	●			●			●						
	FACH	--	--																		
	SPCH	--	--																		
	SUST	33/44	34/44			•		•				●			•						

A High B Medium C Low D & E Indirect or General

Table 50. Change in productivity by ecological attribute for coho, fall Chinook salmon, and spring Chinook salmon and summer steelhead trout in Umatilla subbasin GA26. Environmental attributes are measurable qualities of the environment that are used in EDT to define the Survival Factors in Table 49.

Species	Hydrologic Characteristics						Stream Corridor Structure																												Water Quality										Biological Community									
	Flow Variation				Hydro. Regime		Channel Morphometry				Confinement		Habitat Type									Obstructions		Riparian and Channel Integrity				Sediment Type				Chemistry						Temperature Variation			Community Effects										
	Flow High	Flow Low	Flow diel variation	Flow intraannual variation	HydroRegimeNatural	HydroRegimeReg	Reach length	Maximum width	Minimum width	Gradient	Confine natural	Confine anthropogenic	Pool	Pool tailout	Backwater pool	Beaver pond	Glide	Small cobble riffle	Large cobble riffle	Off-channel habitat	Obstructions	Withdrawals	Bed Scour	Icing	Riparian Function	Woody Debris	Embeddedness	Fine Sediment	Turbidity	Alkalinity	Dissolved oxygen	Metals/pollutants sediment	Metals in water	Misc. toxins	Nutrient enrichment	Temperature maximum	Temperature minimum	Temp. spatial variation	Fish Comm Richness	Fish pathogens	Fish species introduced	Harassment	Hatchery outplants	Predation risk	Salmon carcasses	Benthic Comm Richness	
COHO																																															
FACH																																															
SPCH																																															
SUST																																															

Legend:
FACH fall chinook salmon
SPCH spring chinook salmon
SUST summer steelhead trout
Reduction in productivity >or =0.0005
Reduction in productivity between 0.0005 and 0.00005
Reduction in productivity between 0.00005 and 0.000005
Reduction in productivity < or =0.000005

Geographic Area 27
Description: GA27 consists of six reaches in Wildhorse Creek from the Athena City Park obstruction to a road crossing at an elevation of 3,030 ft, including Eagle Creek. The Athena City Park obstruction occurs within GA27. GA27 only supports summer steelhead trout.
Limiting Factors: Table 51 depicts the protection and restoration ranks and benefits and survival factors for summer steelhead trout in GA27. Survival factors define the impact of habitat conditions on the survival of life stages in the Geographic Area. Survival factors in Table 51 are defined within EDT to be composed of one or more measurable attributes of the environment in Table 52.
GA27 has a moderate protection rank (28 out of 44) and somewhat low restoration rank (11 out of 44), with indirect or general protection and restoration benefits, as indicated in Table 51 by the lack of circles under Protection Benefit and Restoration Benefit.
Summer steelhead trout survival is limited to a high extent by Sediment Load and Temperature (Table 51), attributed to increased embeddedness and maximum daily temperatures (Table 52), respectively. Flow moderately decreases summer steelhead trout survival due to increased high flows, decreased low flows and increased intra-annual variation, as indicated in Table 52. Summer steelhead trout survival is further depressed by Channel Stability (attributed to decreased Riparian Function in Table 52) and Habitat Diversity (caused by decreased amounts of large wood and Riparian Function in Table 52). In addition to decreased habitat quality, the overall reduction in Key Habitat Quantity (due to anthropogenic confinement and reduced low flows in Table 52) has a low impact on survival of summer steelhead trout in GA27.

Table 51. Protection and restoration strategic priority summary for Umatilla subbasin GA27.Area ranks show the rank for an area out of the total areas appropriate for each population. Benefit shows the Protection and Restoration benefit relative to the total benefits across the Umatilla basin for the population. Survival Factors show the relative

Geographic Area	Species	RANK		BENEFIT		SURVIVAL FACTORS														
		Protection Rank	Restoration Rank	Protection benefit	Restoration benefit	Flow	Channel stability/landsc	Habitat diversity	Key habitat quantity	Obstructions	Withdrawals	Sediment load	Oxygen	Chemicals	Temperature	Food	Competition (w/ hatch)	Competition (other sp)	Predation	Pathogens	Harassment/poaching
Wildhorse Cr from Athena City Park obstruction to road crossing at 3,030-ft level, including Eagle Cr	COHO	--	--																		
	FACH	--	--																		
	SPCH	--	--																		
	SUST	28/44	11/44			●	•	•	•			●			●						

A High B Medium C Low D & E Indirect or General

contribution of each EDT survival factor to the Restoration Benefit.

Table 52. Change in productivity by ecological attribute for coho, fall Chinook salmon, and spring Chinook salmon and summer steelhead trout in Umatilla subbasin GA27. Environmental attributes are measurable qualities of the environment that are used in EDT to define the Survival Factors in Table 51.

Species	Hydrologic Characteristics						Stream Corridor Structure																										Water Quality									Biological Community									
	Flow Variation				Hydro. Regime		Channel Morphometry				Confinement		Habitat Type								Obstructions		Riparian and Channel Integrity				Sediment Type				Chemistry						Temperature Variation			Community Effects											
	Flow High	Flow Low	Flow diel variation	Flow intraannual variation	HydroRegimeNatural	HydroRegimeReg	Reach length	Maximum width	Minimum width	Gradient	Confine natural	Confine anthropogenic	Pool	Pool tailout	Backwater pool	Beaver pond	Glide	Small cobble riffle	Large cobble riffle	Off-channel habitat	Obstructions	Withdrawals	Bed Scour	Icing	Riparian Function	Woody Debris	Embeddedness	Fine Sediment	Turbidity	Alkalinity	Dissolved oxygen	Metals/pollutants sediment	Metals in water	Misc. toxins	Nutrient enrichment	Temperature maximum	Temperature minimum	Temp. spatial variation	Fish Comm Richness	Fish pathogens	Fish species introduced	Harassment	Hatchery outplants	Predation risk	Salmon carcasses	Benthic Comm Richness
COHO																																														
FACH																																														
SPCH																																														
SUST																																														

Legend:
FACH fall chinook salmon
SPCH spring chinook salmon
SUST summer steelhead trout
Reduction in productivity >or =0.0005
Reduction in productivity between 0.0005 and 0.00005
Reduction in productivity between 0.00005 and 0.000005
Reduction in productivity < or =0.000005

Geographic Area 28
Description: GA28 consists of the Umatilla River from Mission Bridge to Meacham Creek.
Limiting Factors: Table 53 depicts the protection and restoration ranks and benefits and survival factors for all four species in GA28. Survival factors define the impact of habitat conditions on the survival of life stages in the Geographic Area. Survival factors in Table 53 are defined within EDT to be composed of one or more measurable attributes of the environment in Table 54.
Of the four species, GA28 has the highest protection rank and benefit for fall Chinook salmon (2 out of 12 geographic areas) (Table 53). GA28 has a moderate protection rank for coho salmon (6 out of 32) and spring Chinook salmon (7 out of 22), with a low protection benefit for both species. Summer steelhead trout (17 out of 44) would indirectly benefit from protecting GA28, as indicated by the lack of circles under Protection Benefit (Table 53). Overall, restoring GA28 is important for all four species. Restoration of GA28 is most important for spring Chinook salmon, with a restoration rank of 1 out of 22 and a high restoration benefit. Fall Chinook salmon (2 out of 12), coho salmon (4 out of 32), and summer steelhead trout (3 out of 44) have medium restoration benefits in GA28 (Table 53).
Temperature, due to high daily maximum temperatures (Table 54), and Sediment Load, attributed to increased fine sediment (Table 54), are the most limiting survival factors (Table 53). Fall Chinook salmon productivity is impacted by fine sediment and embeddedness, primarily to the egg incubation and fry colonization life stages. As shown in Table 53, Channel Stability (caused by decreased large wood and Riparian Function in Table 54), Habitat Diversity (caused by decreased amounts of large wood and decreased Riparian Function in Table 54), Flow (due to increased high flows, decreased low flows and increased intra-annual variation in Table 54), Predation, and Pathogens limit survival of all four species to a low degree. In addition to habitat quality, Key Habitat Quantity is limiting to all of the species, with a higher affect on spring Chinook salmon. Key Habitat Quantity (Table 53) is influenced by anthropogenic confinement (Table 54). Coho salmon and summer steelhead trout survival is also limited by competition with hatchery fish.

Table 53. Protection and restoration strategic priority summary for Umatilla subbasin GA28.Area ranks show the rank for an area out of the total areas appropriate for each population. Benefit shows the Protection and Restoration benefit relative to the total benefits across the Umatilla basin for the population. Survival Factors show the relative contribution of each EDT survival factor to the Restoration Benefit.

Geographic Area	Species	RANK		BENEFIT		SURVIVAL FACTORS														
		Protection Rank	Restoration Rank	Protection benefit	Restoration benefit	Flow	Channel stability/landsc	Habitat diversity	Key habitat quantity	Obstructions	Withdrawals	Sediment load	Oxygen	Chemicals	Temperature	Food	Competition (w/ hatch)	Competition (other sp)	Predation	Pathogens	Harassment/poaching
Umatilla R from Mission Br to Meacham Cr	COHO	6/32	4/32	○	○	•	•	•	•			•			●		•		•		
	FACH	2/12	2/12	◯	○	•	•	•	•			•			●				•	•	
	SPCH	7/22	1/22	○	◯	•	•	•	●			●			●				•	•	
	SUST	17/44	3/44		○	•	•	•	•			●			●		•		•	●	

A High B Medium C Low D & E Indirect or General

Table 54. Change in productivity by ecological attribute for coho, fall Chinook salmon, and spring Chinook salmon and summer steelhead trout in Umatilla subbasin GA28. Environmental attributes are measurable qualities of the environment that are used in EDT to define the Survival Factors in Table 53.

Species	Hydrologic Characteristics						Stream Corridor Structure																										Water Quality										Biological Community									
	Flow Variation				Hydro. Regime		Channel Morphometry				Confinement		Habitat Type													Obstructions		Riparian and Channel Integrity			Sediment Type			Chemistry							Temperature Variation			Community Effects									
	Flow High	Flow Low	Flow diel variation	Flow intraannual variation	HydroRegimeNatural	HydroRegimeReg	Reach length	Maximum width	Minimum width	Gradient	Confine natural	Confine anthropogenic	Pool	Pool tailout	Backwater pool	Beaver pond	Glide	Small cobble riffle	Large cobble riffle	Off-channel habitat	Obstructions	Withdrawals	Bed Scour	Icing	Riparian Function	Woody Debris	Embeddedness	Fine Sediment	Turbidity	Alkalinity	Dissolved oxygen	Metals/pollutants sediment	Metals in water	Misc. toxins	Nutrient enrichment	Temperature maximum	Temperature minimum	Temp. spatial variation	Fish Comm Richness	Fish pathogens	Fish species introduced	Harassment	Hatchery outplants	Predation risk	Salmon carcasses	Benthic Comm Richness
COHO																																															
FACH																																															
SPCH																																															
SUST																																															

Legend:
FACH fall chinook salmon
SPCH spring chinook salmon
SUST summer steelhead trout
Reduction in productivity >or =0.0005
Reduction in productivity between 0.0005 and 0.00005
Reduction in productivity between 0.00005 and 0.000005
Reduction in productivity < or =0.000005

Geographic Area 29
Description: GA29 consists of Mission Creek from its confluence with the Umatilla River to the fork at an elevation of 1,900 ft. This geographic area includes Cottonwood, Moonshine, and Coonskin creeks. GA29 only supports summer steelhead trout.
Limiting Factors: Table 55 depicts the protection and restoration ranks and benefits and survival factors for summer steelhead trout in GA29. Survival factors define the impact of habitat conditions on the survival of life stages in the Geographic Area. Survival factors in Table 55 are defined within EDT to be composed of one or more measurable attributes of the environment in Table 56.
GA29 has a low protection rank (31 out of 44) and a moderate restoration rank (13 out of 44), with indirect or general protection and restoration benefits, as indicated in Table 55 by the lack of circles under Protection Benefit and Restoration Benefit.
Summer steelhead trout survival is limited to a high extent by Sediment Load and Temperature (Table 55), attributed to increased embeddedness/fine sediment and maximum daily temperatures (Table 56), respectively. In addition to decreased habitat quality, the overall reduction in Key Habitat Quantity (caused by anthropogenic confinement and reduced low flows in Table 56) has a medium impact on survival of summer steelhead trout in GA29. Flow slightly decreases summer steelhead trout survival due to increased high flows, decreased low flows and increased intra-annual variation, as indicated in Table 56. Summer steelhead trout survival is further depressed by Habitat Diversity (attributed to decreased amounts of large wood and Riparian Function in Table 56) and fish pathogens.

