TECHNICAL MEMORANDUM

DATE:	July 8, 2025
TO:	Methow Salmon Recovery Foundation (MSRF): Camden Shaw, Chris Johnson
FROM:	Lichen Land and Water (Lichen): Nick Legg, LG; Dominique Shore Resource Specialists Inc. (RSI): Gabe Williams, PE
PROJECT:	Twisp Valley Power and Irrigation (TVPI) Efficiencies Study
SUBJECT:	Phase I Study Summary

1 Introduction

This memorandum is provided as a summary of (1) progress made during Phase I of the TVPI Efficiencies Study ("Study"), and (2) anticipated study elements for Phase II of the Study. The overall Study will evaluate site conditions and opportunities to upgrade the existing TVPI irrigation ditch to a more efficient water conveyance and delivery system. The Study is led by Methow Salmon Recovery Foundation (MSRF) with funding support from the Confederated Tribes of the Colville Indian Reservation (CTCR). Lichen Land and Water Inc. (Lichen) and Resource Specialists Inc. (RSI) are leading the science and engineering elements of this study, with support from MSRF.

The TVPI irrigation ditch has its intake located at river mile 7 of the Twisp River, in Okanogan County, Washington. The ditch carries water down-valley for about 4 miles, providing water to about 40 water users along its length.

Phase I of the study extended from December 2024 to June 2025, and included initial scoping, study planning, base map development, alternatives identification, and discussions with water users. This memo describes the project goals, progress to date, summary of preliminary alternatives, and plans for Phase II expected from July 2025-June 2026.

Attachments to this memorandum include:

A. Draft monitoring plan and general schedule
B. Summary sheet of well monitoring
C. TVPI area map
D. Shareholder feedback summary

2 Basic Hydrology and Water Statistics of TVPI

The following hydrological statistics contextualize the project and potential opportunities. A previous study by Konrad et al. (2003) provides generalized estimates of seepage loss from TVPI. The current study seeks to refine the estimates of seepage loss from the ditch.

	Statistic	Value	Source
Early Summer	Twisp River – July Mean – 2010-2024 (cfs)	330 cfs	USGS Gage (RM 2)
	TVPI Diversion Rate (cfs)	16 cfs	Konrad et al. (2003)
	TVPI Seepage Loss (cfs)	4-5 cfs	Konrad et al. (2003)
Late Summer	Twisp River – September Mean – 2010-2024 (cfs)	54 cfs	USGS Gage (RM 2)
	TVPI Diversion Rate (cfs)	8 cfs	Konrad et al. (2003)
	TVPI Seepage Loss (cfs)	2-3 cfs	Konrad et al. (2003)

3 Summary of Existing Issues, Opportunities, and Project Goals

The existing issues with the ditch include:

- High operations and maintenance costs, including labor
- Loss of water due to ditch seepage and evaporation
- Liability associated with ditch failure and vegetation along the ditch

In addition to addressing these known issues, there are potential opportunities to:

- Modernize the ditch infrastructure to provide more functional water delivery
- Add resilience in water delivery for future climate and precipitation changes
- Address fire risks and opportunities for fire-fighting access to water
- Integrate and address salmon habitat and instream flow objectives within the Twisp River

The project goals are:

- To understand and integrate community concerns and needs
- To develop a baseline understanding of the TVPI ditch and the connected hydrology (including river flow, seepage, groundwater connections) to support rational identification of efficiency upgrades
- To quantify current water use to inform opportunities for improved efficiency and system resilience
- To identify and evaluate alternative strategies for efficiency and/or modernization upgrades that will reduce maintenance, costs and liability to future operation of the irrigation company
- To provide baseline information for future design phases, as needed

4 Summary of Alternatives Initially Considered

The Phase I study included initially identifying alternatives and a qualitative evaluation of potential benefits, impacts, and costs. The specific alternatives included:

- Status Quo – This option maintains the ditch in its current configuration and operation
- Partial Piping – Partially pipe problematic sections of the ditch to reduce maintenance costs, ditch seepage, and liability along public and private property
- Pipe Entire Ditch (Gravity Fed) – Pipe and enclose the ditch to reduce maintenance costs, ditch seepage, and liability along public and private property
- Pipe Entire Ditch (Pump Intake) – Pipe and enclose the entire ditch and reconfigure the intake from gravity fed to a pump system.

A preferred alternative has not been identified at this time. Further analysis and community discussions are needed prior to selecting a preferred alternative.

