Northwest **Power** and **Conservation** Council

June 6, 2017

MEMORANDUM

TO: **Fish and Wildlife Committee members**

FROM: **Council staff**

SUBJECT: **Update on discussions with managers/sponsors on tributary habitat monitoring and review of M&E approaches**

BACKGROUND:

Presenter: Nancy Leonard, fish, wildlife and ecosystem M&E manager
Leslie Bach, senior program manager
Rick Golden, Bonneville Power Administration, fish & wildlife project manager
Mark Fritsch, project implementation manager

Summary: Council and Bonneville staff will provide a summary of discussions with Program habitat managers and sponsors regarding tributary habitat monitoring and evaluation and the contribution of the three BPA monitoring projects, Integrated Status and Effectiveness Monitoring Program (ISEMP), Columbia Habitat Monitoring Program (CHaMP), and Action Effectiveness Monitoring (AEM). The discussions focused on understanding: 1) the current approaches used to guide habitat restoration actions and assess action effectiveness; 2) existing gaps and potential options for improving monitoring and evaluation around the region; and 3) the use of tools and products developed through CHaMP, ISEMP and AEM. Staff will also provide an overview and timeline for completing a program-focused tributary habitat monitoring framework and approach.

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Relevance: This work focuses on implementing the Council's 2013 Conditions and recommendations for ensuring a cost-effective approach to tributary habitat monitoring and evaluation for informing effectiveness of program measures. It addresses Programmatic Issue #2 (i.e., *Habitat effectiveness monitoring and evaluation*) from the 2010-11 review of RME and AP Category of projects, including ISEMP, CHaMP, and AEM.

Background: On June 12, 2013 the Council provided recommendations to Bonneville to further advance the intent of the Council's 2011 decision as described under *Programmatic 2 Habitat effectiveness monitoring and evaluation.* Following is the specific language as provided to Bonneville in June 2013.

> *Subsequent ISRP and Council review and recommendations for the two existing Program projects (ISEMP and CHaMP) should follow the timeline and transition as described in the AEM Approach documents. That is, the submission and the review in 2015 should be used for a comprehensive consideration of whether and how to transition CHaMP out of the pilot phase; to confirm or alter the timeline for completion and end of the Program funded IMW studies and the evolution of the rest of the ISEMP project; to confirm and implement or alter the AEM Approach to project-level effectiveness; and to flesh out, explain and decide on the analytical framework for an overarching evaluation of the habitat monitoring and evaluation information. This submittal should be no later than March 2015.*

Although some products and updates have been provided, the comprehensive review as described above has not occurred. At the February 2017 Council briefing and discussion on ISEMP, CHaMP and Action Effectiveness Monitoring, Council members requested that staff develop a plan and schedule for reviewing and recommending actions for Tributary habitat effectiveness monitoring.

At the March 2017 meeting, the Council requested that staff conduct discussions with fish and wildlife managers and sponsors about the 2013 Bonneville approach for habitat action effectiveness in the tributaries, including the role of ISEMP, CHaMP, and BPA AEM projects. These discussions occurred from late March to early June with 32 different groups (see Attachment 1). The discussions focused on understanding: 1) the current approaches used to guide habitat restoration actions and monitor action effectiveness; 2) existing gaps and potential options for improving efforts around the region; and 3) the use of tools and products developed through CHaMP, ISEMP and AEM (see Attachments 2 and 3).

Following is a brief description and expectations of the three projects:

- Project #2003-017-00, *Integrated Status and Effectiveness Monitoring Program* (ISEMP)
  The ISEMP is a monitoring and evaluation design project that was initiated in 2003 as a series of pilots for testing monitoring indicators and metrics, sampling designs, evaluation procedures, data management, and large-scale coordination and implementation logistics.

- Project #2011-006-00, *Columbia Habitat and Monitoring Program - Pilot* (CHaMP)
  The CHaMP is a pilot project designed to monitor fish habitat status and trends using a standardized monitoring protocol with a program-wide approach to data collection and management. It is currently applied in 8 watersheds within the portion of the Columbia Basin accessible to anadromous salmonids.

- Project #2016-001-00, *BPA Project Action Effectiveness Monitoring (AEM) Programmatic*
  AEM is a pilot project designed to develop a standardized, programmatic approach to project-level action effectiveness monitoring. The AEM approach is intended to move action effectiveness monitoring from a project-by-project approach to a coordinated, standardized and cost-effective approach.