Table 55. Protection and restoration strategic priority summary for Umatilla subbasin GA29.Area ranks show the rank for an area out of the total areas appropriate for each population. Benefit shows the Protection and Restoration benefit relative to the total benefits across the Umatilla basin for the population. Survival Factors show the relative contribution of each EDT survival factor to the Restoration Benefit.
Key to strategic priority (corresponding Benefit Category letter also shown):

Geographic Area	Species	RANK: Protection Rank	RANK: Restoration Rank	BENEFIT: Protection benefit	BENEFIT: Restoration benefit	SURVIVAL FACTORS: Flow	Channel stability/landsc	Habitat diversity	Key habitat quantity	Obstructions	Withdrawals	Sediment load	Oxygen	Chemicals	Temperature	Food	Competition (w/ hatch)	Competition (other sp)	Predation	Pathogens	Harassment/poaching
Mission Cr from confluence with Umatilla R to fork at 1,900-ft level, including Cottonwood, Moonshine and Coonskin creeks	COHO	--	--																		
	FACH	--	--																		
	SPCH	--	--																		
	SUST	31/44	13/44			•		•	●			⬤			⬤					•	

A	B	C	D & E
○ / ⬤ High	○ / ● Medium	∘ / • Low	Indirect or General

Table 56. Change in productivity by ecological attribute for coho, fall Chinook salmon, and spring Chinook salmon and summer steelhead trout in Umatilla subbasin GA29. Environmental attributes are measurable qualities of the environment that are used in EDT to define the Survival Factors in Table 55.

Group	Subgroup	Attribute	COHO	FACH	SPCH	SUST
Hydrologic Characteristics	Flow Variation	Flow High				light grey
		Flow Low				light grey
		Flow diel variation				
		Flow intraannual variation				light grey
	Hydro. Reg-ime	HydroRegimeNatural				
		HydroRegimeReg				
Stream Corridor Structure	Channel Morphometry	Reach length				
		Maximum width				
		Minimum width				
		Gradient				
	Confinement	Confine natural				
		Confine anthropogenic				light grey
	Habitat Type	Pool				
		Pool tailout				
		Backwater pool				
		Beaver pond				
		Glide				
		Small cobble riffle				
		Large cobble riffle				
		Off-channel habitat				
	Obstructions	Obstructions				
		Withdrawals				
	Riparian and Channel Integrity	Bed Scour				
		Icing				
		Riparian Function				light grey
		Woody Debris				medium grey
	Sediment Type	Embeddedness				medium grey
		Fine Sediment				light grey
		Turbidity				
Water Quality	Chemistry	Alkalinity				
		Dissolved oxygen				
		Metals/pollutants sediment				
		Metals in water				
		Misc. toxins				
		Nutrient enrichment				
	Temperature Variation	Temperature maximum				medium grey
		Temperature minimum				
		Temp. spatial variation				
Biological Community	Community Effects	Fish Comm Richness				
		Fish pathogens				
		Fish species introduced				
		Harassment				
		Hatchery outplants				
		Predation risk				
		Salmon carcasses				
		Benthic Comm Richness				

Legend:
FACH fall chinook salmon
SPCH spring chinook salmon
SUST summer steelhead trout
(dark grey) Reduction in productivity >or =0.0005
(medium grey) Reduction in productivity between 0.0005 and 0.00005
(light grey) Reduction in productivity between 0.00005 and 0.000005
(white) Reduction in productivity < or =0.000005

Geographic Area 30

Description: GA30 consists of three reaches in Buckaroo Creek from its confluence with the Umatilla River to the forks at an elevation of 2,400 ft. This geographic area supports coho salmon and summer steelhead trout.

Limiting Factors: Table 57 depicts the protection and restoration ranks and benefits and survival factors for both species in GA30. Survival factors define the impact of habitat conditions on the survival of life stages in the Geographic Area. Survival factors in Table 57 are defined within EDT to be composed of one or more measurable attributes of the environment in Table 58.

GA30 has a moderate protection rank for coho salmon (15 out of 32) summer steelhead trout (25 out of 44) with an indirect or general protection benefit (indicated in Table 57 by lack of circles under Protection Benefit). The restoration benefit to both species is also indirect or general. The restoration rank of GA30 for summer steelhead trout is moderate (24 out of 44) and low for coho salmon, which have a restoration rank of 18 out of 32 geographic areas.

As shown in Table 57, summer steelhead trout survival is heavily impacted by Temperature (caused by increased maximum temperature in Table 58). Temperature also has a low effect on coho salmon survival. Key Habitat Quantity has a moderate impact on the survival of both species. Habitat Diversity (caused by decreased amounts of large wood and Riparian Function in Table 58), Flow (attributed to increased high flows and decreased low flows in Table 58), Channel Stability (caused by decreased Riparian Function in Table 58) and Food (attributed to a lack of salmon carcasses) have a low (summer steelhead trout) to moderate (coho salmon) impact on survival in GA30.

Table 57. Protection and restoration strategic priority summary for Umatilla subbasin GA30.Area ranks show the rank for an area out of the total areas appropriate for each population. Benefit shows the Protection and Restoration benefit relative to the total benefits across the Umatilla basin for the population. Survival Factors show the relative contribution of each EDT survival factor to the Restoration Benefit.

Geographic Area	Species	RANK		BENEFIT		SURVIVAL FACTORS														
		Protection Rank	Restoration Rank	Protection benefit	Restoration benefit	Flow	Channel stability/landsc	Habitat diversity	Key habitat quantity	Obstructions	Withdrawals	Sediment load	Oxygen	Chemicals	Temperature	Food	Competition (w/ hatch)	Competition (other sp)	Predation	Pathogens	Harassment/poaching
Buckaroo Cr from confluence with Umatilla R to forks at 2,400-ft level	COHO	15/32	18/32			●	•	●	●						•	•					
	FACH	--	--																		
	SPCH	--	--																		
	SUST	25/44	24/44			•	•	•	●						●	•					

A ● High
B ● Medium
C • Low
D & E Indirect or General

Table 58. Change in productivity by ecological attribute for coho, fall Chinook salmon, and spring Chinook salmon and summer steelhead trout in Umatilla subbasin GA30. Environmental attributes are measurable qualities of the environment that are used in EDT to define the Survival Factors in Table 57.

Species	Hydrologic Characteristics						Stream Corridor Structure																								Water Quality									Biological Community								
	Flow Variation				Hydro. Regime		Channel Morphometry				Confinement		Habitat Type								Obstructions		Riparian and Channel Integrity			Sediment Type			Chemistry						Temperature Variation			Community Effects								
	Flow High	Flow Low	Flow diel variation	Flow intraannual variation	HydroRegimeNatural	HydroRegimeReg	Reach length	Maximum width	Minimum width	Gradient	Confine natural	Confine anthropogenic	Pool	Pool tailout	Backwater pool	Beaver pond	Glide	Small cobble riffle	Large cobble riffle	Off-channel habitat	Obstructions	Withdrawals	Bed Scour	Icing	Riparian Function	Woody Debris	Embeddedness	Fine Sediment	Turbidity	Alkalinity	Dissolved oxygen	Metals/pollutants sediment	Metals in water	Misc. toxins	Nutrient enrichment	Temperature maximum	Temperature minimum	Temp. spatial variation	Fish Comm Richness	Fish pathogens	Fish species introduced	Harassment	Hatchery outplants	Predation risk	Salmon carcasses	Benthic Comm Richness
COHO																																													
FACH																																													
SPCH																																													
SUST																																													

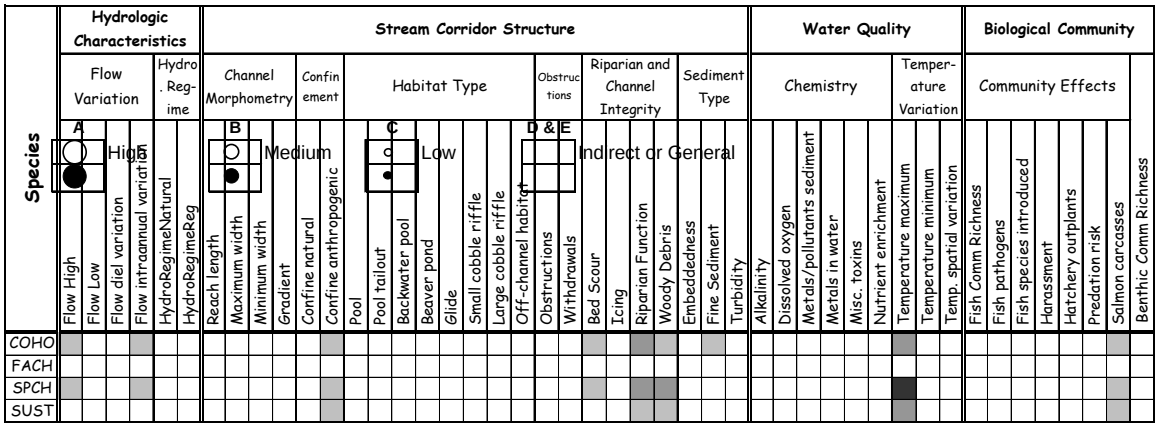
Legend:
FACH fall chinook salmon
SPCH spring chinook salmon
SUST summer steelhead trout
Reduction in productivity >or =0.0005
Reduction in productivity between 0.0005 and 0.00005
Reduction in productivity between 0.00005 and 0.000005
Reduction in productivity < or =0.000005

Geographic Area 31
Description: GA31 consists of Squaw Creek from its confluence with the Umatilla River to Bachelor Creek. This geographic area supports coho and spring Chinook salmon and summer steelhead trout.
Limiting Factors: Table 59 depicts the protection and restoration ranks and benefits and survival factors for all three species in GA31. Survival factors define the impact of habitat conditions on the survival of life stages in the Geographic Area. Survival factors in Table 59 are defined within EDT to be composed of one or more measurable attributes of the environment in Table 60.
GA31 has a high protection rank for coho salmon, 6 out of 32 geographic areas, with a low protection benefit. The protection rank for spring Chinook salmon is moderate (9 out of 22) and low for summer steelhead trout (30 out of 44), with indirect or general protection benefits for both species, as indicated in Table 59 by the lack of circles under Protection Benefit. Restoration of GA31 ranks medium for spring Chinook salmon (12 out of 22), coho salmon (18 out of 32), and summer steelhead trout (25 out of 44). The restoration benefit to all three species is indirect or general (Table 59).
Temperature, due to increased maximum temperature (Table 60), is the most limiting survival factor for all three species (Table 59). Key Habitat Quantity and Sediment Load moderately limit the survival of all three species. Key Habitat Quantity is impacted by channelization as depicted in Table 60. Sediment Load is attributed to increased fine sediment (Table 60). Flow, Channel Stability, and Food also reduce survival of all three species, but to a low degree. The effect of Flow on survival is attributed to increased high flows and intra-annual variation. Channel Stability is caused by decreased Riparian Function (Table 60). As shown in Table 59, Habitat Diversity has a moderate impact on spring Chinook salmon survival and a low impact to the survival of coho salmon. Amounts of large wood and Riparian Function (Table 60) have decreased, both of which contribute to Habitat Diversity.

Table 59. Protection and restoration strategic priority summary for Umatilla subbasin GA31.Area ranks show the rank for an area out of the total areas appropriate for each population. Benefit shows the Protection and Restoration benefit relative to the total benefits across the Umatilla basin for the population. Survival Factors show the relative contribution of each EDT survival factor to the Restoration Benefit.

Geographic Area	Species	RANK		BENEFIT		SURVIVAL FACTORS														
		Protection Rank	Restoration Rank	Protection benefit	Restoration benefit	Flow	Channel stability/landsc	Habitat diversity	Key habitat quantity	Obstructions	Withdrawals	Sediment load	Oxygen	Chemicals	Temperature	Food	Competition (w/ hatch)	Competition (other sp)	Predation	Pathogens	Harassment/poaching
Squaw Cr from confluence with Umatilla R to Bachelor Cr	COHO	6/32	18/32	○		•	•	•	●			●			•	•					
	FACH	--	--																		
	SPCH	9/22	12/22			•	•	●	●			●			●	•					
	SUST	30/44	25/44			•	•		●			●			●	•					

Table 60. Change in productivity by ecological attribute for coho, fall Chinook salmon, and spring Chinook salmon and summer steelhead trout in Umatilla subbasin GA31. Environmental attributes are measurable qualities of the environment that are used in EDT to define the Survival Factors in Table 59.



