Watershed Group
MEETING AGENDA

Wednesday, March 29h, 2017
Mount Baker School District Administrative Office Board Room
Facilitators: Lesley Rigg and Erin Suda

Goal of the Process:

- To develop a framework for talking about conservation and restoration efforts in the South Fork and engage in watershed planning.

Goals for the Meeting

- To hear about, and give initial feedback on the Watershed Conservation Plan
- To test for agreement the final draft long range goals and planning principles
- To determine next steps

5:45 Arrive, Nametags, Refreshments

6:00 Welcome, Ground Rules, and Introductions (10 min)

6:10 Test for agreement on *Goals, Principles, and Objectives,* revised from our last meeting (20 min)

6:30 Discuss next steps for the Watershed Group (20 min)

6:50 **Watershed Conservation Plan**

- Short video – the hyporheic zone (5 min)
- Presentation and Feedback: Watershed Conservation Plan, Oliver Grah (55 min)

7:50 Finish worksheets, wrap up; confirm/adjust topic for next meeting (10 min)

8:00 Closing

PROCESS		
Meeting #1	Jan. 25th	Establish why we are here, how we will work together as a group, and reflect on the stakeholder and community feedback gathered so far
Meeting #2	Feb. 22nd	Develop a common understanding of water issues in the South Fork Determine level of agreement on *Goals, Principles, and Objectives*
Meeting #3	March 8th	Continue to discuss issues and voluntary strategies Determine level of agreement on *Long Term Goals and Planning Principles* Begin discussing potential future of Watershed Group
Meeting #4	March 29th	Provide feedback on the *Watershed Conservation Plan* overview, seek agreement on *Long Term Goals and Planning Principles* and next steps.

DRAFT 3.20.17

South Fork Nooksack River Watershed Project

These goals and principles were developed through a process of gathering Stakeholder and Public Input in 2016. In early 2017, A community Watershed Group, composed of over 30 local residents and landowner representatives, built upon that input to develop a set of broad statements to guide and inform any agencies or other entities engaged in planning in the South Fork Nooksack River Watershed.

Long-Term Community Goals

Although we have a wide range of perspective and interests in the South Fork Nooksack River Valley, we are looking for win-win solutions to protect our water resources for:

- **Our Families:** KWe want to keep the rural way of life as we know it today and protect it for our children.
- **Our Farms:** MWe want to maintain and protect productive agricultural lands and promote long-term agricultural economic viability.
- **Our Fish:** RWe want to recover salmon populations and biodiversity by restoring natural watershed processes. river, wetlands, and riparian habitat, reducing stream temperatures, and ensuring that there is adequate stream flow in the summer.
- **Our Forests:** MWe want to maintain and protect the forestland base and promote a sustainable forest industry with a skilled and steady local workforce.
- **Our Recreation:** Ensure that activities in the valley contribute positively to the health and safety of our watershed and our community.

Watershed Planning Principles

In order for us to achieve our long-range goals, we need:

- Communication, transparency, and trust between landowners, residents, agencies, and other stakeholders in the Watershed.
- Respect for the ability and knowledge of knowledgeable local residents to manage land and water resources wisely.
- Voluntary agreements between landowners and community partners, with incentives for landowner's efforts to improve watershed conditions.
- Shared understanding and open dialogue around data, science, resource management, and the changing climate conditions that affect our watershed.
- Public education around how farmers, foresters, fishers, and other businesses are continually improving their practices to protect and improve water quality.

Future of the Watershed Group – Worksheet Results

(from those in attendance on 3/8/17)

Those preferring to meet monthly (10):
Gabe Epperson
John Stephens
Ross Cline
Amy Margolis
Doug Couvelier
Dominic Moceri
Carol Delahoyde
Ian Smith
Bill Baroch
LeRoy Harkness

Those preferring to meet annually (3):
Gordon Bakke
Brandon Larsen
Emily Pederson

Those preferring to meet quarterly (13):
Cindy Fabbri
Jim Abernathy
Emily Pederson
Jeff Margolis
Elvin Kalsbeek
Harry Patz
Steve Powers
Tricia Stevens
Eric Davis
Chris Hatch
Dominic Moceri
Ian Smith
Bill Baroch

Future activities for Watershed Group, in order of support:

16 votes - Bring more funding and resources to support landowners' voluntary efforts

