Left Hand Watershed Center
Monitoring Assessment Framework
5-14-2019

Monitoring Question: Is the ecological condition of our watershed improving, declining, or remaining the same year-to-year, and which stream segments have the greatest ecological resilience during drought or flood conditions?
Monitoring Hypothesis: ecological parameters indicate functionality of one or more drivers within our watershed.
* reaches will be at minimum 1000 ft in length

#	Sub- Hypothesis	Related Goal (#)	Ecological Parameter	Functional Driver(s)	Monitoring Metric	Method/ Protocol	Performance Standard	Management Trigger	Suggested Action	Lead Entity	Timing	Frequency
ABIOTIC												
Floodplain Connectivity												
1	Channel will maintain connectivity to restored floodplain year to year.	1	Floodplain physical habitat	Flow Regime; sediment Regime	Visual observations	Photomonitoring	Observations of floodplain show connectivity to wetted area. No signs of excessive channel incision, or erosion/depostion near infrastructure.	Observations of floodplain show disconnectivity to wetted area. Signs of excessive channel incision, or erosion/ depostion near infrastructure.	- Investigate functional driver(s) performance to assess impacts on the parameter (e.g. flow regime/flushing flow values). - Assess change in geomorphology using cross sections, LiDAR, and/or aerial photos. - Reconnect floodplain with possible adjustments to channel or bench height. - Improve resilience near infrastructure.	LWOG	Sept/ Oct	Initial and depending on need
2	Benches will be inundated at high flows per the design.	1,7	Floodplain physical habitat	Stream form, flow Regime	Bench inundation at high flow	Photomonitoring at 200+ CFS	Benches are inundated at high flows per the design.	Benches are not inundated at high flows per the design.	- Investigate functional driver(s) performance to assess impacts on the parameter. - Adjust floodplain bench heights and/or channel dimesions. - Actively manage flow.	LWOG	Mid May	Annual
3	The frequency and location of dry up periods at low flow will change if future flow management occurs.	1	In stream physical habitat	Flow Regime	Frequency of dry up periods	Photomonitoring	Frequency of dry up periods at low flow will decrease after flow management.	None. Adaptive learning to apply to future stream management projects.	- Document dry up reaches year to year. - Make before/after comparisons, linking to biotic parameters.	CSP: continuous	May- Nov.	Annual
Channel Morphology and Habitat												
4	Percent pool area will be maintained or increase year to year.	2	Pool habitat quantity	Flow regime; sediment regime	Percent area of pools per reach*	USFS Stream Monitoring	Percent pool area per reach is maintained or increasing.	Percent pool areas per reach is declining.	- Investigate functional driver(s) performance to assess impacts on the parameter (e.g. identify sediment sources, flow regime issues). - Relate pool area to avg. pool depth measurements. - Actively manage flow and/or pool size.	LWOG	August	Annual
5	Average residual pool depth will be maintained or increase to provide refugia for fish year to year.	2	Pool habitat quality	Flow regime; sediment regime	Average pool depth per reach*	USFS Stream Monitoring	At low flow, average residual pool depth per reach is maintained or increasing and greater than 1.0 feet in plains and foothills or 0.8 feet in canyons.	At low flow, average residual pool depth per reach is declining or less than 1.0 foot in plains and foothills or 0.8 feet in canyons.	- Investigate functional driver(s) performance to assess impacts on the parameter. - Relate average pool depth to pool area measurements. - Actively manage flow and/or pool size.	LWOG	August	Annual
6	Average pool temperature at low flow will provide thermal refugia for fish year to year.	2	Pool habitat quality	Flow regime, sediment regime	Bottom of pool temperature at 3 pools per reach*	Temperature readings (USFS Stream Monitoring)	At low flow, bottom of pool temperature does not exceed 70*F in plains and foothills or 65*F in canyons.	At low flow, bottom of pool temperature exceed 70*F in plains and foothills or 65*F in canyons.	- Investigate functional driver(s) performance to assess impacts on the parameter. - Relate avg. pool temperature to avg. pool depth and area measurements. - Actively manage flow and/or pool size.	CSP: at least 1X per month	July- Oct	Annual
7	Median cumulative substrate size class and embeddedness in riffle will be appropriate for the location in the watershed and maintained year to year.	2	Riffle habitat quality	Flow Regime; sediment Regime	Pebble Counts and embeddedness	USFS Stream Monitoring/ CO SVAP Embeddedness Score	Median cummulative substrate size class (D50) in riffle is appropriate for the location and maintained. Embeddedness is maintained.	Median cummulative substrate size class (D50) in riffle is not appropriate for location and increasing or decreasing by two size classes a year. Embeddedness is increasing.	- Investigate functional driver(s) performance to assess impacts on the parameter. - Relate proportion of fine sediment to avg. pool depth measurements. - Actively manage flow.	CSP: Watershed Days	Sept	Annual
BIOTIC												
Riparian Condition												
