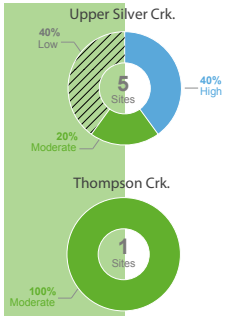
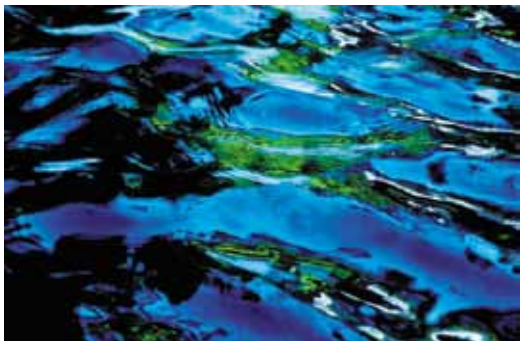
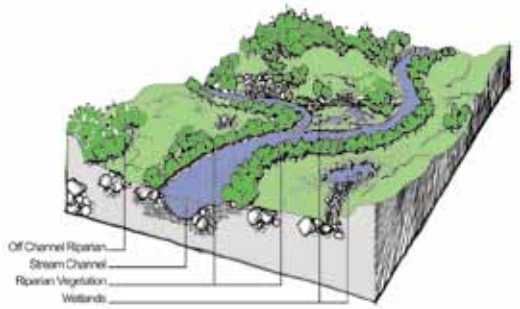
2011

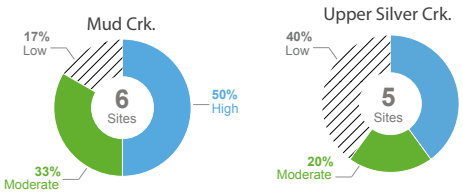
Silver Creek Annual Report

Silver Creek Alliance









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www.silvercreekalliance.org

The Silver Creek Alliance is an association of conservationists working collaboratively to practice ecologically sound land and water management in the Silver Creek watershed of Idaho.

ESF would like to acknowledge with special thanks both Steve Fisher and Greg Loomis for their hours of hard work, dedication and persistence in gathering important field data presented in this report.

Advancing Our Understanding

In 2010, Ecosystem Sciences Foundation (ESF), in partnership with The Nature Conservancy (TNC), developed a restoration and enhancement strategy for the Silver Creek watershed. The strategy identified numerous actions to be taken including filling critical data gaps on stream flow, temperature, and sediment conditions.

A logical outcome of the Silver Creek Watershed Enhancement Strategy was the formation of a landowner's alliance. Many of the numerous stream restoration projects which have been performed throughout the watershed have been on private land using private funds. Landowners have a vested interest in encouraging the enhancement and restoration of streams for two principle reasons. First, landowners want stream reaches on their property to support good fisheries, be ecologically functional, and to ensure that restoration investments already made are sustained. Second, landowners recognize that all of the streams in the watershed are maintained primarily by spring flows and springs are maintained by the groundwater level and maintaining the groundwater level is paramount to sustaining Silver Creek.

What We Learned

This report summarizes data from 2011:

- **Stream Hydrology**
- **Stream Temperatures**
- **Stream Sediment**

The significant conclusions and findings from 2011 are:

- Grove Creek contributes nearly half the stream flow in Silver Creek and appears to have the lowest temperatures of all tributaries.
- Stalker, Mud, and Lower Silver creeks exhibited temperatures above the threshold for very short durations. Otherwise, nearly all stream segments exhibited temperatures within the acceptable range for trout.
- Sediment accumulations were highest in Stalker, Loving and Lower Silver creeks. Upper tributaries appear to be less impacted by sediment.

For more details please visit: www.silvercreekalliance.org www.savesilvercreek.com

The information that is presented in this report reflects summarized analysis of all data. We are presenting the most important aspects of the past season's work in way that tells a story of the stream system and watershed. The raw and tabulated data that is used as the basis for the information presented here is detailed, scientifically rigourous, and reflects a considerable amount of field work to collect this important data. The two websites have more detailed information on programs in the watershed.