13 votes - Continue dialogue and education around watershed issues

13 votes - Serve as a vehicle for our community to give feedback on various agency plans and projects

12 votes - Develop a more comprehensive Community Watershed Plan to inform and guide the efforts of future policy, funding and watershed protection efforts

11 votes - Educate the public on various topics

Most popular topics for future meetings:

11 votes – Forestry

10 votes – Recreation on the river

10 votes – More in-depth water quality

9 votes – Farming

9 votes – Flooding/flood management

Offers: Doug Couvalier: *Elk forage enhancement on Seattle City light ownership-upper S.Fork.*

SOUTH FORK NOOKSACK RIVER WATERSHED CONSERVATION PLAN

DRAFT OUTLINE

1. EXECUTIVE SUMMARY

2. INTRODUCTION
- Background
- Purpose
- Scope

3. WATERSHED CHARACTERIZATION
- Overview of the Watershed
- Changes over Time
    - Geology
    - Land Use/Land Cover
    - Climate Change
- Watershed Processes
    - Hydrology
        - Ground Water
        - Surface Water Quantity
        - Surface Water Quality
    - Sediment Sources and Transport
    - Riparian
    - Channel processes
- Habitat Conditions
    - Physical habitat
    - Temperature
    - Turbidity
- Salmonids
    - Population Recovery
    - Limiting factors

4. WATERSHED PROTECTION AND RESTORATION STRATEGIES
- Regulatory Framework
- SFNR Watershed Conservation and Restoration Goals and Objectives
- Opportunities for Voluntary Action
    - Floodplain Restoration
    - Riparian Restoration
    - Uplands Management
    - Wetlands Restoration
    - Beaver Re-introduction and Re-location
    - Water Banking

5. FUTURE PLANNING NEEDS
- Community Long-Range Goals
    - Issues to be evaluated and addressed
- Planning Principles
- Recommendations for Additional Research
- Implementation and Monitoring

DRAFT – 3.24.17
SFNR Watershed Conservation Plan
SECTION 3: Climate Change

Overview

Projected future changes to the global climate system bring substantial risk to the watershed resources of the South Fork Nooksack River Watershed. Climate modeling studies are in general agreement that annual average surface air temperatures will likely rise on the order of 1 – 5 °C (about 2 – 9 °F) by 2100 throughout the U.S., depending on the future trajectory of greenhouse gas emissions.

Climate models are likewise in general agreement that precipitation will increase at the global scale, but significant uncertainties remain concerning changes in precipitation amount and timing at the local to regional scales. Rising air temperatures will increase the risk of high water temperatures. If flows decrease during critical summer periods, this could further amplify the impacts of higher air temperature on water temperature.

An analysis of potential future climate in the South Fork and its impacts on water temperature and flow is provided in the quantitative assessment (Butcher et al., 2016) and is summarized here. The quantitative assessment is in turn based on work conducted by CIG at the University of Washington (Hamlet et al., 2010; Hamlet et al., 2013). The CIG focuses on the consequences of a changing climate in the PNW.

Among their key products is the Washington Climate Change Impacts Assessment (Littell et al. 2009), a comprehensive assessment of the impacts of climate change on the State of Washington, which was developed under mandate of the Washington State legislature and was recently summarized in Snover et al. (2013) as follows:

- Increases in annual temperature of, on average, 2.2 °F by the 2020s, 3.5 °F by the 2040s, and 5.9 °F by the 2080s (compared to 1970 to 1992), averaged across all climate models.

- April 1 snowpack is projected to decrease by 28 percent across the state by the 2020s, 40 percent by the 2040s, and 59 percent by the 2080s compared with the 1916 - 2006 historical average.

- The Yakima basin reservoir system will likely be less able (compared to 1970 to 2005) to supply water to all users, especially those with junior water rights.

- Rising stream temperatures will likely reduce the quality and extent of freshwater salmon habitat.

- Due to increased summer temperature and decreased summer precipitation, the area burned by fire regionally is projected to double by the 2040s and triple by the 2080s.

- Regional climate model simulations generally predict increases in extreme high precipitation over the next half-century, particularly around Puget Sound.

- Climate change in Washington will likely lead to significantly more heat- and air pollution-related deaths throughout this century.

Table 6. Current Conditions and Potential Future Conditions for the South Fork under Climate Change (Taken from EPA et al. 2017).