Legend:
FACH fall chinook salmon
SPCH spring chinook salmon
SUST summer steelhead trout
Reduction in productivity >or =0.0005
Reduction in productivity between 0.0005 and 0.00005
Reduction in productivity between 0.00005 and 0.000005
Reduction in productivity < or =0.000005

Geographic Area 32

Description: GA32, composed of six reaches, consists of Squaw Creek from Bachelor Creek to confluence at an elevation of 2,780 ft, including Bachelor and Little Squaw creeks and an unnamed tributary. This geographic area supports summer steelhead trout throughout; coho and spring Chinook salmon only occur in Squaw Creek.

Limiting Factors: Table 61 depicts the protection and restoration ranks and benefits and survival factors for all three species in GA32. Survival factors define the impact of habitat conditions on the survival of life stages in the Geographic Area. Survival factors in Table 61 are defined within EDT to be composed of one or more measurable attributes of the environment in Table 62.

GA32 has a moderate protection rank and indirect or general protection benefit for each of the three species, as indicated in Table 61 by the lack of circles under Protection Benefit. Restoration of GA32 ranks medium for summer steelhead trout (9 out of 44) and low for spring Chinook salmon (15 out of 22) and coho salmon (20 out of 32). The restoration benefit to all three species is indirect or general (Table 61).

Temperature, due to increased maximum temperature (Table 62), is the most limiting survival factor for spring Chinook salmon and summer steelhead trout (Table 61). Sediment Load and Key Habitat Quantity moderately limit the survival of all three species. Reduced survival from Sediment Load is attributed to increased fine sediment (Table 62). Key Habitat Quantity is impacted by channelization as depicted in Table 62. Habitat Diversity, Channel Stability, Flow and Food further depress the survival of all three species to a lesser extent. Decreased amounts of large wood and impaired Riparian Function, both of which contribute to Habitat Diversity, have reduced productivities for all three species. As shown in Table 61, spring Chinook salmon survival is limited to a higher degree than the other species by Habitat Diversity. Channel Stability limitations are attributed to by decreased Riparian Function (Table 62). Flow affects survival through increased high flows and intra-annual variation (Table 62).

Table 61. Protection and restoration strategic priority summary for Umatilla subbasin GA32.Area ranks show the rank for an area out of the total areas appropriate for each population. Benefit shows the Protection and Restoration benefit relative to the total benefits across the Umatilla basin for the population. Survival Factors show the relative contribution of each EDT survival factor to the Restoration Benefit.

Geographic Area	Species	RANK		BENEFIT		SURVIVAL FACTORS														
		Protection Rank	Restoration Rank	Protection benefit	Restoration benefit	Flow	Channel stability/landsc	Habitat diversity	Key habitat quantity	Obstructions	Withdrawals	Sediment load	Oxygen	Chemicals	Temperature	Food	Competition (w/ hatch)	Competition (other sp)	Predation	Pathogens	Harassment/poaching
Squaw Cr from Bachelor Cr to confluence at 2,780-ft level, including Bachelor and Little Squaw creeks	COHO	8/32	20/32			•	•	•	●			●			•	•					
	FACH	--	--																		
	SPCH	13/22	15/22			•	•	●	●			●			●	•					
	SUST	22/44	9/44			•	•	•	●			●			●	•					

A High B Medium C Low D & E Indirect or General

Table 62. Change in productivity by ecological attribute for coho, fall Chinook salmon, and spring Chinook salmon and summer steelhead trout in Umatilla subbasin GA32. Environmental attributes are measurable qualities of the environment that are used in EDT to define the Survival Factors in Table 61.

Species	Hydrologic Characteristics						Stream Corridor Structure																										Water Quality											Biological Community								
	Flow Variation				Hydro. Regime		Channel Morphometry				Confinement		Habitat Type										Obstructions		Riparian and Channel Integrity				Sediment Type				Chemistry								Temperature Variation			Community Effects									
	Flow High	Flow Low	Flow diel variation	Flow intraannual variation	HydroRegimeNatural	HydroRegimeReg	Reach length	Maximum width	Minimum width	Gradient	Confine natural	Confine anthropogenic	Pool	Pool tailout	Backwater pool	Beaver pond	Glide	Small cobble riffle	Large cobble riffle	Off-channel habitat	Obstructions	Withdrawals	Bed Scour	Icing	Riparian Function	Woody Debris	Embeddedness	Fine Sediment	Turbidity	Alkalinity	Dissolved oxygen	Metals/pollutants sediment	Metals in water	Misc. toxins	Nutrient enrichment	Temperature maximum	Temperature minimum	Temp.spatial variation	Fish Comm Richness	Fish pathogens	Fish species introduced	Harassment	Hatchery outplants	Predation risk	Salmon carcasses	Benthic Comm Richness
COHO																																															
FACH																																															
SPCH																																															
SUST																																															

Legend:
FACH fall chinook salmon
SPCH spring chinook salmon
SUST summer steelhead trout
Reduction in productivity >or =0.0005
Reduction in productivity between 0.0005 and 0.00005
Reduction in productivity between 0.00005 and 0.000005
Reduction in productivity < or =0.000005

Geographic Area 33
Description: GA33 consists of Meacham Creek from its confluence with the Umatilla River to North Fork Meacham Creek, including Boston Canyon.
Limiting Factors: Table 63 depicts the protection and restoration ranks and benefits and survival factors for all four species in GA33. Survival factors define the impact of habitat conditions on the survival of life stages in the Geographic Area. Survival factors in Table 63 are defined within EDT to be composed of one or more measurable attributes of the environment in Table 64.
Of the four species, GA33 has the highest protection benefit for fall Chinook salmon (3 out of 12 geographic areas) (Table 63), followed by coho salmon (2 out of 32) and spring Chinook salmon (3 out of 22). GA33 has a moderate protection rank for summer steelhead trout (9 out of 44), with a low protection benefit. Restoration of GA33 is most important for summer steelhead trout, with a restoration rank of 5 out of 44 and a medium restoration benefit. Spring Chinook salmon (4 out of 22) and coho salmon (9 out of 32) have medium restoration benefits in GA33 (Table 63). Fall Chinook salmon (7 out of 12) would indirectly benefit from restoring GA33.
Temperature, due to high daily maximum temperatures (Table 64), is the most limiting survival factor (Table 63) in GA33. As shown in Table 63, Habitat Diversity, caused by decreased amounts of large wood, Riparian Function, and pool habitat (Table 64), and Key Habitat Quantity are moderately limiting to all four species. Key Habitat Quantity (Table 63) is influenced by anthropogenic confinement (Table 64). Channel Stability (caused by decreased large wood and Riparian Function in Table 64), Flow (due to increased high flows, decreased low flows and increased intra-annual variation in Table 64), Food, Predation, and Competition with hatchery fish limit survival of all four species to a low degree.

Table 63. Protection and restoration strategic priority summary for Umatilla subbasin GA33.Area ranks show the rank for an area out of the total areas appropriate for each population. Benefit shows the Protection and Restoration benefit relative to the total benefits across the Umatilla basin for the population. Survival Factors show the relative contribution of each EDT survival factor to the Restoration Benefit.

Geographic Area	Species	RANK		BENEFIT		SURVIVAL FACTORS															
		Protection Rank	Restoration Rank	Protection benefit	Restoration benefit	Flow	Channel stability/landsc	Habitat diversity	Key habitat quantity	Obstructions	Withdrawals	Sediment load	Oxygen	Chemicals	Temperature	Food	Competition (w/ hatch)	Competition (other sp)	Predation	Pathogens	Harassment/poaching
Meacham Cr from confluence with Umatilla R to NF Meacham Cr, including Boston Canyon	COHO	2/32	9/32	○	∘	•	•	●	●						●	•	•		•		
	FACH	3/12	7/12	◯		•	•	●	●						●	•	•		•		
	SPCH	3/22	4/22	○	∘	•	•	●	●						●	•	•		•		
	SUST	9/44	5/44	∘	○	•	•	•	●						●	•	•		•		

A ○ ● High
B ○ ● Medium
C ∘ • Low
D & E Indirect or General

Table 64. Change in productivity by ecological attribute for coho, fall Chinook salmon, and spring Chinook salmon and summer steelhead trout in Umatilla subbasin GA33. Environmental attributes are measurable qualities of the environment that are used in EDT to define the Survival Factors in Table 63.

Species	Hydrologic Characteristics						Stream Corridor Structure																										Water Quality										Biological Community								
	Flow Variation				Hydro. Regime		Channel Morphometry				Confinement		Habitat Type										Obstructions		Riparian and Channel Integrity			Sediment Type			Chemistry							Temperature Variation			Community Effects								
	Flow High	Flow Low	Flow diel variation	Flow intraannual variation	HydroRegimeNatural	HydroRegimeReg	Reach length	Maximum width	Minimum width	Gradient	Confine natural	Confine anthropogenic	Pool	Pool tailout	Backwater pool	Beaver pond	Glide	Small cobble riffle	Large cobble riffle	Off-channel habitat	Obstructions	Withdrawals	Bed Scour	Icing	Riparian Function	Woody Debris	Embeddedness	Fine Sediment	Turbidity	Alkalinity	Dissolved oxygen	Metals/pollutants sediment	Metals in water	Misc. toxins	Nutrient enrichment	Temperature maximum	Temperature minimum	Temp. spatial variation	Fish Comm Richness	Fish pathogens	Fish species introduced	Harassment	Hatchery outplants	Predation risk	Salmon carcasses	Benthic Comm Richness
COHO																																														
FACH																																														
SPCH																																														
SUST																																														

Legend:
FACH fall chinook salmon
SPCH spring chinook salmon
SUST summer steelhead trout
Reduction in productivity >or =0.0005
Reduction in productivity between 0.0005 and 0.00005
Reduction in productivity between 0.00005 and 0.000005
Reduction in productivity < or =0.000005

Geographic Area 34
Description: GA34 consists of Line, Camp and Duncan Canyon Creeks, all of which only support summer steelhead trout.
Limiting Factors: Table 65 depicts the protection and restoration ranks and benefits and survival factors for summer steelhead trout in GA34. Survival factors define the impact of habitat conditions on the survival of life stages in the Geographic Area. Survival factors in Table 65 are defined within EDT to be composed of one or more measurable attributes of the environment in Table 66.
GA34 has a moderate protection rank (16 out of 44) and restoration rank (20 out of 44), with an indirect or general protection and restoration benefits, as indicated in Table 65 by the lack of circles under Protection Benefit and Restoration Benefit.
Table 65 indicates that summer steelhead trout survival is limited to a low extent by Flow, Channel Stability, Habitat Diversity, Sediment Load, Competition with hatchery fish and Predation. The influence of Channel Stability on survival is caused by decreased Riparian Function, as depicted in Table 66. Habitat Diversity has decreased due to reduced amounts of large wood and impaired Riparian Function (Table 66). Increased fine sediment (Table 66) has negatively impacted Sediment Load (Table 65). In addition to reduced habitat quality, the overall reduction in Key Habitat Quantity (caused by anthropogenic confinement in Table 66) has a low impact on survival of summer steelhead trout in GA34.

Table 65. Protection and restoration strategic priority summary for Umatilla subbasin GA34.Area ranks show the rank for an area out of the total areas appropriate for each population. Benefit shows the Protection and Restoration benefit relative to the total benefits across the Umatilla basin for the population. Survival Factors show the relative contribution of each EDT survival factor to the Restoration Benefit.

Geographic Area	Species	RANK		BENEFIT		SURVIVAL FACTORS														
		Protection Rank	Restoration Rank	Protection benefit	Restoration benefit	Flow	Channel stability/landsc	Habitat diversity	Key habitat quantity	Obstructions	Withdrawals	Sediment load	Oxygen	Chemicals	Temperature	Food	Competition (w/ hatch)	Competition (other sp)	Predation	Pathogens	Harassment/poaching
Line, Camp and Duncan Canyon creeks	COHO	--	--																	
	FACH	--	--																	
	SPCH	--	--																	
	SUST	16/44	20/44			●	●	●	●			●					●		●		

A ○ ● High
B ○ ● Medium
C ○ • Low
D & E Indirect or General

Table 66. Change in productivity by ecological attribute for coho, fall Chinook salmon, and spring Chinook salmon and summer steelhead trout in Umatilla subbasin GA34. Environmental attributes are measurable qualities of the environment that are used in EDT to define the Survival Factors in Table 65.