5 Summary of Community Feedback Received on March 8, 2025

Phase I included a community meeting to discuss study plans and potential ditch upgrade alternatives. The meeting was held on March 8, 2025, in the Twisp Grange and had attendance by about 25 ditch users and community members. The meeting included brief presentations by MSRF on the project, followed by small group and large group discussions on the project. Additional response to feedback questions is included in Attachment D.

- Users expressed desire for ditch upgrade to integrate with private distribution infrastructure
- Some users expressed concern about potential impacts from piping on groundwater wells. Several users volunteered to have their wells monitored
- Some users expressed concern at the level of operations and maintenance required for the existing ditch
- Some users expressed desire for the study to incorporate variability in climate and water availability

6 Summary of Phase I Study Progress

Phase I of the Study included the following elements:

- Review and summary of existing issues and opportunities
- Preliminary alternatives analysis, as described in the sections above
- Development of project area basemaps to support the Study, including collection of high-resolution imagery (see Attachment C)

- Coordination with ditch users and community members, during the March 8 meeting and other conversations
- Development of study plan for Phase II (described below)
- Initial data collection, including the seepage run reported below

6.1 Summary of Initial Seepage Run Findings

On June 3rd, 2025, MSRF staff measured discharge at nine locations along the TVPI ditch. MSRF coordinated with users to cease use during this time to isolate losses from seepage. The flow measurements and calculated flow losses between measurements are reported in Figure 1 and Table 1. Detailed methodology for the seepage run is provided in Attachment A - *Monitoring Plan and General Schedule*. The major findings of the seepage runs are discussed below.

- Flows decreased from 7.5 cfs at the headgate to 1.8 cfs at the end spill, with measured discharges of 1.2 cfs at the Elbow Coulee Spill and 0.6 cfs at the Frost Spill, resulting in a total seepage loss of approximately 3.9 cfs. The average rate of discharge loss is 0. 17 cfs/1000 linear feet of ditch.
- The highest rate of seepage losses occurred between the Headgate and Elbow Coulee Spill, followed by the segment from Flume Grade Spill to Frost Spill.
- Lower seepage rates (<0. 1 cfs/1000 ft) were observed between Elbow Coulee Spill and Flume Grade Spill and from the Channing Spill to the End Spill

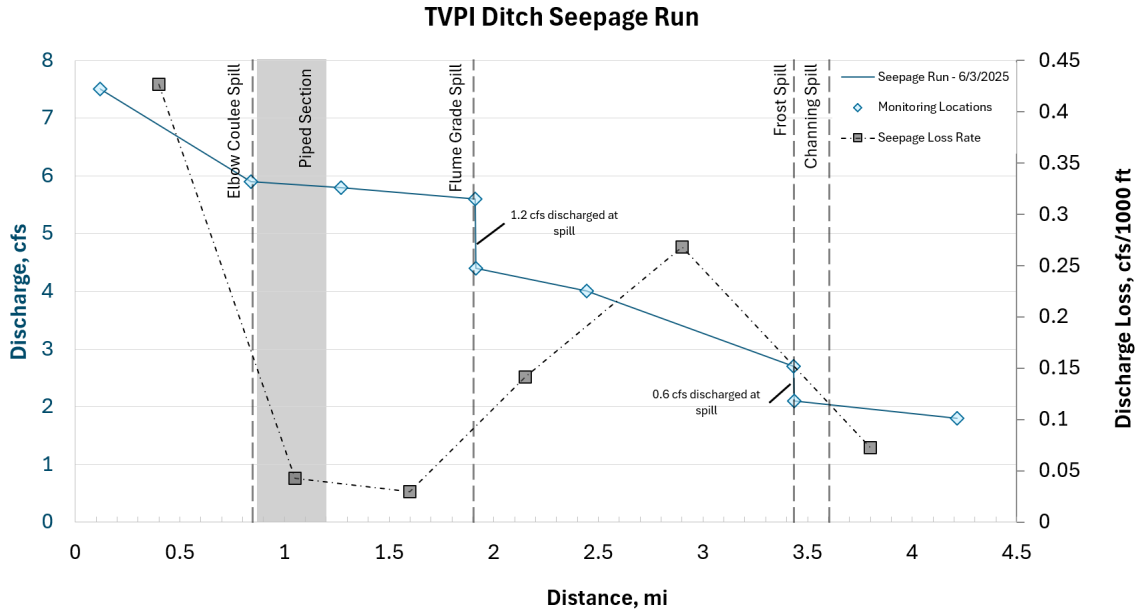


Figure 1. Initial results from TVPI ditch seepage run on June 3, 2025. No water was discharged from the Elbow Coulee or Channing Spill on that date.