Physical Parameters	Current Conditions	Future Conditions with Climate Change	
timeframe	Variable	2040	2080
7DADM (°C)	a) 18.4 b) 20.9 [1]	24.5[2]	25.1[2]
Mean annual flow (cfs)	1032 [3]	+2.5% [4]	+6.2% [4]
Mean low flow (cfs)	a) 102 b) 75.8 [5]	-23% [6]	-34% [6]
Mean high flow (cfs)	1,970 [3]	+12% [7]	+11% [7]
Sediment flux	38,872 [8]	+12% [9]	+11% [9]
Mean annual turbidity	35.7 [10]	+12% [9]	+11% [9]
Mean annual AT (°C)	a) 4-7 b) 8-9 [11]	+2.2 [12]	+3.0 [12]
Mean summer AT (°C)	15.5 [12]	+3.3 [12]	+4.0 [12]
Max summer AT (°C)	23 [12]	27.5 [12]	28.1 [12]
Annual Precipitation (in)	50-125 [11]	+1% [12]	+1% [12]
Summer Precipitation (in)	5-7	-39% [12]	-25% [12]
SWE (in)	39.3-78.7 [13]	-46% [14]	-70% [14]

[1] +Modeled results for a) typical low-flow conditions (7Q2 flows; 50th percentile air temperature) and b) Critical low-flow conditions; (7Q10 flows; 90th percentile air temperature), for all reaches of the South Fork (Butcher et al. 2016).
[2] Spatially averaged 7Q10 maximum water temperature in the South Fork mainstem for future climate under the medium impact scenario (A1B) with existing shade (Butcher et al. 2016). See Butcher et al. (2016) for the high and low impact scenarios.
[3] Values based on Ecology data at gaging station 01F070 (WY 2004-2010) at Potter Road bridge (Kennedy and Butcher 2012). High-flow value indicates the 90th percentile flow.
[4] Total annual streamflow projections for the A1B scenario for Washington State, relative to the 1917-2006 time period (Elsner et al. 2010).
[5] Low flow values at the a) 7Q2 recurrence interval (Curran and Olsen 2009), b) 7Q10 recurrence interval (Butcher et al. 2016).
[6] Average change in summer low flows for Washington State relative to 1917-2006 (Snover et al. 2013).
[7] The VIC model's 25-year projected increased flood magnitude under the medium impact scenario CCSM2 (Butcher et al. 2016).
[8] Maximum Suspended sediment yield observed for South Fork River at Saxon on March 31, 2011 (NIT 2011).
[9] Changes in sediment flux are assumed to reflect changes in mean high-flow
[10] NIT turbidity data from 2009-2014 at Saxon Rd. Bridge.
[11] Annual air temperature for a) high elevations (>5000ft) and b) low elevations (<5000 ft.) and annual precipitation for the South Fork (USGS 2000).
[12] Values found using moderate warming scenario CCSM3_A1B. Values for summer are during June, July, and August (Butcher et al. 2016).
[13] Range in mean springtime SWE from Wells Creek Snotel (4030 ft.) to Middle Fork Snotel (4970 ft.) (Dickerson 2010).
[14] Average April 1st snowpack relative to 1916-2006 under medium emission scenario conditions (Snover et al. 2013).

Streamflow

Murphy (2016) applied the Distributed Hydrology Soil Vegetation Model (DHSVM) with the coupled dynamic glacier model to project the impacts of climate change on streamflows within the Nooksack River watershed. Table 7 summarizes the project changes in flow as a percentage deviation from the historical period (1950-2010). Streamflows are projected to increase in the SFNR in the period of November through March by as much as 112 percent due to greater precipitation amounts in the form of rain over a shorter high precipitation period, reduced area of snow accumulation, and warmer temperatures. In contrast, streamflows are projected to decrease from April through October by as much as 76 percent due to reduced precipitation over this period, reduced snowmelt, and higher temperatures.