Discussion: The discussions with mangers and sponsors indicated that there are a variety of approaches being used to guide habitat restoration actions and monitor action effectiveness. Many of these are less robust than managers/sponsors would like due to lack of technical and financial resources. This is true for both guiding on-the-ground work and demonstrating the overall benefit of habitat restoration actions. In the geographies where the BPA monitoring projects are occurring, there is some ability to use the products and tools being developed. However, many entities identified a lack of alignment between the programmatic tools and the needs of restoration practitioners and fish and wildlife managers. Throughout the region, managers and sponsors are strongly invested in developing solid approaches for planning, monitoring and evaluation. Please see attachment 1 for a detailed summary.

Using the information gathered through the discussions, Council and Bonneville staff will develop a framework for a program-focused tributary habitat monitoring strategy. This framework will incorporate pieces of the existing BPA monitoring projects, as relevant. Staff will develop the draft framework and solicit input and review by the fish and wildlife managers and sponsors. Our expectations are that a generalized framework can be presented in July, with a final monitoring strategy completed by the end of the calendar year.

Attachment 1: Basin review of Habitat Action Monitoring and Evaluation Council and Bonneville Joint Staff Discussions with Fish and Wildlife Program Project Sponsors.

Council and Bonneville staff held joint discussion meetings with Program project sponsors to gain a more comprehensive understanding of habitat implementation information and associated monitoring. These discussions focused on what is working, what could be improved, and what are the outstanding gaps that are limiting effective implementation of habitat actions. The pilot programmatic projects, CHaMP and ISEMP, and the nascent Bonneville AEM project, were discussed to understand their role in habitat action implementation and assessments.

Summary of Meetings:

- Staff held 32 in-person meetings and conference calls between March 29th and 1st week of June, 2017.
- Number of participants ranged from 1 to 10 participants per meeting.
- Discussions ranged from 45 minutes to 3 hours in duration; generally 1 hour.
- Discussions provided a broad representation of expertise and perspectives from across the Basin, from both the anadromous and blocked-areas. This included project sponsors who worked in the 8 CHaMP/ISEMP pilot watersheds and 3 IMWs, as well as outside of these areas.
- Entities represented in these discussions included:
    - State agencies: IDFG, MTFWP, ODFW, WDFW, and ID OSC.
    - Tribes: Confederated Tribes of Grande Ronde, Kootenai Tribe of Idaho, Shoshone-Paiute Tribes, Coeur d'Alene Tribe of Indians, Spokane Tribe of Indians, Confederated Tribes of the Umatilla Indian Reservation, Confederated Tribes of the Colville Reservation, Shoshone-Bannock Tribes, Confederated Tribes of the Yakama Nation, Nez Perce Tribe and the Cowlitz Indian Tribe.
    - Tribal organizations: Columbia River Inter-Tribal Fish Commission and Upper Snake River Tribes.
    - Federal Agencies and Public Utility Districts
    - Coordinating and partnership organizations: Pacific Northwest Aquatic Monitoring Partnership, Lower Columbia River Estuary Partnership, Lower Columbia Salmon Recovery Board, Upper Columbia Salmon Recovery Board, Snake River Salmon Recovery Board , Yakima Basin Fish and Wildlife Recovery Board, Grand Ronde Model Watershed, Walla Walla Basin Watershed Council, Asotin County Conservation District, and the Wenatchee and Entiat Joint Habitat Sub-Committee.
    - County Conservation Districts: Kittitas County Conservation District and Asotin County Conservation District.
    - Consulting firms: including Cramer Fish Sciences, Natural System Design, and others invited by the project sponsors.

Summary of Discussions:

For the purposes of summarizing the information gathered through these meetings, the basin was divided into 4 geographic areas:

Lower Columbia River: Columbia Estuary and Lower Columbia provinces.
Middle Columbia River: Columbia Gorge, Columbia Plateau provinces.
Upper Columbia River: Columbia Cascade, Intermountain, and Mountain Columbia provinces.
Snake River: Mountain Snake, Middle Snake and Upper Snake and Blue Mountains provinces.

The information is summarized into 4 key areas: problem identification, planning and prioritization; evaluating success of habitat work; data management and reporting; gaps and outstanding needs.