Species	Hydrologic Characteristics						Stream Corridor Structure																										Water Quality										Biological Community									
	Flow Variation				Hydro. Regime		Channel Morphometry				Confinement		Habitat Type									Obstructions		Riparian and Channel Integrity				Sediment Type			Chemistry						Temperature Variation			Community Effects											
	Flow High	Flow Low	Flow diel variation	Flow intraannual variation	HydroRegimeNatural	HydroRegimeReg	Reach length	Maximum width	Minimum width	Gradient	Confine natural	Confine anthropogenic	Pool	Pool tailout	Backwater pool	Beaver pond	Glide	Small cobble riffle	Large cobble riffle	Off-channel habitat	Obstructions	Withdrawals	Bed Scour	Icing	Riparian Function	Woody Debris	Embeddedness	Fine Sediment	Turbidity	Alkalinity	Dissolved oxygen	Metals/pollutants sediment	Metals in water	Misc. toxins	Nutrient enrichment	Temperature maximum	Temperature minimum	Temp. spatial variation	Fish Comm Richness	Fish pathogens	Fish species introduced	Harassment	Hatchery outplants	Predation risk	Salmon carcasses	Benthic Comm Richness
COHO																																															
FACH																																															
SPCH																																															
SUST																																															

Legend:
FACH fall chinook salmon
SPCH spring chinook salmon
SUST summer steelhead trout
Reduction in productivity >or =0.0005
Reduction in productivity between 0.0005 and 0.00005
Reduction in productivity between 0.00005 and 0.000005
Reduction in productivity < or =0.000005

Geographic Area 35

Description: GA35 consists of 13 reaches in North Fork Meacham Creek from its confluence with mainstem Meacham Creek to an elevation of 3,800 ft, and its tributaries (Sawmill, Bear, Hoskins, Pot and Canyon creeks). North Fork Meacham Creek supports coho and spring Chinook salmon and summer steelhead trout. Coho salmon also occur in Bear and Pot creeks. Summer steelhead trout inhabit the entire geographic area.

Limiting Factors: Table 67 depicts the protection and restoration ranks and benefits and survival factors for all three species in GA35. Survival factors define the impact of habitat conditions on the survival of life stages in the Geographic Area. Survival factors in Table 67 are defined within EDT to be composed of one or more measurable attributes of the environment in Table 68.

GA35 has a high protection rank for spring Chinook salmon (2 out of 22) and summer steelhead trout (4 out of 44), with medium protection benefits for both species, as indicated in Table 67 by the medium circles under Protection Benefit. The protection rank of GA35 for coho salmon is moderately high (7 out of 32); the protection benefit of GA35 for coho is low (Table 67). Restoration of GA35 ranks medium for summer steelhead trout (10 out of 44) and spring Chinook salmon (9 out of 22) and low for coho salmon (22 out of 32). The restoration benefit to all three species is indirect or general (Table 67).

Habitat Diversity, Key Habitat Quantity, and Temperature, are the most limiting survival factors for all three species (Table 67). Decreased amounts of large wood and impaired Riparian Function (Table 68), both of which contribute to Habitat Diversity, have reduced productivities. As shown in Table 67, spring Chinook salmon and coho salmon survival is limited to a higher degree than summer steelhead trout by Habitat Diversity. Key Habitat Quantity is impacted by channelization as depicted in Table 68. Temperature limitations are attributed to increased maximum daily temperature (Table 68). Flow, Competition with hatchery fish, and Predation limit the survival of each of the species to a low degree. Channel Stability (caused by decreased Riparian Function in Table 68) and Food are also slightly limiting to spring Chinook salmon in GA35. The waterfall in upper North Fork Meacham Creek is a barrier to migrating adult summer steelhead trout.

Table 67. Protection and restoration strategic priority summary for Umatilla subbasin GA35.Area ranks show the rank for an area out of the total areas appropriate for each population. Benefit shows the Protection and Restoration benefit relative to the total benefits across the Umatilla basin for the population. Survival Factors show the relative contribution of each EDT survival factor to the Restoration Benefit.

Geographic Area	Species	RANK		BENEFIT		SURVIVAL FACTORS															
		Protection Rank	Restoration Rank	Protection benefit	Restoration benefit	Flow	Channel stability/landsc	Habitat diversity	Key habitat quantity	Obstructions	Withdrawals	Sediment load	Oxygen	Chemicals	Temperature	Food	Competition (w/ hatch)	Competition (other sp)	Predation	Pathogens	Harassment/poaching
NF Meacham Cr from confluence with mainstem to 3,800-ft level, including Sawmill, Bear, Hoskins, Pot and Canyon creeks	COHO	7/32	22/32	○ C		● C		● B	● C						● C		● C		● C		
	FACH	--	--																		
	SPCH	2/22	9/22	○ B		● C	● C	● B	● B						● B	● C	● C		● C		
	SUST	4/44	10/44	○ B		● C		● C	● C	● A					● C		● C		● C		

A: ○ / ● High B: ○ / ● Medium C: ○ / ● Low D & E: Indirect or General

Table 68. Change in productivity by ecological attribute for coho, fall Chinook salmon, and spring Chinook salmon and summer steelhead trout in Umatilla subbasin GA35. Environmental attributes are measurable qualities of the environment that are used in EDT to define the Survival Factors in Table 67.

Species	Hydrologic Characteristics						Stream Corridor Structure																						
	Flow Variation				Hydro. Reg-ime		Channel Morphometry				Confinement		Habitat Type								Obstructions		Riparian and Channel Integrity				Sediment Type		
	Flow High	Flow Low	Flow diel variation	Flow intraannual variation	HydroRegimeNatural	HydroRegimeReg	Reach length	Maximum width	Minimum width	Gradient	Confine natural	Confine anthropogenic	Pool	Pool tailout	Backwater pool	Beaver pond	Glide	Small cobble riffle	Large cobble riffle	Off-channel habitat	Obstructions	Withdrawals	Bed Scour	Icing	Riparian Function	Woody Debris	Embeddedness	Fine Sediment	Turbidity
COHO												light											light		medium	medium			
FACH																													
SPCH												medium													medium	medium			
SUST												light									light				medium	medium			

Species	Water Quality									Biological Community							
	Chemistry						Temper-ature Variation			Community Effects							
	Alkalinity	Dissolved oxygen	Metals/pollutants sediment	Metals in water	Misc. toxins	Nutrient enrichment	Temperature maximum	Temperature minimum	Temp. spatial variation	Fish Comm Richness	Fish pathogens	Fish species introduced	Harassment	Hatchery outplants	Predation risk	Salmon carcasses	Benthic Comm Richness
COHO							light							light		light	
FACH																	
SPCH							medium							light		light	
SUST							medium							medium		light	

Legend:
FACH fall chinook salmon
SPCH spring chinook salmon
SUST summer steelhead trout
(dark) Reduction in productivity >or =0.0005
(medium) Reduction in productivity between 0.0005 and 0.00005
(light) Reduction in productivity between 0.00005 and 0.000005
(white) Reduction in productivity < or =0.000005

Geographic Area 36
Description: The five reaches making up GA36 includes of Meacham Creek from North Fork Meacham Creek to an elevation of 3,820 ft and Sheep Creek. GA36 only supports summer steelhead trout.
Limiting Factors: Table 69 depicts the protection and restoration ranks and benefits and survival factors for summer steelhead trout in GA36. Survival factors define the impact of habitat conditions on the survival of life stages in the Geographic Area. Survival factors in Table 69 are defined within EDT to be composed of one or more measurable attributes of the environment in Table 70.
GA36 has a moderate protection rank (13 out of 44) and high restoration rank (7 out of 44), with low protection and restoration benefits, as indicated in Table 69 by small circles under Protection Benefit and Restoration Benefit.
Temperature, attributed to increased maximum daily temperatures (Table 70), is the most limiting survival factor for summer steelhead trout (Table 69). The overall reduction in Key Habitat Quantity, caused by anthropogenic confinement and reduced low flows (Table 70), has a medium impact on survival of summer steelhead trout in GA36. Flow (caused by increased high flows, decreased low flows and increased intra-annual variation in Table 70), Channel Stability (caused by impaired Riparian Function in Table 70), and Habitat Diversity (caused by decreased amounts of large wood and Riparian Function in Table 70) limit summer steelhead trout survival to a low degree. As indicated in Table 69, competition with hatchery fish and increased predation further depresses summer steelhead trout survival.

Table 69. Protection and restoration strategic priority summary for Umatilla subbasin GA36.Area ranks show the rank for an area out of the total areas appropriate for each population. Benefit shows the Protection and Restoration benefit relative to the total benefits across the Umatilla basin for the population. Survival Factors show the relative contribution of each EDT survival factor to the Restoration Benefit.

		RANK		BENEFIT		SURVIVAL FACTORS																
Geographic Area	Species	Protection Rank	Restoration Rank	Protection benefit	Restoration benefit	Flow	Channel stability/landsc	Habitat diversity	Key habitat quantity	Obstructions	Withdrawals	Sediment load	Oxygen	Chemicals	Temperature	Food	Competition (w/ hatch)	Competition (other sp)	Predation	Pathogens	Harassment/poaching
Meacham Cr from NF Meacham Cr to 3,820-ft level, including Sheep Cr	COHO	--	--																		
	FACH	--	--																		
	SPCH	--	--																		
	SUST	13/44	7/44	○	○	•	•	•	●						⬤		•		•		

A	B	C	D & E
◯ / ⬤ High	○ / ● Medium	○ / • Low	Indirect or General

Table 70. Change in productivity by ecological attribute for coho, fall Chinook salmon, and spring Chinook salmon and summer steelhead trout in Umatilla subbasin GA36. Environmental attributes are measurable qualities of the environment that are used in EDT to define the Survival Factors in Table 69.

Species	Hydrologic Characteristics: Flow Variation				Hydro. Regime	
	Flow High	Flow Low	Flow diel variation	Flow intraannual variation	HydroRegimeNatural	HydroRegimeReg
COHO						
FACH						
SPCH						
SUST	light grey	light grey		light grey		

Species	Stream Corridor Structure: Channel Morphometry				Confinement		Habitat Type								Obstructions		Riparian and Channel Integrity				Sediment Type		
	Reach length	Maximum width	Minimum width	Gradient	Confine natural	Confine anthropogenic	Pool	Pool tailout	Backwater pool	Beaver pond	Glide	Small cobble riffle	Large cobble riffle	Off-channel habitat	Obstructions	Withdrawals	Bed Scour	Icing	Riparian Function	Woody Debris	Embeddedness	Fine Sediment	Turbidity
COHO																							
FACH																							
SPCH																							
SUST						light grey											light grey		medium grey	medium grey			

Species	Water Quality: Chemistry						Temperature Variation		
	Alkalinity	Dissolved oxygen	Metals/pollutants sediment	Metals in water	Misc. toxins	Nutrient enrichment	Temperature maximum	Temperature minimum	Temp. spatial variation
COHO									
FACH									
SPCH									
SUST							medium grey		

Species	Biological Community: Community Effects							
	Fish Comm Richness	Fish pathogens	Fish species introduced	Harassment	Hatchery outplants	Predation risk	Salmon carcasses	Benthic Comm Richness
COHO								
FACH								
SPCH								
SUST					medium grey		light grey	

Legend:
FACH fall chinook salmon
SPCH spring chinook salmon
SUST summer steelhead trout
(dark grey) Reduction in productivity >or =0.0005
(medium grey) Reduction in productivity between 0.0005 and 0.00005
(light grey) Reduction in productivity between 0.00005 and 0.000005
(white) Reduction in productivity < or =0.000005

Geographic Area 37
Description: GA37 consists of East Meacham Creek from its confluence with Meacham Creek to an elevation of 3,800 ft and includes Owsley and Butcher creeks. GA37, composed of four reaches, only supports summer steelhead trout.
Limiting Factors: Table 71 depicts the protection and restoration ranks and benefits and survival factors for summer steelhead trout in GA37. Survival factors define the impact of habitat conditions on the survival of life stages in the Geographic Area. Survival factors in Table 71 are defined within EDT to be composed of one or more measurable attributes of the environment in Table 72.
GA37 has a high protection rank (8 out of 44), with low protection benefit, as indicated in Table 71 by a small circle under Protection Benefit. The restoration rank of GA37 is moderate (27 out of 44), having an indirect or general restoration benefit.
Key Habitat Quantity, caused by anthropogenic confinement and reduced low flows (Table 72), is the most limiting survival factor for summer steelhead trout (Table 71). Summer steelhead trout survival is impacted at a low level by Flow (attributed to increased high flows in Table 72) and Habitat Diversity (caused by decreased amounts of large wood and Riparian Function in Table 72). As indicated in Table 71, competition with hatchery fish and increased predation further depresses summer steelhead trout survival.

Table 71. Protection and restoration strategic priority summary for Umatilla subbasin GA37.Area ranks show the rank for an area out of the total areas appropriate for each population. Benefit shows the Protection and Restoration benefit relative to the total benefits across the Umatilla basin for the population. Survival Factors show the relative contribution of each EDT survival factor to the Restoration Benefit.