Table 1. Summary of initial seepage run results from June 3, 2025

Section	Station (mi)	Flow Loss (cfs)	Flow Loss Rate (cfs/1000 ft)
Headgate to Elbow Coulee Spill	0 – 0.8	1.6	0.43
Elbow to Barnes	0.8 – 1.3	0.1	0.043
Barnes to Flume Grade Spill	1.3 – 1.9	0.1	0.030
Flume Grade Spill to Christianson	1.9 – 2.4	0.4	0.14
Christianson to Frost Spill	2.4 – 3.4	1.4	0.27
Frost Spill to End Spill	3.4 – 4.2	0.3	0.073

7 Summary of Phase II Study Plan

The Phase II Study will include the following study elements described below.

Project Coordination and Management – The team will continue to engage with the ditch users and community to ensure that findings are communicated and input is incorporated. This will include one to three community meetings to discuss results and implications.

Site Evaluations and Monitoring – The site evaluation and monitoring will include the following elements. The goals are to provide baseline understanding to inform potential efficiency upgrades.

- Field reconnaissance to support site evaluations
- Topographic survey and aerial imagery collection of the ditch
- Flow measurements in the ditch and river to understand patterns of loss from the ditch and returns to the river (see Attachment A)
- Water use accounting to support design and identification of potential conservation measures
- Groundwater well risk assessment to inform potential zones of impact to supply wells from reduction in seepage (in piping scenario) – the study includes on-going monitoring of selected groundwater wells to assess potential responses of groundwater tables to the ditch
- Analysis of impacts/opportunities for floodplain habitat from irrigation efficiencies

Alternatives Analysis and Conceptual Design – The team will conduct a more in-depth alternatives analysis based on the findings of site evaluations and community input.

Preliminary (30%) Design – The team will develop preliminary designs of selected efficiency upgrades

8 References

Konrad, C. P., Drost, B. W., & Wagner, R. J. (2003). Hydrogeology of the unconsolidated sediments, water quality, and ground-water/surface-water exchanges in the Methow River Basin, Okanogan County, Washington (No. 3). US Department of the Interior, US Geological Survey.

ATTACHMENT A – DRAFT MONITORING PLAN

TECHNICAL MEMO (DRAFT)

DATE:	April 10, 2025
TO:	Methow Salmon Recovery Foundation (MSRF)
FROM:	Lichen Land and Water (Lichen): Nick Legg and Dominique Shore
PROJECT:	Twisp Valley Power Irrigation (TVPI) Efficiencies
SUBJECT:	Data collection plans for summer 2025

1 Introduction

This memorandum is provided as a synopsis of proposed monitoring data collection for summer 2025. We would be happy to discuss adjustments to these plans if they are outside of MSRF's budget or capacity for this work. This memorandum is not intended to describe all rationale for the proposed strategies. We are continuing to develop the specific locations for monitoring and measurements.

The data collection efforts are intended to inform the water budgets and levels along the ditch, in the adjacent aquifer, and the river.

2 Seepage Runs in the Ditch

We recommend conducting three seepage runs to inform loss rates and patterns along the ditch.

2.1 Timing

Conduct seepage runs in early season after "seal-up", mid-season (~July), and late-season (September).

Seepage runs should occur during water use stoppage pre-arranged with users. An individual seepage run will be conducted over a single day with a constant diversion rate from the river.

2.2 Data Collection Strategy

The diversion rate from the river should be set to the maximal amount that can be spilled from a combination of the Frost, Channing, and end spills while accounting for anticipated seepage. This strategy avoids the need to account for the Elbow Coulee and Flume Grade spills and a majority of the ditch length.

Flow measurements should be distributed at a maximum spacing of 0.5 miles. Flow measurements should also bracket spills actively discharging water.

The proposed spacing will result in approximately 10 flow measurements per seepage run. GPS locations should be collected at each measurement. Duplicate measurements should be collected at every other site and at the spill bracketing measurements to support quality assurance

3 Well Monitoring

The well monitoring effort includes two data collection methods.

- A series of 7 wells will be monitored using pressure transducers ("monitoring wells") to understand water level variations over time
- A series of 8 wells will be spot checked ("spot check wells") using a water level tape on a regular basis

General protocols for each are described below.