1. Problem Identification, Planning and Prioritization:

- Lower Columbia River (no ISEMP/CHaMP overlap)
    - There are a variety of approaches which are in different stages of development depending on the geographic area. These include: structured decision-making frameworks based on key metrics; strategy/planning documents that guide restoration based on habitat information; recovery plan priorities; and the Council's 2004-2005 Subbasin Plans.
    - The approaches are similar in that they segment the geographic area into subsections based on geomorphology and habitat criteria to provide an organized approach to assessing limiting factors and habitat improvements.
    - Resources to collect and analyze data are limited, which creates a lack of critical fish and habitat information needed to guide restoration actions.
    - A strength of the processes used in some of the areas is collaboration among fish/habitat data collection entities and habitat restoration entities to identify the highest priority restoration needs.

- Middle Columbia River
    - Managers and sponsors are using a variety of approaches to identify restoration actions. These include: geomorphic/habitat-based assessments to identify limiting factors and guide project prioritization; structured decision-making processes (Atlas, expert panels); the Regional Technical Team's (RTT) Upper Columbia Biological Strategy; species and life-stage specific life-cycle models; the 2004-2005 Subbasin Plan and Ecological Diagnostic Treatment (EDT). Some have developed this guidance for a broad geographic area while others have focused on a smaller watershed area.
    - Resources to collect and analyze data are limited, which creates a lack of critical fish and habitat data needed to guide restoration actions. In some

cases, information gathered by CHaMP, ISEMP or AEM are not addressing key management questions, or are not at a scale that can be used to inform restoration action design and implementation.
    - A strength of the processes used in some of the areas is collaboration among fish/habitat data collection entities and habitat restoration entities to identify the highest priority restoration needs.

- Upper Columbia River
    - Managers and sponsors are using a variety of approaches. These include: process-based habitat assessments that identify limiting factors and prioritize watersheds, reaches and restoration actions; combined habitat (EDT) and fish use assessment that is updated with new data to assess changes in limiting factors; RTT Upper Columbia Biological Strategy; species and life-stage specific life cycle models. There is a current effort to improve the RTT's approach by incorporating data from new sources and building on what has worked in other areas, such as the ATLAS decision making approach.
    - Resources for managers to collect and analyze data are limited, which creates a lack of critical fish and habitat data needed to guide restoration actions. In some cases, information gathered by CHaMP, ISEMP or AEM are not addressing key management questions, or are not at a scale that can be used to inform restoration action design and implementation.
    - A strength of the processes used in some of the areas is collaboration among fish/habitat data collection entities and habitat restoration entities to identify the highest priority restoration needs.

- Snake River
    - Observational information is being used in some areas to determine restoration needs due to limited access to data/information. Some areas are starting to use a structured decision-making process (e.g. Atlas) or are working with partners to develop a structured decision-making process tool to match their needs.
    - A strength of the processes used in some of the areas is collaboration among fish/habitat data collection entities and habitat restoration entities to identify the highest priority restoration needs.

2. <u>Evaluating Success of Habitat Work:</u>

- Lower Columbia River
    - There is very limited funding for this work. There is some status and trend, and habitat effectiveness monitoring in the estuary. There are also a subset of locations in the mainstem conducting regular sampling of control and treatment sites to detect use by fish and changes in habitat. Effectiveness monitoring in the estuary was to be funded by ACOE but this has been limited.

  - Where geographic frameworks are being developed, effectiveness monitoring will be organized within those frameworks.
  - The findings of the BPA project action effectiveness approach have not been applied and it is unclear if any actions are being included from this area of the basin.

- Middle Columbia River
  - The programmatic BPA Project AEM is gathering data from some sites in this portion of the basin. The information being gathered is not targeting questions of interest to the practitioners, such as whether the action is reducing the life-stage specific limiting factor. Rather, it is focused on a broader scale such as whether the action type provides general benefits to ESA listed salmon and steelhead.
  - There is some use of Quantile regression forests (QRF), Habitat Suitability Index (HSI), and life-cycle models populated with ISEMP/CHaMP data in watersheds where those programs exist.
  - Some areas are using general data to determine benefits including: streamflow and temperature monitoring; biomonitoring; fish status and trend data; remote sensing and physical habitat monitoring strategies.