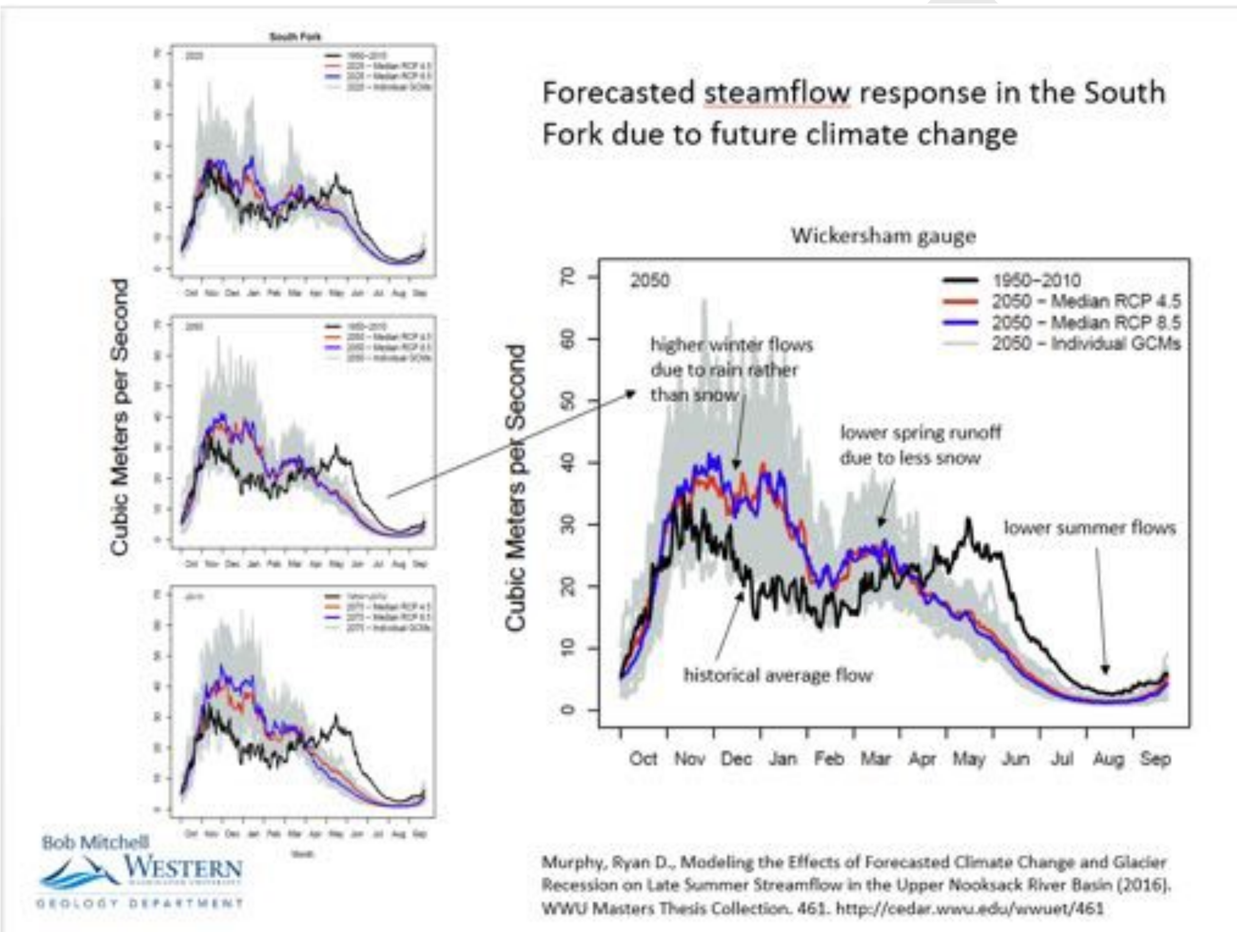

Figure 17. Forecasted Steamflow Response to Future Climate Change in the South Fork Nooksack River.

In addition to changes in streamflow from one season to the next, the shape of the hydrograph will likely change. As can be seen in Figure 17 and 18 the historical hydrograph is bi-modal with peaks in November-December due to rainfall and rain-on-snowmelt events, and a second peak in May- June due primarily to snowmelt. With continued climate change the shape of the hydrograph is predicted to become more unimodal with a higher peak in the November-January period and a minor peak in March-April, with streamflows diminishing rapidly in the April-September timeframe.