Case Study

Stream Hydrology

Measuring stream hydrology through flow measurements on each of the stream tributaries is an essential part of understanding the Silver Creek ecosystem. Until this year, the flows on most of the tributaries to Silver Creek had never been measured. In 2011, we initiated a surface flow monitoring program. The initial results have improved our understanding of the contribution of each tributary to Silver Creek. Over time, we will gain more understanding of the influence of springs to the water system and the importance of each tributary during high flows in the spring and lower flows in the summer.

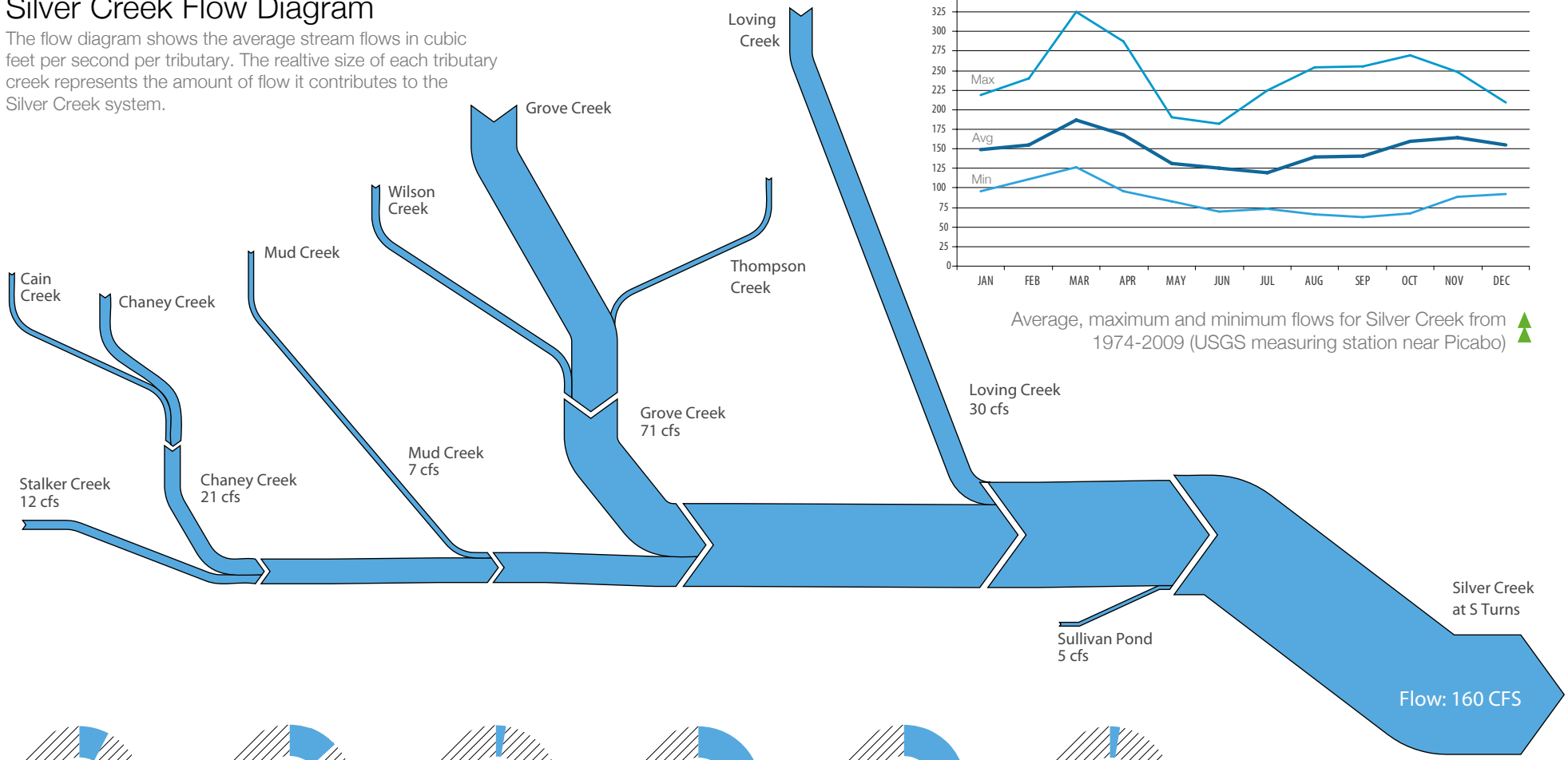
Stream Flow

In spring creek ecosystems, seasonal fluctuations of stream water flow are very small. These small changes can be difficult to measure. Inaccuracies in measurements can create problems when establishing the stage-discharge relationship, or the amount of water flow relative to the depth of the stream. In order to detect trends over time, accuracy is important. For this reason, the hydrology program includes several measurements on each tributary over a year period to establish the relationship between stage and discharge. In the future, we will be able to calculate flows by simply reading a staff gauge. In 2011, six suitable stream flow measurement sites were established. Most sites received two measurements in 2011 due to funding and time constraints. Sites will be revisited a minimum of three times in the spring.

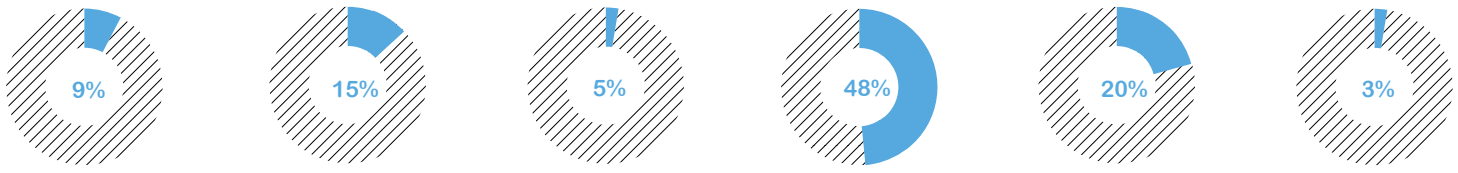
The results of last season's efforts are summarized on the facing page. The most interesting thing learned about the stream flows was the importance of Grove Creek. As you can see by the graphic, Grove Creek is responsible for roughly half of Silver Creek's stream flow. We also began to learn more about the contribution of springs to the system. As we measure these sites through time, we will understand more about the seasonality of these flows, and the influence that irrigation and precipitation have on the surface water of the stream system.