- Upper Columbia River
  - In one watershed the EDT model and standardized reporting are informing effectiveness of actions at reducing limiting factors and benefiting specific life-stages. Other areas are working on developing species/life-stage specific models that could inform effectiveness or are conducting pre- and post- project monitoring for specific parameters. Other areas are lacking in data and funding to assess action effectiveness.
  - Programmatic approaches to reach-scale action effectiveness have limited application for site-specific effectiveness that can be used by habitat practitioners. The WA GSRO generate some site-specific effectiveness reports for select actions which have been valuable for stakeholder education/support and for grant proposal applications. The BPA AEM generates rolled-up findings on effectiveness of a given action category, which is of limited use to practitioners at this time. The field data collected by BPA AEM is available but would need to be synthesized to the scale matching the scale of restoration actions. It is currently not directly designed to assess the effectiveness of an action on a life-stage specific limiting factor, which limits its utility for restoration practitioners.
  - Many are using the fish in/out data to help inform restoration actions. In some areas monitoring is being conducted to meet grant obligations, e.g. water quality. Some rely on published literature or BMPs to convey that the action is known to be effective.

- Snake River
  - In some locations, managers are collecting habitat data over time to detect changes due to restoration actions at the expected scale. Others are

developing or using life-cycle models to assess changes in fish population, density and/or distribution from habitat actions. Other areas don't appear to have access to the information needed to determine effectiveness of their actions.

- Currently the effectiveness information generated by the ISEMP/CHaMP and BPA AEM have limited use by the co-managers for reasons summarized in other geographies, above. Some areas that are associated with ISEMP/CHaMP sites are using tools or think they may be applicable in the future. Some would like to see these tools exported to other watersheds, but in a streamlined manner.

3. Data Management and Reporting

- Lower Columbia River
  - Some of the coordinating entities have publicly available data including reports, GIS layers, maps and databases. Examples include SalmonPort, SIP, SLICES. These websites/databases are undergoing improvements to make the data more accessible to the public. There is some discussion about Bonneville funding a new database for estuary data that would reside and be managed by a private consulting firm. Fish managers provide salmon and steelhead data to StreamNet.

- Middle Columbia River
  - Managers and sponsores provide reporting as required by the state and the FCRPs BiOP.
  - They also provide information in annual reports to funding entities.
  - Entities have varying degrees of internal data management and publically-available sites due to limited funding. Many are not able to effectively leverage the CHaMP/ISEMP data management system.
  - Several entities have publically-available data/report websites including Washington DFW, Yakima Nation, CRITFC, Walla Walla Watershed Council, CTUIR.

- Upper Columbia River
  - Managers mentioned a web-based reporting tool targeted for completion by the end of 2017 that will report progress towards addressing limiting factors within a target watershed.
  - Fish information is available for some species and populations in tribal, state, and regional databases.
  - Managers and sponsors also provide information in annual reports to funding entities.
  - Entities have varying degrees of internal data management and publically-available sites due to limited funding. Many are not able to effectively leverage the CHaMP/ISEMP data management system.

- Snake River
    - Some entities are maintaining publically-available databases.
    - The also provide information in annual reports to funding entities.
    - Entities have varying degrees of internal data management and publically-available sites due to limited funding. Many are not able to effectively leverage the CHaMP/ISEMP data management system.

4. Gaps and Outstanding Needs:

   The majority of the sponsors need access to technical expertise to help summarize data, conduct assessments or develop models. This access would help provide information to guide restoration actions and develop restoration designs. Some suggested that there be increased support for structured decision-making processes like ATLAS to inform prioritization of habitat actions.

   Throughout the basin, gaps were identified in understanding the status of limiting factors for different life-stages of fish needed to inform prioritization of restoration actions. Many identified the need for updated stream assessments and the need to move from opportunistic to strategic restoration. There is also a need to re-visit target limiting factors to assess if the implemented action(s) has reduced that limiting factor. Most entities do not have the resources they need to conduct effectiveness monitoring. All want an expanded pit tag array and more fish status and trend information. Many believe this should be handled by the fish and wildlife managers.

   In general the move from action-scale monitoring to a population/ESU/ watershed scale assessment over the last 10+ years has resulted in decreasing availability of and access to information needed to guide on-the-ground work. Several of the programmatic tools were developed in isolation of program and management oversight. This gap in coordination and regular engagement between the programmatic project sponsors and the end-users, co-managers, Council and Bonneville, likely contributed to current gaps in available information and analytical tools. There is also a lack of alignment between the location of the programmatic monitoring sites and the location of habitat restoration projects, which limits the utility of those sites for effectiveness monitoring. Scale is also an issue; programmatic approaches were designed for watershed/population-scale and many entities need more reach-scale info for determining restoration actions.