Geographic Area	Species	RANK		BENEFIT		SURVIVAL FACTORS														
		Protection Rank	Restoration Rank	Protection benefit	Restoration benefit	Flow	Channel stability/landsc	Habitat diversity	Key habitat quantity	Obstructions	Withdrawals	Sediment load	Oxygen	Chemicals	Temperature	Food	Competition (w/ hatch)	Competition (other sp)	Predation	Pathogens	Harassment/poaching
East Meacham from confluence with mainstem to 3,800-ft level, including Owsley and Butcher creeks	COHO	--	--																	
	FACH	--	--																	
	SPCH	--	--																	
	SUST	8/44	27/44	○		●		●	●								●		●			

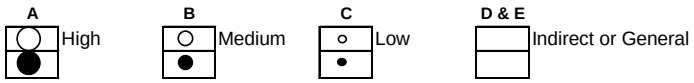


Table 72. Change in productivity by ecological attribute for coho, fall Chinook salmon, and spring Chinook salmon and summer steelhead trout in Umatilla subbasin GA37. Environmental attributes are measurable qualities of the environment that are used in EDT to define the Survival Factors in Table 71.

Species	Hydrologic Characteristics						Stream Corridor Structure																										Water Quality									Biological Community										
	Flow Variation				Hydro. Regime		Channel Morphometry				Confinement		Habitat Type								Obstructions		Riparian and Channel Integrity				Sediment Type				Chemistry								Temperature Variation			Community Effects										
	Flow High	Flow Low	Flow diel variation	Flow intraannual variation	HydroRegimeNatural	HydroRegimeReg	Reach length	Maximum width	Minimum width	Gradient	Confine natural	Confine anthropogenic	Pool	Pool tailout	Backwater pool	Beaver pond	Glide	Small cobble riffle	Large cobble riffle	Off-channel habitat	Obstructions	Withdrawals	Bed Scour	Icing	Riparian Function	Woody Debris	Embeddedness	Fine Sediment	Turbidity	Alkalinity	Dissolved oxygen	Metals/pollutants sediment	Metals in water	Misc. toxins	Nutrient enrichment	Temperature maximum	Temperature minimum	Temp. spatial variation	Fish Comm Richness	Fish pathogens	Fish species introduced	Harassment	Hatchery outplants	Predation risk	Salmon carcasses	Benthic Comm Richness
COHO																																															
FACH																																															
SPCH																																															
SUST																																															

Legend:
FACH fall chinook salmon
SPCH spring chinook salmon
SUST summer steelhead trout
Reduction in productivity >or =0.0005
Reduction in productivity between 0.0005 and 0.00005
Reduction in productivity between 0.00005 and 0.000005
Reduction in productivity < or =0.000005

Geographic Area 38
Description: GA38 consists of Meacham Creek (five reaches) from Sheep Creek to an elevation of 4,000 ft, including Twomile Creek (three reaches). This geographic area only supports summer steelhead trout.
Limiting Factors: Table 73 depicts the protection and restoration ranks and benefits and survival factors for summer steelhead trout in GA38. Survival factors define the impact of habitat conditions on the survival of life stages in the Geographic Area. Survival factors in Table 73 are defined within EDT to be composed of one or more measurable attributes of the environment in Table 74.
GA38 has a moderate protection rank (23 out of 44) and restoration rank (26 out of 44), with an indirect or general protection and restoration benefits, as indicated in Table 73 by the lack of circles under Protection Benefit and Restoration Benefit.
Sediment load is the most limiting survival factor for summer steelhead trout (Table 73), attributed to increased embeddedness and fine sediment (Table 74). The overall reduction in Key Habitat Quantity, caused by anthropogenic confinement and reduced low flows (Table 74), and Habitat Diversity (due to decreased amounts of large wood and Riparian Function in Table 74) have a medium impact on survival of summer steelhead trout in GA38. Flow (caused by increased high flows, decreased low flows and increased intra-annual variation in Table 74) and Channel Stability (caused by impaired Riparian Function in Table 74) decrease summer steelhead trout survival to a low extent. As indicated in Table 73, competition with hatchery fish and increased predation further depresses summer steelhead trout survival.

Table 73. Protection and restoration strategic priority summary for Umatilla subbasin GA38.
Area ranks show the rank for an area out of the total areas appropriate for each population. Benefit shows the Protection and Restoration benefit relative to the total benefits across the Umatilla basin for the population. Survival Factors show the relative contribution of each EDT survival factor to the Restoration Benefit.

Geographic Area	Species	RANK		BENEFIT		SURVIVAL FACTORS															
		Protection Rank	Restoration Rank	Protection benefit	Restoration benefit	Flow	Channel stability/landsc	Habitat diversity	Key habitat quantity	Obstructions	Withdrawals	Sediment load	Oxygen	Chemicals	Temperature	Food	Competition (w/ hatch)	Competition (other sp)	Predation	Pathogens	Harassment/poaching
Meacham Cr from Sheep Cr to 4,000-ft level, including Twomile Cr	COHO	--	--																		
	FACH	--	--																		
	SPCH	--	--																		
	SUST	23/44	26/44			•	•	●	●			●					•		•		

A ○ / ● High
B ○ / ● Medium
C ○ / • Low
D & E Indirect or General

Table 74. Change in productivity by ecological attribute for coho, fall Chinook salmon, and spring Chinook salmon and summer steelhead trout in Umatilla subbasin GA38. Environmental attributes are measurable qualities of the environment that are used in EDT to define the Survival Factors in Table 73.

Species	Hydrologic Characteristics						Stream Corridor Structure																										Water Quality										Biological Community									
	Flow Variation				Hydro. Regime		Channel Morphometry				Confinement		Habitat Type										Obstructions		Riparian and Channel Integrity				Sediment Type				Chemistry							Temperature Variation			Community Effects									
	Flow High	Flow Low	Flow diel variation	Flow intraannual variation	HydroRegimeNatural	HydroRegimeReg	Reach length	Maximum width	Minimum width	Gradient	Confine natural	Confine anthropogenic	Pool	Pool tailout	Backwater pool	Beaver pond	Glide	Small cobble riffle	Large cobble riffle	Off-channel habitat	Obstructions	Withdrawals	Bed Scour	Icing	Riparian Function	Woody Debris	Embeddedness	Fine Sediment	Turbidity	Alkalinity	Dissolved oxygen	Metals/pollutants sediment	Metals in water	Misc. toxins	Nutrient enrichment	Temperature maximum	Temperature minimum	Temp. spatial variation	Fish Comm Richness	Fish pathogens	Fish species introduced	Harassment	Hatchery outplants	Predation risk	Salmon carcasses	Benthic Comm Richness
COHO																																															
FACH																																															
SPCH																																															
SUST																																															

Legend:
FACH fall chinook salmon
SPCH spring chinook salmon
SUST summer steelhead trout
Reduction in productivity >or =0.0005
Reduction in productivity between 0.0005 and 0.00005
Reduction in productivity between 0.00005 and 0.000005
Reduction in productivity < or =0.000005

Geographic Area 39

Description: GA39 consists of Beaver Creek (four reaches) from its confluence with the mainstem to an elevation of 4,200 ft, and Little Beaver Creek (one reach). This geographic area only supports summer steelhead trout.

Limiting Factors: Table 75 depicts the protection and restoration ranks and benefits and survival factors for summer steelhead trout in GA39. Survival factors define the impact of habitat conditions on the survival of life stages in the Geographic Area. Survival factors in Table 75 are defined within EDT to be composed of one or more measurable attributes of the environment in Table 76.

GA39 has a moderate protection rank (25 out of 44) and restoration rank (28 out of 44), with an indirect or general protection and restoration benefits, as indicated in Table 75 by the lack of circles under Protection Benefit and Restoration Benefit.

Sediment load is the most limiting survival factor for summer steelhead trout (Table 75), attributed to increased embeddedness and fine sediment (Table 76). The overall reduction in Key Habitat Quantity, caused by anthropogenic confinement (Table 76), has a medium impact on survival of summer steelhead trout in GA39. Flow, due to increased high flows (Table 76), decreases summer steelhead trout survival to a lesser degree. As indicated in Table 75, competition with hatchery fish and increased predation further depresses productivities. Meacham Lake Dam is a partial barrier to migrating adults.

Table 75. Protection and restoration strategic priority summary for Umatilla subbasin GA39.Area ranks show the rank for an area out of the total areas appropriate for each population. Benefit shows the Protection and Restoration benefit relative to the total benefits across the Umatilla basin for the population. Survival Factors show the relative contribution of each EDT survival factor to the Restoration Benefit.

Geographic Area	Species	RANK		BENEFIT		SURVIVAL FACTORS															
		Protection Rank	Restoration Rank	Protection benefit	Restoration benefit	Flow	Channel stability/landsc	Habitat diversity	Key habitat quantity	Obstructions	Withdrawals	Sediment load	Oxygen	Chemicals	Temperature	Food	Competition (w/ hatch)	Competition (other sp)	Predation	Pathogens	Harassment/poaching
Beaver Cr from conluence with mainstem to 4,200-ft level, including Little Beaver Cr	COHO	--	--																		
	FACH	--	--																		
	SPCH	--	--																		
	SUST	25/44	28/44			● (Low)			● (Medium)	● (Low)		● (High)					● (Low)		● (Low)		

A	B	C	D & E
○ / ● High	○ / ● Medium	○ / ● Low	Indirect or General

Table 76. Change in productivity by ecological attribute for coho, fall Chinook salmon, and spring Chinook salmon and summer steelhead trout in Umatilla subbasin GA39. Environmental attributes are measurable qualities of the environment that are used in EDT to define the Survival Factors in Table 75.

Hydrologic Characteristics

Species	Flow Variation				Hydro. Regime	
	Flow High	Flow Low	Flow diel variation	Flow intraannual variation	HydroRegimeNatural	HydroRegimeReg
COHO						
FACH						
SPCH						
SUST	light grey					

Stream Corridor Structure

Species	Channel Morphometry				Confinement		Habitat Type									Obstructions		Riparian and Channel Integrity				Sediment Type		
	Reach length	Maximum width	Minimum width	Gradient	Confine natural	Confine anthropogenic	Pool	Pool tailout	Backwater pool	Beaver pond	Glide	Small cobble riffle	Large cobble riffle	Off-channel habitat	Obstructions	Withdrawals	Bed Scour	Icing	Riparian Function	Woody Debris	Embeddedness	Fine Sediment	Turbidity
COHO																							
FACH																							
SPCH																							
SUST																			light grey	light grey	light grey	light grey	

Water Quality

Species	Chemistry						Temperature Variation		
	Alkalinity	Dissolved oxygen	Metals/pollutants sediment	Metals in water	Misc. toxins	Nutrient enrichment	Temperature maximum	Temperature minimum	Temp. spatial variation
COHO									
FACH									
SPCH									
SUST							light grey		

Biological Community

Species	Community Effects							
	Fish Comm Richness	Fish pathogens	Fish species introduced	Harassment	Hatchery outplants	Predation risk	Salmon carcasses	Benthic Comm Richness
COHO								
FACH								
SPCH								
SUST					light grey			

Legend:
FACH fall chinook salmon
SPCH spring chinook salmon
SUST summer steelhead trout
(black) Reduction in productivity >or =0.0005
(dark grey) Reduction in productivity between 0.0005 and 0.00005
(light grey) Reduction in productivity between 0.00005 and 0.000005
(white) Reduction in productivity < or =0.000005

Geographic Area 40
Description: GA40 consists of the Umatilla River from Meacham Creek to the confluence of North and South Fork Umatilla River, including Hillbilly, StarveToDeath, Hagar, Bobsled, Rock, Bear and Lick creeks.
Limiting Factors: Table 77 depicts the protection and restoration ranks and benefits and survival factors for all four species in GA40. Survival factors define the impact of habitat conditions on the survival of life stages in the Geographic Area. Survival factors in Table 77 are defined within EDT to be composed of one or more measurable attributes of the environment in Table 78.
GA40 has the highest overall protection rank of any of the geographic areas in the Umatilla subbasin. The protection rank of GA40 is first for coho, fall and spring Chinook salmon and second for summer steelhead trout. Restoration of GA40 is most important for summer steelhead trout, with a restoration rank of 4 out of 44 and a medium restoration benefit. Spring Chinook salmon (5 out of 22) and coho salmon (11 out of 32) have medium restoration benefits in GA40 (Table 77). Fall Chinook salmon (8 out of 12) would indirectly benefit from restoring GA40.
Temperature, due to high daily maximum temperatures (Table 78), is the most limiting survival factor (Table 77) in GA40. Summer steelhead trout and spring Chinook salmon survival is heavily limited by temperature. As shown in Table 77, Habitat Diversity, caused by decreased amounts of large wood and impaired Riparian Function (Table 78), and Key Habitat Quantity are moderately limiting to the three salmon species. Key Habitat Quantity (Table 77) is influenced by anthropogenic confinement (Table 78). Channel Stability (caused by decreased large wood and Riparian Function in Table 78), and Flow (due to increased high flows, decreased low flows and increased intra-annual variation in Table 78) limit survival of all four species to a low degree.