Silver Creek Flow Diagram

The flow diagram shows the average stream flows in cubic feet per second per tributary. The realtive size of each tributary creek represents the amount of flow it contributes to the Silver Creek system.



Average, maximum and minimum flows for Silver Creek from 1974-2009 (USGS measuring station near Picabo)



Stalker Creek % of flow | Chaney Creek % of flow | Mud Creek % of flow | Grove Creek % of flow | Loving Creek % of flow | Sullivan Pond % of flow

Percent of Flow Contribution by Creek. The data collected in 2011 indicate that the tributaries provide the above contributions to Silver Creek's flow. The graphics are based on average stream flows measured in July, August and October 2011. These measurements revealed that Grove Creek contributes nearly half of the flow in Silver Creek. Temperature data also indicates Grove Creek remains very cool throughout the summer. Consequently, recognizing Grove Creek's influence on Silver Creek's ecology is an important discovery. In early 2012, we will continue to take flow measurements, install staff gauges and develop rating curves.

Groundwater Hydrology

Because it is a spring system, the entire Silver Creek watershed is dependent upon groundwater for its survival. The springs are fed by groundwater and supply cold water to the Silver Creek ecosystem. Therefore, understanding the groundwater system is of critical importance as more wells are developed in the upper watershed. For this reason, a groundwater monitoring plan is being developed that augments and integrates available resources and data (see the "Next Steps" section for more information).

Spring outflow on Silver Creek Tributary
Silver Creek watershed is dependent upon on natural flowing springs from groundwater for its stream flows.

Case Study

Stream Temperature

Temperature monitoring data will be coupled with sediment analyses, hydrologic data, and watershed characteristics data, such as land use and riparian vegetation, to derive a more complete picture of the Silver Creek watershed and the critical factors influencing its health.