   In general, many felt that the current data are hard to access and that there is a lack of useful data summaries, analysis and interpretation. Most felt that there is a need for more transparency and more communication. Some suggested the need for a data synthesis, analysis and reporting team to coordinate data analysis and dissemination and create end-user products. Many entities identified the need for support or a program for tracking and reporting project effectiveness and status and trends; for data protocols and standardized data collection; and for data management.

Attachment 2: Summary of ISEMP/CHaMP Resources and Tools

This table is a summary to inform the NW Power and Conservation Council and Bonneville Power Administration (BPA) in their review of basinwide monitoring and evaluation. It focuses on two BPA projects, the Integrated Status and Effectiveness Monitoring Program (ISEMP; BPA Project No. 2003-011-00) and the Columbia Habitat Monitoring Program (CHaMP; Project No. 2011-006-00) and the watersheds specific to those projects.

ISEMP is a monitoring and evaluation design project that was initiated in 2003 as a series of pilots for testing monitoring indicators and metrics, sampling designs, evaluation procedures, data management, and large-scale coordination and implementation logistics. The project focuses on two key monitoring and evaluation programs: (i) subbasin-scale pilot status and trend monitoring efforts for anadromous salmonids and their habitat in the Wenatchee/Entiat, John Day and Salmon River basins, and (ii) effectiveness monitoring for suites of habitat restoration projects in selected watersheds within the three target subbasins above (aka IMWs). ISEMP was expanded to include an extensive program of installing, operating and maintaining instream PIT tag detection arrays in collaboration with co-managers. Additional efforts have focused on developing tools for evaluating fish-habitat relationships and action effectiveness.

CHaMP is a pilot project designed to monitor fish habitat status and trends using a standardized monitoring protocol with a program-wide approach to data collection and management. It is currently applied in 8 pilot watersheds within the portion of the Columbia Basin accessible to anadromous salmonids. The monitoring effort supports correlations of basin-wide habitat condition with biological response indicators for fish to evaluate habitat management strategies and inform habitat restoration. The CHaMP pilot watersheds referred to in the table are the: Entiat, John Day, Lemhi, Methow, South Fork Salmon, Tucannon, Upper Grande Ronde, and Wenatchee.

Product/ Tool	BPA Project	Overall Purpose/ Output	Status of tool/method	Locations	Current Use
IMWs	ISEMP	Habitat-fish relationships and responses to restoration actions Habitat action effectiveness at the watershed/ population scale	On-going implementation	Lemhi, Bridge Creek/John Day, Entiat	Mainly used within the 3 IMW areas
Habitat metrics	CHaMP	Habitat status and trends	On-going implementation	CHaMP pilot watersheds	Limited
Network estimates of habitat metrics	CHaMP	Habitat status and trend using Globally Available Attributes	In Development	Testing at existing CHaMP watersheds; applying at several others	Unclear
Instream PIT Tag Detection Systems; spawning surveys; juvenile data	ISEMP	Fish status and trends	Ongoing implementation	3 IMWs and select CHaMP pilot watersheds. Others outside ISEMP project.	Yes
Mark/ Recapture Models	ISEMP	Juvenile fish abundance	In development	Bridge Creek, Lemhi	Unclear
Lower Granite Dam Escapement; Snake River tributary escapement; Sex and age structured escapement	ISEMP	Adult Escapement	In use	Snake River and Tributaries	Yes
Hydraulic model	CHaMP	Depth and velocity to be used with HSI and other metrics to estimate fish habitat capacity	In use in select areas	CHaMP pilot watersheds	Yes

Habitat Suitability Index (HSI)	ISEMP/ CHaMP	Habitat Suitability (Weighted Usable Area)	In use in select areas	CHaMP pilot watersheds	Yes
NREI	ISEMP/ CHaMP	Carrying Capacity	In development	Entiat, Grande Ronde, Lemhi (Hayden creek & lower Lemhi), Wenatchee	Unclear
Quantile Regression Forests (QRF)	ISEMP	Carrying Capacity	In development	Entiat, Grande Ronde, Lemhi (Hayden creek & lower Lemhi), Wenatchee	Limited
Geomorphic Unit Tool (GUT)	CHaMP	Identify geomorphic units (landforms) from DEMs	In use in select areas		Limited
Geomorphic change detection (GCD)	CHaMP	Changes in habitat in a reach over time by comparing DEMs	In use in select areas	CHaMP pilot watersheds	Limited
Geomorphic Assessments: Beaver Restoration Assessment Tool (BRAT) Valley Bottom Extraction Tool Confinement Tool Riparian Condition Assessment Tool	ISEMP/ CHaMP	 Capacity of the landscape to support beaver dam-building activity Delineates valley-bottoms from stream network information Stream channel confining margins Riparian condition at the reach scale	Variable – often developed for limited use in one or more watersheds	Depends on the specific tool	Limited - Some interest in future use