Table 77. Protection and restoration strategic priority summary for Umatilla subbasin GA40.Area ranks show the rank for an area out of the total areas appropriate for each population. Benefit shows the Protection and Restoration benefit relative to the total benefits across the Umatilla basin for the population. Survival Factors show the relative contribution of each EDT survival factor to the Restoration Benefit.

Geographic Area	Species	RANK: Protection Rank	RANK: Restoration Rank	BENEFIT: Protection benefit	BENEFIT: Restoration benefit	SURVIVAL FACTORS: Flow	Channel stability/landsc	Habitat diversity	Key habitat quantity	Obstructions	Withdrawals	Sediment load	Oxygen	Chemicals	Temperature	Food	Competition (w/ hatch)	Competition (other sp)	Predation	Pathogens	Harassment/poaching
Umatilla R from Meacham Cr to NF/SF Umatilla R, including Hillbilly, StarveToDeath, Hagar, Bobsled, Rock, Bear and Lick creeks	COHO	1/32	11/32	High	Low	Low	Low	High	High						Low						
	FACH	1/12	8/12	High		Low	Low	High	High						Low						
	SPCH	1/22	5/22	High	Low	Low	Low	High	High						High						
	SUST	2/44	4/44	High	Medium	Low	Low	Low	Low						High						

A: High B: Medium C: Low D & E: Indirect or General

Table 78. Change in productivity by ecological attribute for coho, fall Chinook salmon, and spring Chinook salmon and summer steelhead trout in Umatilla subbasin GA40. Environmental attributes are measurable qualities of the environment that are used in EDT to define the Survival Factors in Table 77.

Hydrologic Characteristics (Flow Variation; Hydro. Regime)

Species	Flow High	Flow Low	Flow diel variation	Flow intraannual variation	HydroRegimeNatural	HydroRegimeReg
COHO	Light					
FACH						
SPCH	Light			Light		
SUST		Light				

Stream Corridor Structure (Channel Morphometry; Confinement; Habitat Type; Obstructions; Riparian and Channel Integrity; Sediment Type)

Species	Reach length	Maximum width	Minimum width	Gradient	Confine natural	Confine anthropogenic	Pool	Pool tailout	Backwater pool	Beaver pond	Glide	Small cobble riffle	Large cobble riffle	Off-channel habitat	Obstructions	Withdrawals	Bed Scour	Icing	Riparian Function	Woody Debris	Embeddedness	Fine Sediment	Turbidity
COHO				Light		Medium											Light		Medium	Medium			
FACH				Light		Medium				Light							Medium		Dark	Dark			
SPCH				Light		Dark				Light							Medium		Dark	Dark			
SUST				Light		Medium											Light		Medium	Medium			

Water Quality (Chemistry; Temperature Variation)

Species	Alkalinity	Dissolved oxygen	Metals/pollutants sediment	Metals in water	Misc. toxins	Nutrient enrichment	Temperature maximum	Temperature minimum	Temp. spatial variation
COHO							Medium		
FACH							Dark		
SPCH							Dark		
SUST							Dark		

Biological Community (Community Effects)

Species	Fish Comm Richness	Fish pathogens	Fish species introduced	Harassment	Hatchery outplants	Predation risk	Salmon carcasses	Benthic Comm Richness
COHO					Light		Light	
FACH							Medium	
SPCH					Light		Medium	
SUST					Medium		Light	

Legend:
FACH fall chinook salmon
SPCH spring chinook salmon
SUST summer steelhead trout
(Dark) Reduction in productivity >or =0.0005
(Medium) Reduction in productivity between 0.0005 and 0.00005
(Light) Reduction in productivity between 0.00005 and 0.000005
(White) Reduction in productivity < or =0.000005

Geographic Area 41
Description: GA41 consists of one reach, Ryan Creek from its confluence with the Umatilla River to an elevation of 3,800 ft. This geographic area only supports summer steelhead trout.
Limiting Factors: Table 79 depicts the protection and restoration ranks and benefits and survival factors for summer steelhead trout in GA41. Survival factors define the impact of habitat conditions on the survival of life stages in the Geographic Area. Survival factors in Table 79 are defined within EDT to be composed of one or more measurable attributes of the environment in Table 80.
GA41 has a moderate protection rank (18 out of 44) and low restoration rank (31 out of 44), with an indirect or general protection and restoration benefits, as indicated in Table 79 by the lack of circles under Protection Benefit and Restoration Benefit.
None of the survival factors greatly affect summer steelhead trout survival. The overall reduction in Key Habitat Quantity, the most limiting survival factor in Ryan Creek (Table 79), has a medium impact on survival of summer steelhead trout prespawning holding, spawning and egg incubation life stages. Habitat Diversity (due to decreased amounts of large wood and Riparian Function in Table 80), Flow, and Channel Stability (caused by impaired Riparian Function in Table 80) decrease summer steelhead trout survival to a low extent. The availability and diversity of food further depresses summer steelhead trout productivity.

Table 79. Protection and restoration strategic priority summary for Umatilla subbasin GA41.Area ranks show the rank for an area out of the total areas appropriate for each population. Benefit shows the Protection and Restoration benefit relative to the total benefits across the Umatilla basin for the population. Survival Factors show the relative contribution of each EDT survival factor to the Restoration Benefit.

Geographic Area	Species	RANK		BENEFIT		SURVIVAL FACTORS														
		Protection Rank	Restoration Rank	Protection benefit	Restoration benefit	Flow	Channel stability/landsc	Habitat diversity	Key habitat quantity	Obstructions	Withdrawals	Sediment load	Oxygen	Chemicals	Temperature	Food	Competition (w/ hatch)	Competition (other sp)	Predation	Pathogens	Harassment/poaching
Ryan Cr from confluence with Umatilla R to 3,800-ft level	COHO	--	--																	
	FACH	--	--																	
	SPCH	--	--																	
	SUST	18/44	31/44			•	•	•	●							•				

A ○ ● High
B ○ ● Medium
C ○ • Low
D & E Indirect or General

Table 80. Change in productivity by ecological attribute for coho, fall Chinook salmon, and spring Chinook salmon and summer steelhead trout in Umatilla subbasin GA41. Environmental attributes are measurable qualities of the environment that are used in EDT to define the Survival Factors in Table 79.

Species	Hydrologic Characteristics						Stream Corridor Structure																										Water Quality										Biological Community									
	Flow Variation				Hydro. Regime		Channel Morphometry				Confinement		Habitat Type								Obstructions		Riparian and Channel Integrity				Sediment Type				Chemistry						Temperature Variation			Community Effects											
	Flow High	Flow Low	Flow diel variation	Flow intraannual variation	HydroRegimeNatural	HydroRegimeReg	Reach length	Maximum width	Minimum width	Gradient	Confine natural	Confine anthropogenic	Pool	Pool tailout	Backwater pool	Beaver pond	Glide	Small cobble riffle	Large cobble riffle	Off-channel habitat	Obstructions	Withdrawals	Bed Scour	Icing	Riparian Function	Woody Debris	Embeddedness	Fine Sediment	Turbidity	Alkalinity	Dissolved oxygen	Metals/pollutants sediment	Metals in water	Misc. toxins	Nutrient enrichment	Temperature maximum	Temperature minimum	Temp. spatial variation	Fish Comm Richness	Fish pathogens	Fish species introduced	Harassment	Hatchery outplants	Predation risk	Salmon carcasses	Benthic Comm Richness
COHO																																															
FACH																																															
SPCH																																															
SUST																																															

Legend:
FACH fall chinook salmon
SPCH spring chinook salmon
SUST summer steelhead trout
Reduction in productivity >or =0.0005
Reduction in productivity between 0.0005 and 0.00005
Reduction in productivity between 0.00005 and 0.000005
Reduction in productivity < or =0.000005

Geographic Area 42
Description: GA42, composed of eight reaches, includes the North Fork Umatilla River from its confluence with the mainstem Umatilla River to waterfalls at an elevation of 3,370 feet, and Coyote, Woodward and Johnson creeks. This geographic area supports coho salmon (NF Umatilla and Coyote Creek), spring Chinook salmon (NF Umatilla) and summer steelhead trout (throughout GA42).
Limiting Factors: Table 81 depicts the protection and restoration ranks and benefits and survival factors for all three species in GA42. Survival factors define the impact of habitat conditions on the survival of life stages in the Geographic Area. Survival factors in Table 81 are defined within EDT to be composed of one or more measurable attributes of the environment in Table 82.
GA42 has a the highest protection rank for summer steelhead trout (1 out of 44) and a high protection rank (Table 81). This geographic area also has a high protection rank for spring Chinook salmon (4 out of 22) and a low protection benefit. For coho salmon, this geographic area has indirect or general protection benefits, with a protection rank of 10 out of 32 geographic areas. Restoration of GA42 ranks medium for summer steelhead trout (15 out of 44) and low for spring Chinook salmon (17 out of 22) and coho salmon (24 out of 32). The restoration benefit to all three species is indirect or general (Table 81).
In accordance with the high protection ranks for GA42, non of the survival factors are significantly limiting to any of the species. Channel Stability, caused by decreased Riparian Function (Table 82), has a low impact on summer steelhead trout survival. Decreased amounts of large wood, which influences Habitat Diversity, is moderately limiting to coho salmon and has a low impact on spring Chinook salmon.

Table 81. Protection and restoration strategic priority summary for Umatilla subbasin GA42.Area ranks show the rank for an area out of the total areas appropriate for each population. Benefit shows the Protection and Restoration benefit relative to the total benefits across the Umatilla basin for the population. Survival Factors show the relative contribution of each EDT survival factor to the Restoration Benefit.

Geographic Area	Species	RANK		BENEFIT		SURVIVAL FACTORS															
		Protection Rank	Restoration Rank	Protection benefit	Restoration benefit	Flow	Channel stability/landsc	Habitat diversity	Key habitat quantity	Obstructions	Withdrawals	Sediment load	Oxygen	Chemicals	Temperature	Food	Competition (w/ hatch)	Competition (other sp)	Predation	Pathogens	Harassment/poaching
NF Umatilla R from confluence with mainstem to falls at 3,370-ft level, including Coyote, Woodward, and Johnson creeks	COHO	10/32	24/32					●													
	FACH	--	--																		
	SPCH	4/22	17/22	○				●													
	SUST	1/44	15/44	◯			●														

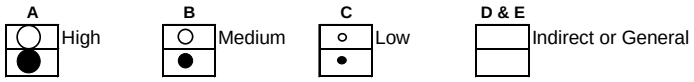


Table 82. Change in productivity by ecological attribute for coho, fall Chinook salmon, and spring Chinook salmon and summer steelhead trout in Umatilla subbasin GA42. Environmental attributes are measurable qualities of the environment that are used in EDT to define the Survival Factors in Table 81.

Species	Hydrologic Characteristics						Stream Corridor Structure																										Water Quality										Biological Community									
	Flow Variation				Hydro. Regime		Channel Morphometry				Confinement		Habitat Type										Obstructions		Riparian and Channel Integrity				Sediment Type				Chemistry							Temperature Variation			Community Effects									
	Flow High	Flow Low	Flow diel variation	Flow intraannual variation	HydroRegimeNatural	HydroRegimeReg	Reach length	Maximum width	Minimum width	Gradient	Confine natural	Confine anthropogenic	Pool	Pool tailout	Backwater pool	Beaver pond	Glide	Small cobble riffle	Large cobble riffle	Off-channel habitat	Obstructions	Withdrawals	Bed Scour	Icing	Riparian Function	Woody Debris	Embeddedness	Fine Sediment	Turbidity	Alkalinity	Dissolved oxygen	Metals/pollutants sediment	Metals in water	Misc. toxins	Nutrient enrichment	Temperature maximum	Temperature minimum	Temp. spatial variation	Fish Comm Richness	Fish pathogens	Fish species introduced	Harassment	Hatchery outplants	Predation risk	Salmon carcasses	Benthic Comm Richness
COHO																																															
FACH																																															
SPCH																																															
SUST																																															

Legend:
FACH fall chinook salmon
SPCH spring chinook salmon
SUST summer steelhead trout
Reduction in productivity >or =0.0005
Reduction in productivity between 0.0005 and 0.00005
Reduction in productivity between 0.00005 and 0.000005
Reduction in productivity < or =0.000005

Geographic Area 43
Description: GA43 consists of two reaches in West Fork Birch Creek from its confluence with mainstem Birch Creek to Bear Creek. This geographic area supports coho and spring Chinook salmon and summer steelhead trout.
Limiting Factors: Table 83 depicts the protection and restoration ranks and benefits and survival factors for all three species in GA43. Survival factors define the impact of habitat conditions on the survival of life stages in the Geographic Area. Survival factors in Table 83 are defined within EDT to be composed of one or more measurable attributes of the environment in Table 84.
GA43 has a high protection rank for spring Chinook salmon (4 out of 22) and summer steelhead trout (7 out of 44), with low protection benefits for both species. The protection benefit of GA43 for coho salmon is indirect or general, as indicated in Table 83 by the lack of circles under Protection Benefit, with a protection rank of 23 out of 32 geographic areas. Restoration of GA43 ranks medium for summer steelhead trout (15 out of 44) and low for spring Chinook salmon (14 out of 22) and coho salmon (23 out of 32). The restoration benefit to all three species is indirect or general (Table 83).
Overall, Habitat Diversity (Table 84) is the most limiting survival factor in GA43 (Table 83). Decreased amounts of large wood and impaired Riparian Function (Table 84) contribute to Habitat Diversity, have reduced productivities. As shown in Table 83, spring Chinook salmon and coho salmon survival is limited to a higher degree than summer steelhead trout by Habitat Diversity. Channel Stability (caused by decreased Riparian Function in Table 84), Flow (attributed to anthropogenic confinement in Table 84), and Food, slightly limit the survival of all three species.