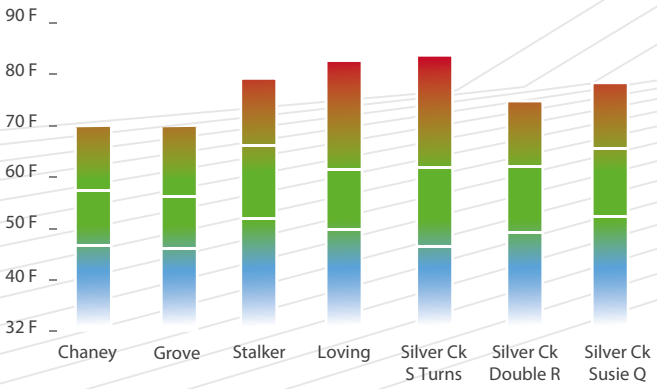
A stream temperature monitoring program was installed throughout the Silver Creek watershed in 2011 and was maintained by Save Silver Creek and TNC. The monitoring array collects water temperature data for every tributary within the Watershed, and Silver Creek itself. This year, 44 stream temperature loggers collected data, some year-round while others are deployed only during the summer months.

Temperature data is paramount to monitoring the overall health of the Silver Creek ecosystem. This data can aid in identifying potential reaches where elevated temperatures are problematic for fish and instream biota, or in assessing temperature responses to habitat restoration, changes in landuse, or recovery from wildfire. Importantly, the data can help determine strategies for future management and enhancements.

Spring Driven Ecosystem

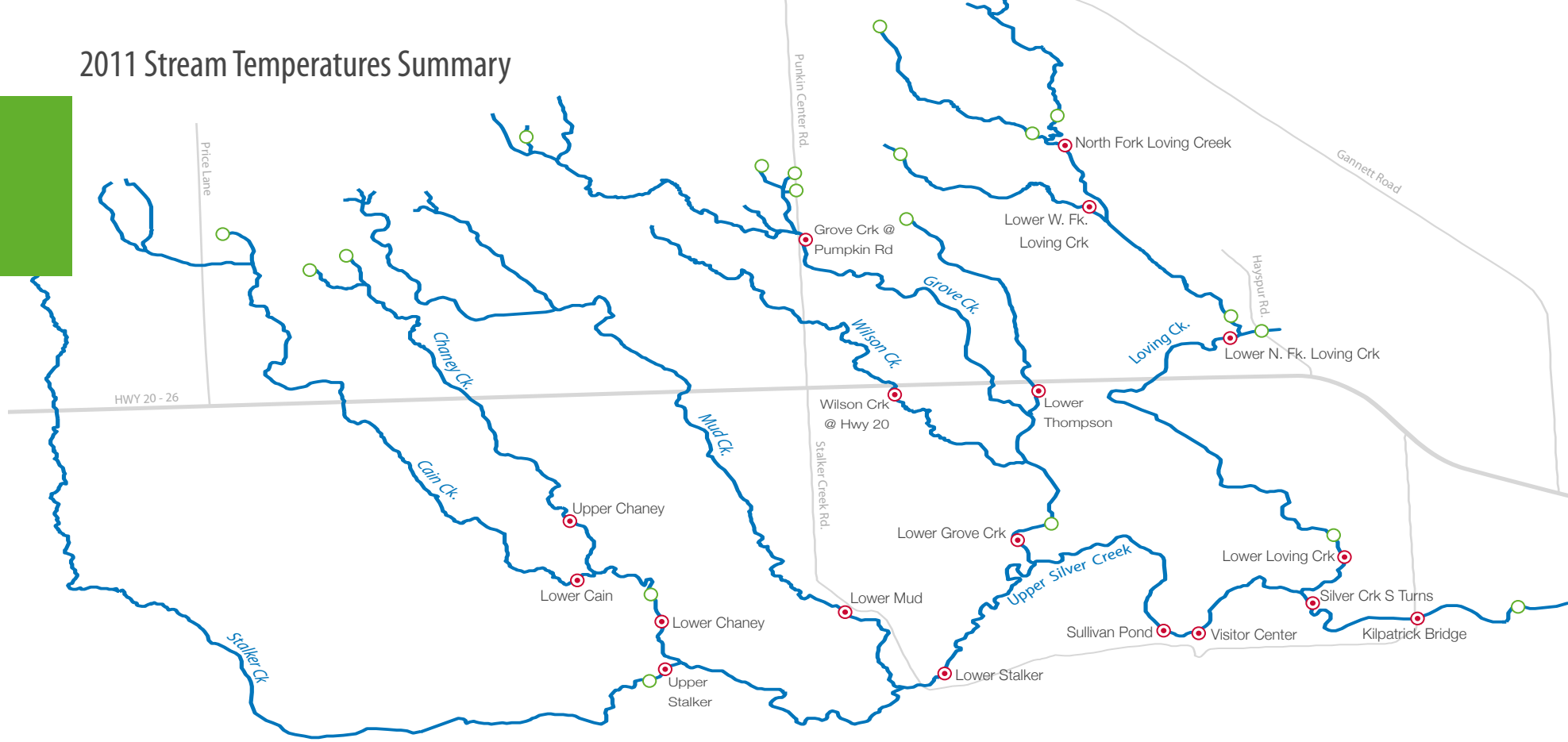
Stream temperatures in a spring driven system, such as Silver Creek, should be relatively constant and not fluctuate greatly with changes in air temperature or climatic conditions. Long periods of warm weather accompanied by clear sunny skies (high solar input)