3.1 Steps for Monitoring Wells

Pressure transducers should be deployed prior to the irrigation season. A barometric logger should also be deployed within the project area at the same time.

Deployment steps include:

- Ensure logger has adequate battery level to cover the anticipated deployment period.
- Set recording increment to 1 hr.
- Deploy logger to a depth of at least 5 feet (ideally 10-15 feet) below the static water level at the time of deployment. If the well has potential to be impacted by water pumping in nearby wells, it is important to deploy well below (greater than 10 feet below) the static water.
- Record the static water level (depth below casing) at the time of deployment.

Deployment periods:

- The initial deployment period is expected to extend through the irrigation season, beginning in late April. Although, strategic mid-summer data downloads may be desirable at select wells.
- We recommend continuation of monitoring in the off-season.

At a minimum, water level should be measured manually at the beginning and ending of each deployment period, plus at least once during the deployment period. We recommend spot check measurements more frequently than that minimum, and specifically during the same data collection efforts as those for "spot check" wells as described below.

3.2 Steps at Spot Check Wells

Spot check measurements should be made at the identified wells at least six times distributed throughout the year (roughly once every 2 months). The purpose of these spot checks is to inform the spatial patterns of groundwater elevations more than temporal variations.

Each data acquisition should include spot checks at all wells on a single day. We recommend including monitoring wells in these spot checks.

Prior to spot checks, it is important to coordinate the measurements with a period of low water pumping as identified by well owners.

At each well, record the water level twice, 10 minutes apart, to assess stability of the water level (depth below casing top). Record the time of each measurement. All data recording should identify the landowner and well tag ID.

4 River Monitoring and Seepage Runs

The following monitoring efforts are intended to assess water levels and gains/losses in the reach of the Twisp River along the project area.

- Water level logger (stage recorder) at Poorman Creek bridge. Combined with flow measurements collected during seepage runs, we will develop a stage-discharge rating curve suitable for low summer flows at this site.
- Seepage runs on four occasions throughout summer and fall season – timing of individual runs to occur around Aug 1, Sept 1, Oct 1, and Nov 1. Each seepage run to incorporate about 6-8 flow measurements between the ditch intake and the USGS gage, as well as one measurement on Poorman Creek itself near the outlet. On each date, the TVPI intake rate and spill quantities should be recorded if possible.
- At ~3 locations near river-adjacent monitoring wells, field efforts will include staking (driven wood stakes) of water levels during each seepage run. These stakes should be clearly labeled and photographed with date and time. Consultant team will survey the elevations of these stakes at the end of summer.

ATTACHMENT B – SUMMARY SHEET OF WELL MONITORING

Summary of Groundwater Well Monitoring Activities

Twisp Valley Power & Irrigation (TVPI) – Efficiency Project and Feasibility Study | May 2025

We are conducting a study of groundwater wells surrounding the Twisp Valley Power & Irrigation (TVPI) Ditch. The goal of the study is to understand whether water seeping from the TVPI ditch influences groundwater levels and if so, where and how much. Results from this study will be shared with the community after irrigation season ends in the fall. We are monitoring water levels using the two approaches below. The feasibility study is being led by Methow Salmon Recovery Foundation, Lichen Land and Water Inc., and Resources Specialists Inc.

1. Continuous Monitoring

We have installed automatic (pressure transducer) data loggers in seven wells that are currently not being pumped for drinking water. These loggers will record water levels every hour, providing a continuous record of how groundwater levels rise and fall throughout the year with minimal effects of nearby pumping. These wells were selected because they are situated near the ditch and to coincide with previous monitoring by the USGS (2003).

TABLE 1. WELLS SELECTED FOR CONTINUOUS MONITORING VIA DATA LOGGER.