Table 83. Protection and restoration strategic priority summary for Umatilla subbasin GA43.Area ranks show the rank for an area out of the total areas appropriate for each population. Benefit shows the Protection and Restoration benefit relative to the total benefits across the Umatilla basin for the population. Survival Factors show the relative contribution of each EDT survival factor to the Restoration Benefit.

Geographic Area	Species	RANK		BENEFIT		SURVIVAL FACTORS														
		Protection Rank	Restoration Rank	Protection benefit	Restoration benefit	Flow	Channel stability/landsc	Habitat diversity	Key habitat quantity	Obstructions	Withdrawals	Sediment load	Oxygen	Chemicals	Temperature	Food	Competition (w/ hatch)	Competition (other sp)	Predation	Pathogens	Harassment/poaching
SF Umatilla R from confluence with mainstem to Thomas Cr	COHO	12/32	23/32			●	●	●								●					
	FACH	--	--																		
	SPCH	4/22	14/22	○		●	●	●								●					
	SUST	7/44	15/44	○		●	●	●								●					

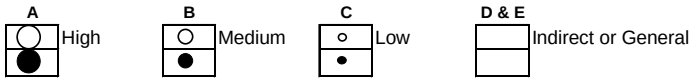


Table 84. Change in productivity by ecological attribute for coho, fall Chinook salmon, and spring Chinook salmon and summer steelhead trout in Umatilla subbasin GA43. Environmental attributes are measurable qualities of the environment that are used in EDT to define the Survival Factors in Table 83.

Species	Hydrologic Characteristics						Stream Corridor Structure																										Water Quality										Biological Community									
	Flow Variation				Hydro. Regime		Channel Morphometry				Confinement		Habitat Type										Obstructions		Riparian and Channel Integrity				Sediment Type				Chemistry								Temperature Variation			Community Effects									
	Flow High	Flow Low	Flow diel variation	Flow intraannual variation	HydroRegimeNatural	HydroRegimeReg	Reach length	Maximum width	Minimum width	Gradient	Confine natural	Confine anthropogenic	Pool	Pool tailout	Backwater pool	Beaver pond	Glide	Small cobble riffle	Large cobble riffle	Off-channel habitat	Obstructions	Withdrawals	Bed Scour	Icing	Riparian Function	Woody Debris	Embeddedness	Fine Sediment	Turbidity	Alkalinity	Dissolved oxygen	Metals/pollutants sediment	Metals in water	Misc. toxins	Nutrient enrichment	Temperature maximum	Temperature minimum	Temp. spatial variation	Fish Comm Richness	Fish pathogens	Fish species introduced	Harassment	Hatchery outplants	Predation risk	Salmon carcasses	Benthic Comm Richness
COHO																																															
FACH																																															
SPCH																																															
SUST																																															

Legend:
FACH fall chinook salmon
SPCH spring chinook salmon
SUST summer steelhead trout
Reduction in productivity >or =0.0005
Reduction in productivity between 0.0005 and 0.00005
Reduction in productivity between 0.00005 and 0.000005
Reduction in productivity < or =0.000005

Geographic Area 44
Description: GA44 consists of five reaches in Buck Creek from its confluence with the South Fork Umatilla River to an elevation of 4,820 ft and includes Swamp and Lake creeks. This geographic area only supports summer steelhead trout.
Limiting Factors: Table 85 depicts the protection and restoration ranks and benefits and survival factors for summer steelhead trout in GA44. Survival factors define the impact of habitat conditions on the survival of life stages in the Geographic Area. Survival factors in Table 85 are defined within EDT to be composed of one or more measurable attributes of the environment in Table 86.
GA44 has a high protection rank (3 out of 44) and a moderate restoration rank (22 out of 44) for summer steelhead trout. The protection benefit is high, with an indirect or general restoration benefit, as indicated in Table 85 by the large circle and blank cell under Protection Benefit and Restoration Benefit, respectively.
None of the survival factors affect summer steelhead trout survival to a high or even moderate degree. Flow and the availability and diversity of food (Table 85), due to a lack of salmon carcasses and large wood (Table 86), slightly depresses summer steelhead trout survival.

Table 85. Protection and restoration strategic priority summary for Umatilla subbasin GA44.Area ranks show the rank for an area out of the total areas appropriate for each population. Benefit shows the Protection and Restoration benefit relative to the total benefits across the Umatilla basin for the population. Survival Factors show the relative contribution of each EDT survival factor to the Restoration Benefit.

Geographic Area	Species	RANK		BENEFIT		SURVIVAL FACTORS														
		Protection Rank	Restoration Rank	Protection benefit	Restoration benefit	Flow	Channel stability/landsc	Habitat diversity	Key habitat quantity	Obstructions	Withdrawals	Sediment load	Oxygen	Chemicals	Temperature	Food	Competition (w/ hatch)	Competition (other sp)	Predation	Pathogens	Harassment/poaching
Buck Cr from confluence with SF Umatilla R to 4,820-ft level, including Swamp and Lake creeks	COHO	--	--																	
	FACH	--	--																	
	SPCH	--	--																	
	SUST	3/44	22/44	○		•										•				

A ○ ● High
B ○ ● Medium
C ○ • Low
D & E Indirect or General

Table 86. Change in productivity by ecological attribute for coho, fall Chinook salmon, and spring Chinook salmon and summer steelhead trout in Umatilla subbasin GA44. Environmental attributes are measurable qualities of the environment that are used in EDT to define the Survival Factors in Table 85.

Species	Hydrologic Characteristics						Stream Corridor Structure																										Water Quality										Biological Community									
	Flow Variation				Hydro. Regime		Channel Morphometry				Confinement		Habitat Type								Obstructions		Riparian and Channel Integrity				Sediment Type				Chemistry								Temperature Variation			Community Effects									Benthic Comm Richness
	Flow High	Flow Low	Flow diel variation	Flow intraannual variation	HydroRegimeNatural	HydroRegimeReg	Reach length	Maximum width	Minimum width	Gradient	Confine natural	Confine anthropogenic	Pool	Pool tailout	Backwater pool	Beaver pond	Glide	Small cobble riffle	Large cobble riffle	Off-channel habitat	Obstructions	Withdrawals	Bed Scour	Icing	Riparian Function	Woody Debris	Embeddedness	Fine Sediment	Turbidity	Alkalinity	Dissolved oxygen	Metals/pollutants sediment	Metals in water	Misc. toxins	Nutrient enrichment	Temperature maximum	Temperature minimum	Temp.spatial variation	Fish Comm Richness	Fish pathogens	Fish species introduced	Harassment	Hatchery outplants	Predation risk	Salmon carcasses	
COHO																																															
FACH																																														
SPCH																																														
SUST																																														

Legend:
FACH fall chinook salmon
SPCH spring chinook salmon
SUST summer steelhead trout
Reduction in productivity >or =0.0005
Reduction in productivity between 0.0005 and 0.00005
Reduction in productivity between 0.00005 and 0.000005
Reduction in productivity < or =0.000005

Geographic Area 45
Description: GA45 consists of Thomas Creek (five reaches) from its confluence with the South Fork Umatilla River to an elevation of 4,000 ft, Whitman Spring (one reach) and Spring Creek (one reach). This geographic area only supports summer steelhead trout.
Limiting Factors: Table 87 depicts the protection and restoration ranks and benefits and survival factors for summer steelhead trout in GA45. Survival factors define the impact of habitat conditions on the survival of life stages in the Geographic Area. Survival factors in Table 87 are defined within EDT to be composed of one or more measurable attributes of the environment in Table 88.
GA45 has a moderately high protection rank (9 out of 44) and a moderate restoration rank (17 out of 44). As indicated in Table 87 by small or no circles under Protection Benefit and Restoration Benefit, respectively, the protection benefit is low while the restoration benefit is indirect or general.
None of the survival factors greatly affect summer steelhead trout survival in GA45. The overall reduction in Key Habitat Quantity, the most limiting survival factor in GA 45 (Table 87), has a medium impact on survival of summer steelhead trout during the spawning and egg incubation life stages. Habitat Diversity (due to decreased amounts of large wood and Riparian Function in Table 88), Flow, and Channel Stability (caused by impaired Riparian Function in Table 88) decrease summer steelhead trout survival to a low extent. The availability and diversity of food further depresses summer steelhead trout survival, attributed to a lack of salmon carcasses (Table 88).

Table 87. Protection and restoration strategic priority summary for Umatilla subbasin GA45.Area ranks show the rank for an area out of the total areas appropriate for each population. Benefit shows the Protection and Restoration benefit relative to the total benefits across the Umatilla basin for the population. Survival Factors show the relative contribution of each EDT survival factor to the Restoration Benefit.

Geographic Area	Species	RANK		BENEFIT		SURVIVAL FACTORS														
		Protection Rank	Restoration Rank	Protection benefit	Restoration benefit	Flow	Channel stability/landsc	Habitat diversity	Key habitat quantity	Obstructions	Withdrawals	Sediment load	Oxygen	Chemicals	Temperature	Food	Competition (w/ hatch)	Competition (other sp)	Predation	Pathogens	Harassment/poaching
Thomas Cr from confluence with SF Umatilla R to 4,000-ft level, including Whitman Spring and Spring Cr	COHO	--	--																	
	FACH	--	--																	
	SPCH	--	--																	
	SUST	9/44	17/44	○		●	●	●	●							●				

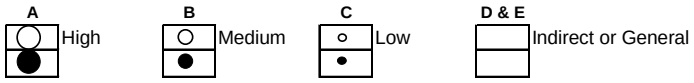


Table 88. Change in productivity by ecological attribute for coho, fall Chinook salmon, and spring Chinook salmon and summer steelhead trout in Umatilla subbasin GA45. Environmental attributes are measurable qualities of the environment that are used in EDT to define the Survival Factors in Table 87.

Species	Hydrologic Characteristics						Stream Corridor Structure																										Water Quality									Biological Community									
	Flow Variation				Hydro. Regime		Channel Morphometry				Confinement		Habitat Type										Obstructions		Riparian and Channel Integrity				Sediment Type				Chemistry								Temperature Variation			Community Effects									
	Flow High	Flow Low	Flow diel variation	Flow intraannual variation	HydroRegimeNatural	HydroRegimeReg	Reach length	Maximum width	Minimum width	Gradient	Confine natural	Confine anthropogenic	Pool	Pool tailout	Backwater pool	Beaver pond	Glide	Small cobble riffle	Large cobble riffle	Off-channel habitat	Obstructions	Withdrawals	Bed Scour	Icing	Riparian Function	Woody Debris	Embeddedness	Fine Sediment	Turbidity	Alkalinity	Dissolved oxygen	Metals/pollutants sediment	Metals in water	Misc. toxins	Nutrient enrichment	Temperature maximum	Temperature minimum	Temp. spatial variation	Fish Comm Richness	Fish pathogens	Fish species introduced	Harassment	Hatchery outplants	Predation risk	Salmon carcasses	Benthic Comm Richness
COHO																																															
FACH																																															
SPCH																																															
SUST																																															

Legend:
FACH fall chinook salmon
SPCH spring chinook salmon
SUST summer steelhead trout
Reduction in productivity >or =0.0005
Reduction in productivity between 0.0005 and 0.00005
Reduction in productivity between 0.00005 and 0.000005
Reduction in productivity < or =0.000005

Geographic Area 46

Description: GA46 consists of the two reaches in the South Fork Umatilla River from the confluence with Thomas Creek to an elevation of 4,720 feet. Summer steelhead trout, coho and spring Chinook salmon inhabit the South Fork Umatilla River. This geographic area also includes Shimmiehorn Creek, subdivided into three reaches, which only supports summer steelhead trout.