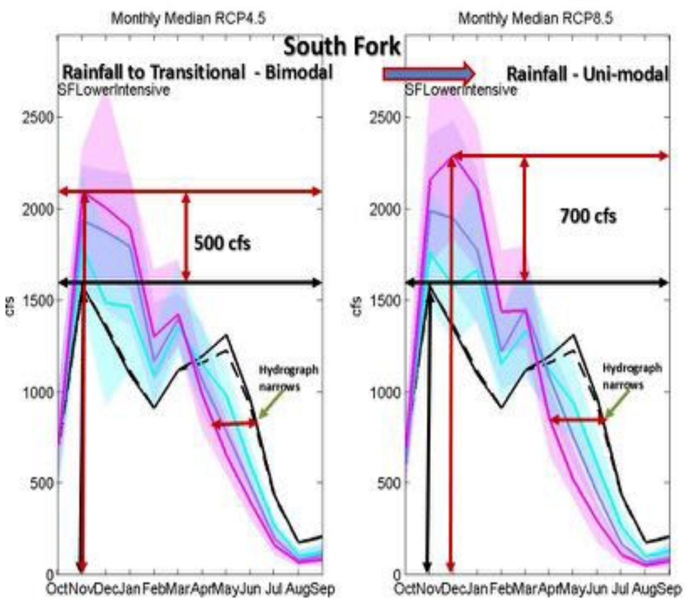

Figure 18. Change in Magnitude of Peak Flows and Timing of Flows Due to Climate

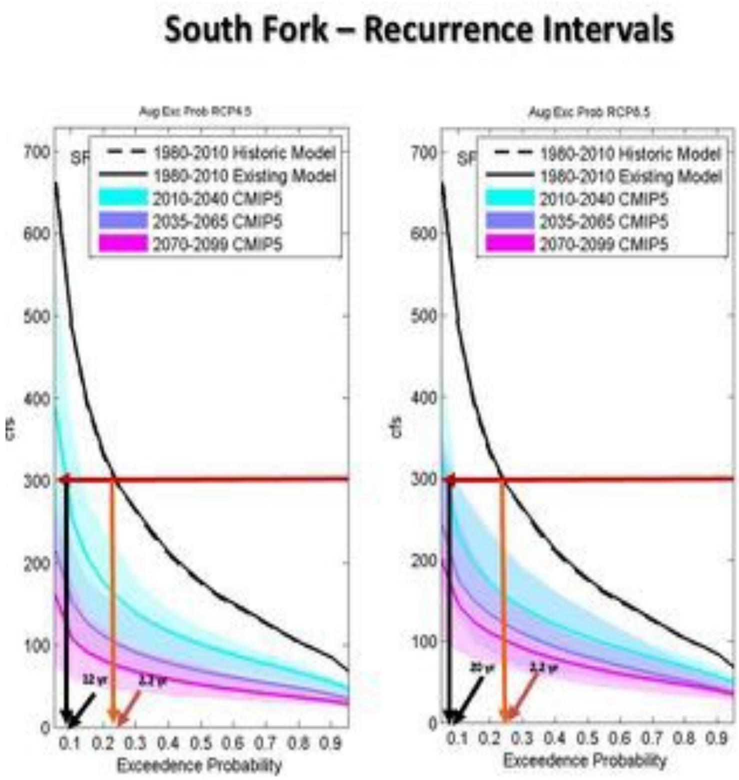

Figure 18 shows projected changes in the hydrograph due to various climate change scenarios. Assuming the RCP 8.5 and 2070-2099 CMIP5, there could be a 700 cfs increase in flow compared to historical peak flow. There is a distinct loss in the bimodal hydrograph, as snowmelt becomes a greatly reduced component of flow.

Sediment Dynamics

Sediment loads are likely to increase under climate change due to loss of soil-protecting snowpack, increased saturation of soils on steep slopes, increased frequency and magnitude of over-steepened slopes associated with valley glacier recession, increased entrainment and transport of sediment within the channels, and increasing intensity of precipitation events yielding more extreme peak flows.

Flow and sediment modeling on the Skagit River has shown a possible six-fold increase in sediment load during the winter high-flow period by the 2080s. While the Skagit watershed is larger, more heavily glaciated, and contains multiple dams, the physical drivers in the Nooksack watershed are similar and it will likely experience a similar response to climate change. Increased sediment flux in the Nooksack will likely come as a result of several processes: increased streambank erosion, increased mass wasting, and increased surface erosion.

The channel shape and plan-form of the South Fork and its tributaries are expected to respond to increases in winter peak flow and more frequent high-flow events. Changes in channel width, depth, slope, grain size, bedforms, sinuosity and bed scour depth are all possible responses to increased frequency, magnitude and duration of flow. In the lower-gradient alluvial valleys of the South Fork and its tributaries, these changes will likely lead to an increase in bed and bank erosion. A partial sediment budget for the upper South Fork found that streambank erosion and undercutting of stream-adjacent unstable landforms was a dominant source (59 percent) of sediment to the river between 1967 and 1991 (Kirtland 1995).