Well Owner	Well Depth	Well Tag	Well Substrate
P1*	61	ACX746	Shale Bedrock
P2*	38	ACX745	Unconsolidated Gravel
P3	266	BMN749	Shale Bedrock
P4*	80	ACX742	Shale Bedrock
P5	-	BNY445	-
P6	173	-	Shale Bedrock
P7*	32	ACX744	Unconsolidated Gravel

*Indicates well used in USGS Report

2. Spot Measurements

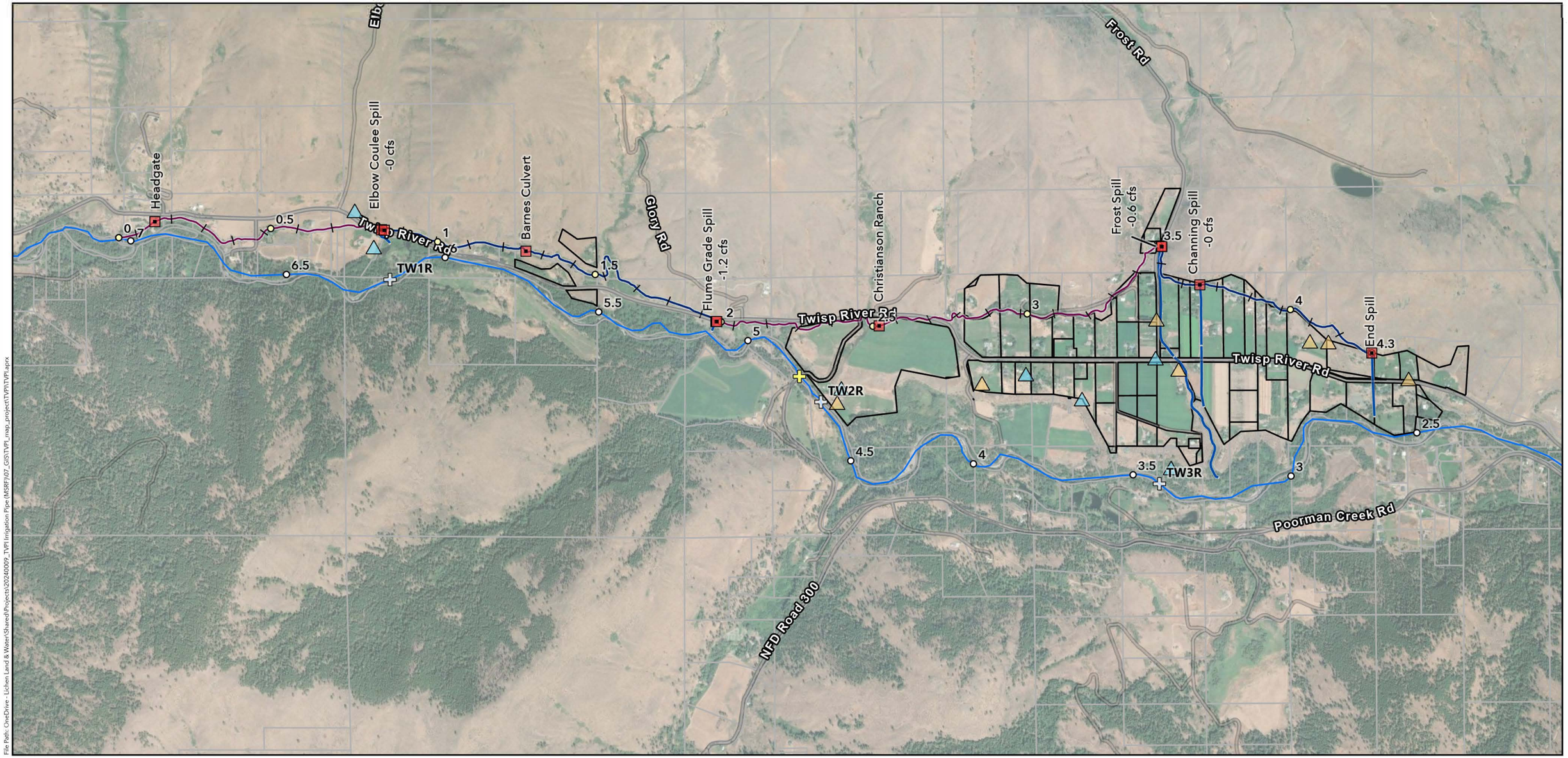
We are taking hand measurements of eight wells throughout the valley roughly 10 times throughout the year. The wells are regularly in use and pumped for household water use. Because pumping causes water levels to fluctuate frequently, these wells are not suitable for continuous monitoring for this study. Instead, we will take manual readings when pumps have been off for a while to give us a better understanding of 'static' (natural) water levels at more locations and aquifer depths and types surrounding TVPI ditch. The spot measurements are intended to gain a broader understanding of groundwater patterns in the project area.