Limiting Factors: Table 89 depicts the protection and restoration ranks and benefits and survival factors for all three species in GA46. Survival factors define the impact of habitat conditions on the survival of life stages in the Geographic Area. Survival factors in Table 89 are defined within EDT to be composed of one or more measurable attributes of the environment in Table 90.

GA46 has a moderately high protection rank for spring Chinook salmon (6 out of 22) and summer steelhead trout (6 out of 44), with low protection benefits for both species. The protection benefit of GA46 for coho salmon is indirect or general, as indicated in Table 89 by the lack of circles under Protection Benefit, with a protection rank of 23 out of 32 geographic areas. Restoration of GA46 ranks medium for summer steelhead trout (23 out of 44) and low for spring Chinook salmon (16 out of 22) and coho salmon (26 out of 32). The restoration benefit to all three species is indirect or general (Table 89).

Overall, Habitat Diversity, caused by decreased amounts of large wood (Table 90), is the most limiting survival factor in GA46 (Table 89). As shown in Table 89, spring Chinook salmon survival is limited to a higher degree than the other species by Habitat Diversity. Flow slightly limits the survival of all three species. Availability and diversity of food further depresses coho and spring Chinook salmon survival.

Table 89. Protection and restoration strategic priority summary for Umatilla subbasin GA46.Area ranks show the rank for an area out of the total areas appropriate for each population. Benefit shows the Protection and Restoration benefit relative to the total benefits across the Umatilla basin for the population. Survival Factors show the relative contribution of each EDT survival factor to the Restoration Benefit.

Geographic Area	Species	RANK		BENEFIT		SURVIVAL FACTORS														
		Protection Rank	Restoration Rank	Protection benefit	Restoration benefit	Flow	Channel stability/landsc	Habitat diversity	Key habitat quantity	Obstructions	Withdrawals	Sediment load	Oxygen	Chemicals	Temperature	Food	Competition (w/ hatch)	Competition (other sp)	Predation	Pathogens	Harassment/poaching
SF Umatilla R from Thomas Cr to 4,720-ft level, including Shimmiehorn Cr	COHO	23/32	26/32			●		●								●					
	FACH	--	--																		
	SPCH	6/22	16/22	○		●		●								●					
	SUST	6/44	23/44	○		●		●													

A High B Medium C Low D & E Indirect or General

Table 90. Change in productivity by ecological attribute for coho, fall Chinook salmon, and spring Chinook salmon and summer steelhead trout in Umatilla subbasin GA46. Environmental attributes are measurable qualities of the environment that are used in EDT to define the Survival Factors in Table 89.

Species	Hydrologic Characteristics						Stream Corridor Structure																												Water Quality										Biological Community									
	Flow Variation				Hydro. Regime		Channel Morphometry				Confinement		Habitat Type										Obstructions		Riparian and Channel Integrity				Sediment Type				Chemistry						Temperature Variation			Community Effects									Benthic Comm Richness
	Flow High	Flow Low	Flow diel variation	Flow intraannual variation	HydroRegimeNatural	HydroRegimeReg	Reach length	Maximum width	Minimum width	Gradient	Confine natural	Confine anthropogenic	Pool	Pool tailout	Backwater pool	Beaver pond	Glide	Small cobble riffle	Large cobble riffle	Off-channel habitat	Obstructions	Withdrawals	Bed Scour	Icing	Riparian Function	Woody Debris	Embeddedness	Fine Sediment	Turbidity	Alkalinity	Dissolved oxygen	Metals/pollutants sediment	Metals in water	Misc. toxins	Nutrient enrichment	Temperature maximum	Temperature minimum	Temp. spatial variation	Fish Comm Richness	Fish pathogens	Fish species introduced	Harassment	Hatchery outplants	Predation risk	Salmon carcasses	
COHO																																															
FACH																																															
SPCH																																															
SUST																																															

Legend:
FACH fall chinook salmon
SPCH spring chinook salmon
SUST summer steelhead trout
Reduction in productivity >or =0.0005
Reduction in productivity between 0.0005 and 0.00005
Reduction in productivity between 0.00005 and 0.000005
Reduction in productivity < or =0.000005

Priority areas as identified by EDT are shown in the following series of 8 tables. Geographic areas highlighted in blue were removed from the ranking used in the Assessment and the Management Plan.

Steelhead Priority Geographic Areas for Restoration

GA	GA Description	Priority	Rationale for Removal
GA12	Birch, mouth to forks including Stewart Creek	1	
GA5	Butter Creek, Madison Diversion to East Butter	2	Steelhead currently blocked by barriers and flow
GA28	Umatilla, Mission Bridge to Meacham Creek	3	
GA40	Umatilla, Meacham to Forks including all tribs except Ryan Creek	4	
GA33	Meacham, Mouth to North Fork	5	
GA15	West Birch, Bear top of gorge, including tribs	6	
GA21	Mckay Cr, McKay Dam to North Fork	7	Steelhead blocked by barrier
GA13	West Birch, mouth to Bear Creek	8	
GA32	Squaw Cr, Bachelor Canyon to headwaters, inlcuding tribs	9	
GA35	NF Meacham and tribs	10	
GA27	Wildhorse Cr, Athena to Headwaters, inlcuding tribs	11	Very limitied presence/use
GA19	Pearson Creek (East Birch)	12	
GA20	Mckay Cr, mouth to McKay Dam	13	Adults blocked by barrier
GA17	East Birch mouth to California Gulch	14	
GA42	NF Umatilla, mouth ot headwaters including tribs	15	Wilderness Area
GA6	Little Butter	16	Steelhead currently blocked by barriers and flow
GA18	East Birch, Cal Gulch to headwaters and tribs except Pearson	17	
GA2	Umatilla, Threemile Dam to Butter Creek	18	
GA14	Bear Creek and tribs (West Birch)	19	
GA34	Meacham, Tribs from mouth to NF	20	
GA8	Butter Cr, EF to headwaters and Johnson Creek	21	Steelhead currently blocked by barriers and flow
GA44	Buck Creek and tribs	22	Wilderness Area
GA1	Umatilla, mouth to Threemile Dam	23	Low restoration opportunity for sediment and temperatu
GA 30	Buckaroo Creek	24	
GA7	EF Butter and tribs	25	
GA38	Meacham, Twomile to headwaters, including Twomile	26	

None of the top 15 priority areas for protection for steelhead were removed, and therefore, no table is shown.

Spring Chinook Priority Geographic Areas for Restoration

GA	GA Description	Priority	Rationale for removal
GA28	Umatilla, Mission Bridge to Meacham Creek	1	
GA21	Mckay Cr, McKay Dam to North Fork	2	Barrier
GA12	Birch, mouth to forks including Stewart Creek	3	ChS not currently present
GA33	Meacham, Mouth to North Fork	4	
GA40	Umatilla, Meacham to Forks including all tribs except Ryan Creek	5	
GA24	McKay Cr, NF to headwaters including tribs	6	Barrier
GA25	Umatilla, Mckay Creek to Mission Bridge	7	
GA20	Mckay Cr, mouth to McKay Dam	8	Adult Barrier
GA35	NF Meacham and tribs	9	
GA9	Umatilla, Butter Cr to Westland Dam	10	
GA2	Umatilla, Threemile Dam to Butter Creek	11	
GA31	Squaw Cr, Mouth to Bachelor Canyon	12	
GA18	East Birch, Cal Gulch to headwaters and tribs except Pearson	13	ChS not currently present
GA43	SF Umatilla, mouth to Thomas Creek	14	
GA11	Umatilla, Westland Dam to McKay Creek	15	

Spring Chinook Priority Geographic Areas for Protection			
GA	**GA Description**	**Priority**	**Rationale for Removal**
GA40	Umatilla, Meacham to Forks including all tribs except Ryan Creek	1	
GA35	NF Meacham and tribs	2	
GA33	Meacham, Mouth to North Fork	3	
GA42	NF Umatilla, mouth to headwaters including tribs	4	
GA43	SF Umatilla, mouth to Thomas Creek	4	
GA9	Umatilla, Butter Cr to Westland Dam	5	
GA46	SF Umatilla, Thomas Cr to headwaters including shimmiehorn	6	
GA28	Umatilla, Mission Bridge to Meacham Creek	7	
GA17	East Birch mouth to California Gulch	8	ChS not currently present
GA24	McKay Cr, NF to headwaters including tribs	9	Barrier
GA25	Umatilla, Mckay Creek to Mission Bridge	10	
GA2	Umatilla, Threemile Dam to Butter Creek	11	
GA11	Umatilla, Westland Dam to McKay Creek	12	

Coho Priority Geographic Areas for Restoration			
GA	**GA Description**	**Priority**	**Rationale for Removal**
GA5	Butter Creek, Madison Diversion to East Butter	1	Blocked Passage and insufficient flows
GA9	Umatilla, Butter Cr to Westland Dam	2	
GA8	Butter Cr, EF to headwaters and Johnson Creek	3	Blocked Passage and insufficient flows
GA28	Umatilla, Mission Bridge to Meacham Creek	4	
GA7	EF Butter and tribs	5	Blocked Passage and insufficient flows
GA25	Umatilla, Mckay Creek to Mission Bridge	6	
GA4	Butter Creek, mouth to Madison Diversion	7	Blocked Passage and insufficient flows
GA26	Wildhorse Cr, mouth to Athena, including tribs	8	
GA33	Meacham, Mouth to North Fork	9	
GA11	Umatilla, Westland Dam to McKay Creek	10	
GA40	Umatilla, Meacham to Forks including all tribs except Ryan Creek	11	
GA1	Umatilla, mouth to Threemile Dam	12	Low opportunity for restoration
GA15	West Birch, Bear top of gorge, including tribs	13	Not Present/Steelhead Sanctuary
GA24	McKay Cr, NF to headwaters including tribs	14	Barrier
GA13	West Birch, mouth to Bear Creek	15	Not Present/Steelhead Sanctuary

Coho Priority Geographic Areas for Protection			
GA	**GA Description**	**Priority**	**Rationale for Removal**
GA40	Umatilla, Meacham to Forks including all tribs except Ryan Creek	1	
GA14	Bear Creek and tribs (West Birch)	2	Not Present/Steelhead Sanctuary
GA17	East Birch mouth to California Gulch	3	Not Present/Steelhead Sanctuary
GA18	East Birch, Cal Gulch to headwaters and tribs except Pearson	4	Not Present/Steelhead Sanctuary
GA24	McKay Cr, NF to headwaters including tribs	5	Barrier
GA31	Squaw Cr, Mouth to Bachelor Canyon	6	
GA35	NF Meacham and tribs	7	
GA32	Squaw Cr, Bachelor Canyon to headwaters, inlcuding tribs	8	
GA19	Pearson Creek (East Birch)	9	Not Present/Steelhead Sanctuary
GA42	NF Umatilla, mouth ot headwaters including tribs	10	Really coho habitat?
GA8	Butter Cr, EF to headwaters and Johnson Creek	11	Blocked Passage and insufficient flows
GA15	West Birch, Bear top of gorge, including tribs	12	Not Present/Steelhead Sanctuary
GA7	EF Butter and tribs	13	Blocked Passage and insufficient flows
GA12	Birch, mouth to forks including Stewart Creek	14	
GA 30	Buckaroo Creek	15	

Fall Chinook Priority Geographic Areas for Restoration

GA	GA Description	Priority	Rationale for Removal
GA9	Umatilla, Butter Cr to Westland Dam	1	
GA28	Umatilla, Mission Bridge to Meacham Creek	2	
GA2	Umatilla, Threemile Dam to Butter Creek	3	
GA1	Umatilla, mouth to Threemile Dam	4	Limited restoration opportunity
GA11	Umatilla, Westland Dam to McKay Creek	5	
GA12	Birch, mouth to forks including Stewart Creek	6	Limited fall flows
GA21	Mckay Cr, McKay Dam to North Fork	7	Barrier
GA9	Umatilla, Butter Cr to Westland Dam	9	

Fall Chinook Priority Geographic Areas for Protection

GA	GA Description	Priority	Rationale for Removal
GA40	Umatilla, Meacham to Forks including all tribs except Ryan Creek	1	
GA28	Umatilla, Mission Bridge to Meacham Creek	2	
GA33	Meacham, Mouth to North Fork	3	
GA21	Mckay Cr, McKay Dam to North Fork	4	Barrier
GA20	Mckay Cr, mouth to McKay Dam	5	Adult Barrier
GA25	Umatilla, Mckay Creek to Mission Bridge	6	
GA12	Birch, mouth to forks including Stewart Creek	7	