Increased winter peak flow is expected to be more strongly affected in reaches of the SFNR that have been impacted by artificial confinement to prevent erosion. Much of the valley has also incised into its floodplain during the historic period, further abandoning the floodplain surfaces. Sediment flux is expected to reflect the increase in peak flow, as sediment transport increases. Increases in bank erosion and potentially an increase in mass wasting could deliver more sediment to the channel in the steeper areas of the upper watershed and subbasins.

Temperature

Tetra Tech, Inc. was contracted by EPA-ORD to model the impacts of continued climate change on stream temperatures in the SFNR. The basis of the climate change assessment is a common set of simulations using 21 global climate models (GCMs) from the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report and Coupled Model Intercomparison Project 3 (CMIP3). Tetra Tech, Inc. (2015) developed a quantitative assessment of climate change impacts on the SFNR. The quantitative analysis therefore selected three climate models that are anticipated to produce the least warming of air temperature (model low-impact scenario), medium warming (medium-impact scenario), and highest warming (high-impact scenario). These were evaluated at three time horizons through the 2080s.

The climate models predict a trend of increasing air temperature over the 21st century. By the 2080s, the average summer air temperature across the SFNR watershed is projected to rise by 2.81°C to 6.31 °C (or about 5 to 11 °F), while the average winter air temperature is projected to rise by 2.44 to 4.28 °C (or about 4 to 8 °F).

Tetra Tech's modeling predicts that average water temperatures in August could increase up to 6°C by the 2080s under the high impact scenario if no actions are taken to mitigate the impacts. Coupled with the air temperature changes, the climate models suggest a decrease in precipitation and an increase in dew point temperature during the critical summer period.

The combined effects of changes in climate and changes in summer low flow on summer water temperatures was evaluated through application of the QUAL2Kw model (Ecology 2003) that was calibrated for application to the South Fork as part of the TMDL effort. QUAL2Kw is a quasi- steady state model and is Ecology's preferred tool for TMDLs. The model simulates hourly temperature and heat budget with hourly variations in input parameters and boundary conditions.

Large increases in the 7DADMax water temperature are predicted by 2080 if stream shading is left at current levels, with temperatures increasing to above 23 °C throughout much of the length of the river (Figure 20). Restoration of system potential vegetation (tree heights associated with the 100-year site index) dampens the increase by about 2 °C in the TMDL scenario. There could be additional mitigation of water temperature increases through effective buffering on all tributaries to the South Fork, as was investigated in additional natural conditions scenarios summarized below in Table 8.

Table 8. Summary of Sensitivity Analysis for Natural Conditions Estimate using Current Climate.

Scenario/Variation	River Reach		
	Headwaters to RM 18	RM18 to Confluence	All Reaches Combined
Water Quality Criteria (°C)	12	16	16
TMDL Original System Potential, Scenario 5	17.8	19.6	18.7
Cooler Headwater Tributaries (20 percent cooler)	16.9	19.0	18.0
Reduced Natural Channel Width	17.2	18.9	18.1
Increased Riparian Climax Tree Height and 80 percent Effective Buffer	16.7	18.2	17.5
Enhanced Hyporheic Exchange	17.8	19.3	18.6
Combined Natural Parameter Variations	15.1	16.4	15.8
% Change in Temperature with Combined Natural Parameter Variations	-15.2%	-16.3%	-15.5%

The Tribe believed that the TMDL (WADOE undated) did not utilize a realistic assumption of natural conditions. The Tribe provided Tetra Tech (WADOE undated) with what the Tribe considered be more realistic natural conditions. If system potential vegetation was in place it would be projected to protect against increases in 7Q10 temperature through the 2020s, but increases on the order of 2 °C are still expected by the 2080s. It should be noted that the "combined natural parameters variations" scenario (referred to as "natural/restored") suggested a 15.5 percent reduction in stream temperatures for the South Fork overall relative to the TMDL scenario. The majority of this reduction was due to using climax tree height (290 feet) as compared to the assumed 100-year site index tree height (160 feet). The sensitivity analysis suggested that under climax conditions, the SFNR would have likely just met the numerical standards for temperature, which is a different conclusion reached by the TMDL

TO BE CONTINUED….