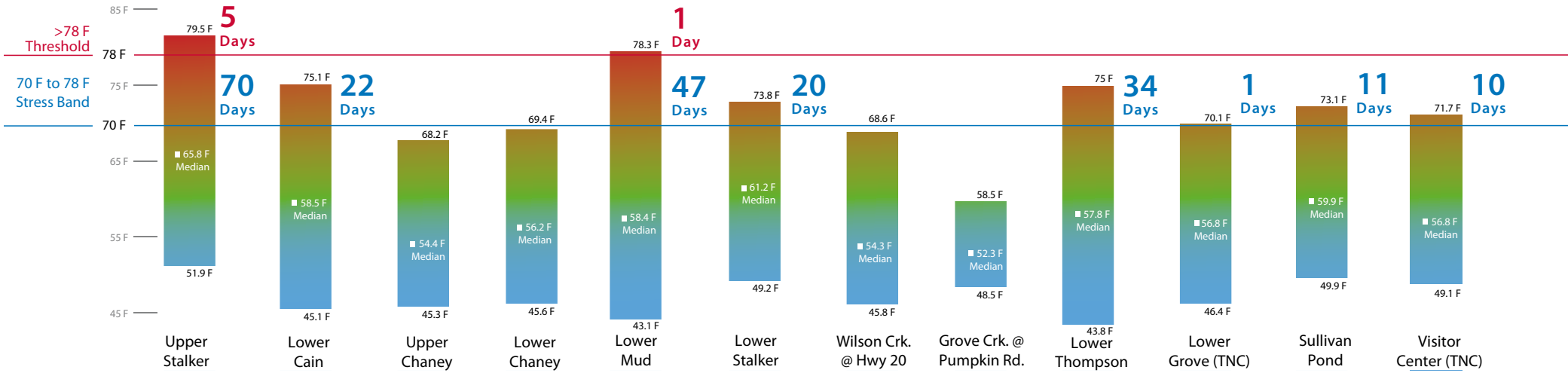
could elevate stream temperatures in a spring system. Like other spring driven systems, stream temperatures in Silver Creek remain relatively constant. The summer of 2011 can serve as a baseline to compare with future monitoring data. •



Summer Stream Temperatures: 2006-2010. The graphs indicate the maximum, average and minimum summer water temperatures on selected areas of Silver Creek over a five year period. This year 44 stream temperature loggers were placed throughout Silver Creek and each tributary to record critical information and track changes in the system.

2011 Stream Temperatures Summary





Stream temperature bands The above graphic depicts the summarized stream temperature data for the entire summer season for a selected group of data loggers and locations. The data was analyzed for the summer season to illustrate the high temperatures that occurred throughout the stream system for the period of June through the end of September, 2011. Each graph displays the total temperature range for the period of record; the absolute high and low temperatures are given and the median stream temperature is shown for that particular stream.