Riparian Vegetation Departure Index Wood Recruitment Assessment Tool		Vegetation changes from pre-European settlement conditions Probably of Instream Wood Recruitment			
Gross Primary Production (using Conductivity or solar inputs)	CHaMP	Gross Primary Productivity	In development	CHaMP pilot watersheds	Unclear – but probably limited
Riverstyles	CHaMP	Recovery Potential	No longer supported by Bonneville	3 CHaMP watersheds: Wenatchee, Tuccanon, Lemhi; plus Asotin	No
Life-cycle models (informed by several sub-models)	ISEMP	Habitat benefits within context of entire life-cycle	In development	4 watersheds: Lemhi; Entiat; MF John Day; and Upper Salmon/ Yankee Fork	NOAA use; some use by local managers
Data Warehousing	CHaMP	Data management and data access	In development		No
CHaMP Workbench	CHaMP	Data management and data access	In development		No
Status and effectiveness monitoring databank (STEM)	ISEMP	Data management and data access	Developed for limited use		No

Attachment 3: Summary of BPA Project Action Effectiveness Monitoring (AEM) Programmatic Products

This table is a summary to inform the NW Power and Conservation Council and Bonneville Power Administration (BPA) in their review of basinwide monitoring and evaluation. It focuses on the actions evaluated and products generated by BPA Project Action Effectiveness Monitoring (AEM) Programmatic.

Overview of AEM

AEM is a pilot project designed to develop a standardized, programmatic approach to project-level action effectiveness monitoring. The AEM approach is intended to move action effectiveness monitoring from a project-by-project approach to a coordinated, cost-effective, standardized and statistically-valid method for assessment. The intention is to work in a collaborative manner with project sponsors to guide and provide information about the effectiveness of habitat restoration actions that address habitat impairments (limiting factors).

- Geographic extent: Anadromous zone with ESA-listed salmon and steelhead.

- Applies two monitoring approaches that collect samples during summer low flow.
    - Extensive Post Treatment (EPT): samples one time at 15 to 30 existing locations for a specific action.
    - Multi-Before After Control Impact (MBACI): for a specific action subcategory (see table below), samples one time a year, twice before and five-times after the action is implemented. Goal is 10-15 implemented actions for an action subcategory.

- Tests the effect at the reach (action) scale of 4 categories of actions (12 subcategories) to answer the following questions:
    - What is the effect on habitat?
    - What is the effect on fish and other biota?
    - Within an action category, why are some sites more successful than others?
    - Are there differences in the detected effects among geographic areas (ESUs)?

- Products:
    - Roll up of findings at the action subcategory level or ESU level.
    - Summary of findings in annual report.
    - Raw data available from a web-based database.
    - Data reliability assessments.

- Current Co-manager use
    - Unclear how used by co-managers. Most indicate they are not able to use the information.

- Findings reported at programmatic scale and may not match the scale needed to guide specific restoration actions.

12 Habitat Action sub-Categories and (method)	Current Status/Findings
Complete barriers (EPT)	Completed, 30 existing sites sampled during 2014 and 2015. Barrier removals successfully allowed fish to use the previously blocked habitat with no differences in fish detected.
Partial barriers (MBACI)	Ongoing
LWD/Boulders/Pool & complexity (EPT)	Initiated in 2016, should be completed in 2017
Bank stabilization (MBACI)	Ongoing
Engineered logjams/structures (EPT)	Not initiated
Levee set-back removal (MBACI)	Ongoing
Channel reconnection (MBACI)	Ongoing
Channel creation (MBACI)	Ongoing
Channel re-meandering (MBACI)	Ongoing
Fencing (MBACI)	Ongoing
Planting (EPT)	Not initiated
Invasive plant removal (EPT)	Not initiated