8	Abundance of in stream herbaceous and/or woody encroachment will be absent, the same, or reduced year to year.	3	Riparian condition	Stream form; flow regime	Visual observations	Weed/ EWP assessments	Abundance of in stream herbaceous and/or woody vegetation is absent, remains the same, or is reduced.	Abundance of instream herbaceous and/or woody vegetation is present and/or increasing. Monitoring for adaptive learning.	- Investigate functional driver(s) performance to assess impacts on the parameter. - Compare abundance of weeds by riparian zones and levels of disturbance. - Monitor floodplain hydrology. - Actively manage nuisance species.	LWOG	May- Oct	Annual
9	Average native richness will increase or remain the same from year to year.	3	Riparian community	Flow regime, sediment regime	Plot monitoring in riparian zones	Riparian zone plot surveys/ LWOG/Biohabitats	Average native richness is increasing or remaining the same.	Average native richness is declining.	- Investigate functional driver(s) performance to assess impacts on the parameter. - Compare native richness by riparian zones. - Monitor floodplain hydrology. - Actively manage and seed areas with low native richness.	LWOG/ Consultants	Sept	Annual
10	Average native cover will increase or remain the same year to year.	3	Riparian community	Flow regime, sediment regime	Plot monitoring in riparian zones	Riparian zone plot surveys/ LWOG/Biohabitats	Average percent native cover is increasing or remaining the same.	Average percent native cover is declining.	- Investigate functional driver(s) performance to assess impacts on the parameter. - Compare native cover by riparian zones. - Monitor floodplain hydrology. - Actively manage and seed/re-plant areas with low native cover.	LWOG/ Consultants	Sept	Annual
Macroinvertebrate Community												
11	Diversity scores will remain the same or increase depending on location in the watershed.	4	Invertebrate community diversity	Overall watershed health	Shannon diversity index from BMI survey	BMI Survey	Diversity scores greater than implairment threshold are maintained or increasing. Diversity scores less than impairment threshold are increasing. Threshold values: biotype 1= 2.4; biotype 2= 3.0.	Diversity scores are declining or remaining below impairment threshold.	- Investigate functional driver(s) performance to assess impacts on the parameter. - Relate HBI to substrate size and embeddedness or surrounding landuse. - Actively manage flow.	CSP Watershed Days/ Timberline Aquatics	Sept	Annual or depending on need
12	Hilsenhoff Biotic Index (HBI) scores will remain the same or decrease depending on location in the watershed.	4	Invertebrate community tolerance	Overall watershed health	Hilsenhoff Biotic Index (HBI) from BMI survey	BMI Survey	HBI scores less than implairment threshold are maintained or decreasing. Diversity scores above impairment threshold are decreasing. Threshold values: biotype 1= 5.4; biotype 2= 5.1.	HBI scores are increasing or remaining above impairment threshold.	- Investigate functional driver(s) performance to assess impacts on the parameter. - Relate HBI to substrate size and embeddedness or surrounding landuse. - Actively manage flow.	CSP Watershed Days/ Timberline Aquatics	Sept	Annual or depending on need
13	Multimetric Index (MMI) scores will remain the same or increase depending on location in the watershed.	5	Invertebrate community Multimetric Index	Overall watershed health	Multimetric Index (MMI) from BMI Survey	BMI Survey	MMI scores greater than attainment threshold are maintained or increasing. MMI scores less than attainment threshold are increasing. Threshold values: biotype 1= 52; biotype 2= 50.	MMI is declining or remaining below attainment threshold.	- Investigate functional driver(s) performance to assess impacts on the parameter. - Relate MMI to substrate size and embeddedness or surrounding landuse. - Monitor water chemistry. - Actively manage flow.	CSP Watershed Days/ Timberline Aquatics	Sept	Annual or depending on need
Fish Community and Condition												
14	Fish species richness and diversity will remain the same or increase year to year.	6	Fish community	Overall watershed health	Species richness and diversity	Two-pass electrofishing	Abundance and diversity of species are maintained or increasing after implementation of stream management plan.	Richness and diversity of species declines.	- Assess functional drivers performance including flow regime, sediment regime, and habitat availability and connectivity for target species. - Consider flow management options (via SMP effort) - Make before/after comparisons, set up additional experiments.	LWOG/ Consultants	Sept/Oct	Initial and depending on need
15	Fish density and biomass of species will remain the same or increase year to year.	6	Fish condition	Overall watershed health	Density and biomass per species	Two-pass electrofishing	Density and biomass of species are maintained or increasing after implementation of stream management plan.	Density and biomass of native species decline.	- Assess functional drivers performance including flow regime, sediment regime, and habitat availability and connectivity for target species. - Consider flow management options (via SMP effort) - Make before/after comparisons, set up additional experiments.	LWOG/ Consultants	Sept/Oct	Initial and depending on need