TABLE 2. WELLS SELECTED FOR SPOT MEASUREMENTS

Well Owner	Well Depth	Well Tag	Well Substrate
S1	160	BQG512	Shale Bedrock
S2*	38	ACX743	Unconsolidated Gravel
S3	666	APT965	Shale Bedrock
S4	-	-	-
S5	-	-	-
S6	-	AET 810	-
S7	206	APE 487	Shale Bedrock
S8	220	APG263	Granite

*Indicates well used in USGS Report

ATTACHMENT C – PROJECT AREA MAP



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- Twisp River
- TVPI Spills
- Twisp River Station (mi)
- TVPI Dith Station (mi)
- Estimated Parcels with TVPI-sourced water use
- Taxlot Boundaries (approx.)

- Discharge measurement points for June 3 seepage run

TVPI Ditch

Seepage Rate cfs/1000 ft - June3rd

- 0 - 0. 1
- > 0. 1
- Spill

Wells with on-going monitoring for study

Method

- Pressure Transducer
- Spot Check

Surface Water Monitoring Site

- USGS Report 03-4244
- Potential Stage Recorder

TVPI Efficiency Study

Basemap and Seepage Run (June 3, 2025)

METHOW SALMON RECOVERY FOUNDATION

LICHEN LAND & WATER

0 0.25 0.5 1

Miles

ATTACHMENT D – SHAREHOLDER FEEDBACK SUMMARY

TVPI Shareholders feedback summary from March 8, 2025 shareholder meeting

Well table:

- Seasonal/climate trends and fluctuations.
- Multiple years of monitoring – accounts for climate trends.
- Look at individual laterals.
- Closed basins.
- Community wells.
- Clean transducers placed in wells.
- How do you measure seepage?
- How much seepage loss vs inefficient irrigation?

Habitat info table:

- When you study impacts on habitat, please take a comprehensive look including habitat throughout the Twisp Watershed-Deer, beavers, birds, flora, etc.
- Which choice leaves the most water in the river?
- Habitat…flows…climate and hydrology. Earlier peak flows shift how well those interact with habitat with piping/and non-piping options.
- Chewuch project-options to maintain some of the plants/least impact possible on the ditch right of way.
- Specific ditch supported seeps and springs.
- Upland ditch supported vegetation supports evapotranspiration.
- What's the best option for reduced streamflow, which is likely?
- Very concerned about low flow at diversion point- especially with changing hydrology.

Water availability table:

- What is the current status of delivery and what is the projected? Is metering in the future?
- How will piping affect the folks at the end of the ditch past the last spill?
- Would/could the feasibility study include consultation of inefficient ditch boxes?
- What are maintenance costs with piping as it ages, what is lifetime of pipe?
- How many cfs would be saved if we replaced the tail pipe at the end of the ditch for a larger diameter pipe and shut off spillways?

Maintenance info table:

- If a pipe is put in, will our culvert in our driveway be converted to filled roadway? 338 Twisp River Road.
- How big a hurdle is keeping labor for system maintenance? Won't piping eliminate a big headache, which maybe generational-farmer and ranchers of the past were more willing to

maintain the system than today's mix of ditch members? Is this a human or mechanical issue?

Liability

- Quantifying projects and improvements that aren't included in the scope of current study. Including rough estimates of what landowners might expect, where those funds will come from and forecasting the possibility.
- What other activities/spillways are taking water from river and how can we improve that infrastructure and how does that benefit fish?
- Costs to users after upgrade from a point of source to crop.
- I didn't get a good understanding of impact/benefit to fish. Please include this in the study.
- Could there be a consideration on keeping portions of the ditch open/improving access to the ditch for fire protection (engine draft sites). Safest option right now is Poorman Cutoff. Can we widen pullout near flume grade and one lower on the ditch line?

General discussion:

- How much loss from the ditch-seepage test needed
- Will we be forced to pipe someday anyway
- How does the pipe stay full?
- What if we have multiple users off of a lateral
- Specific seeps and cold water connection from ditch to river
- Can users/ditch support seeps, cold patches
- Cold water patches in the Twisp River-where?
- Sub-irrigated field- will they need to be irrigated more? Are they sub-irrigated?
- What changes of laterals are required?
- Define terms better, turn out etc.
- Does the construction project remove all vegetation necessary to reduce liability to landowner (i.e. trees that will die). What if not in the right of way? Or just outside right away?
- Will you walk the ditch and map all vegetation to be affected by piping?
- What if problems in the future, how pays for that? Endowment?
- Why are lining options not being considered?
- Wells getting paid for if they go dry?