Locations of Stream Temperature Logger Array

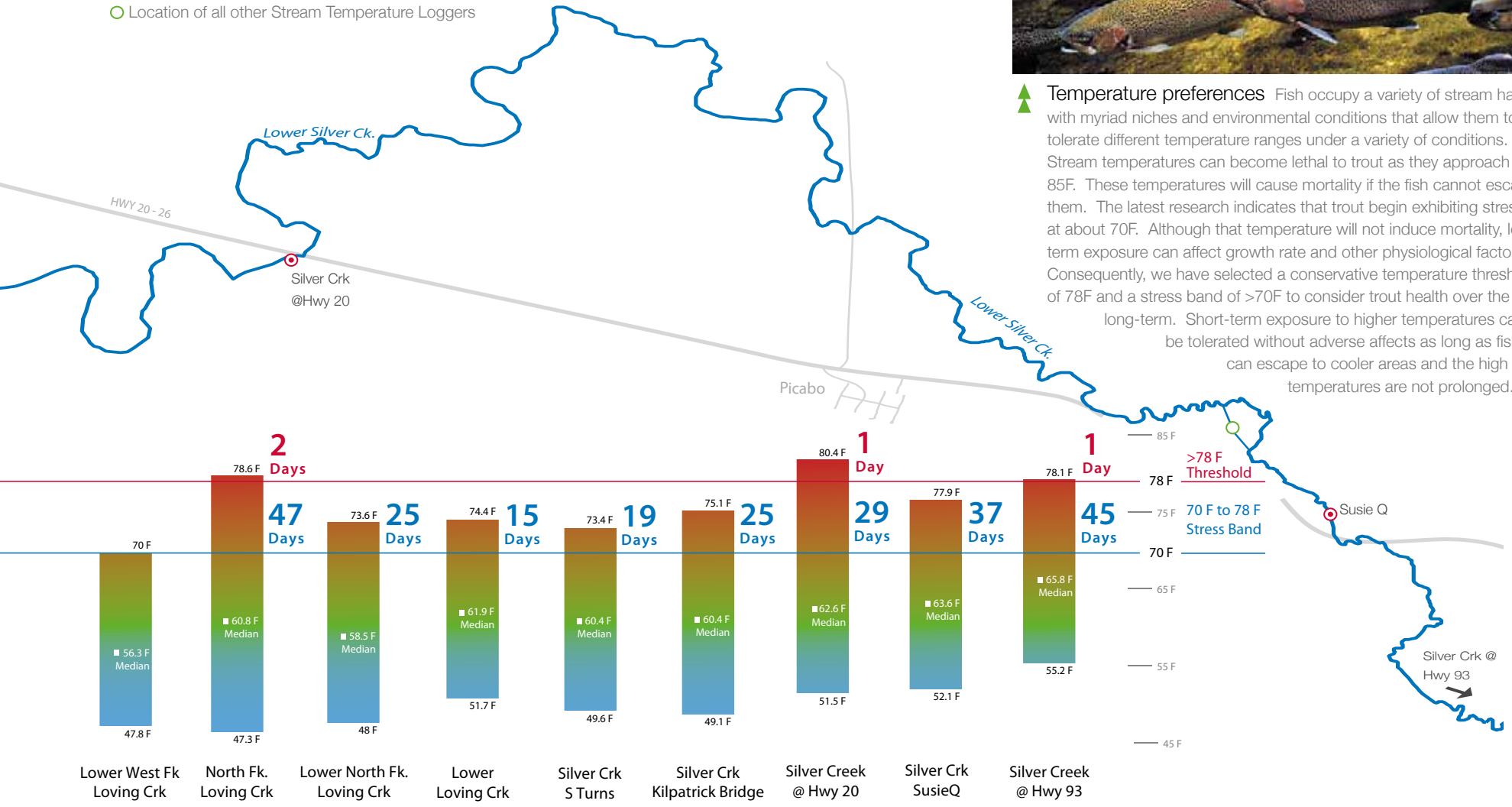
The map illustrates the Silver Creek stream and tributary system with the locations of the stream temperature loggers. The temperature loggers are expressed in two categories for discussion and analysis purposes:

◉ Location of Stream Temperature Loggers illustrated in bottom graphic of seasonal temperatures

○ Location of all other Stream Temperature Loggers

Stream temperatures are logged at half-hour intervals over a twenty four hour period for as long as the logger is left in place. The array of stream temperature loggers in the Silver Creek system is designed to capture temperature differences for each stream and tributary segment, from the spring source through to Lower Silver Creek at the Highway 93 crossing.

Temperature preferences Fish occupy a variety of stream habitats with myriad niches and environmental conditions that allow them to tolerate different temperature ranges under a variety of conditions. Stream temperatures can become lethal to trout as they approach 85F. These temperatures will cause mortality if the fish cannot escape them. The latest research indicates that trout begin exhibiting stress at about 70F. Although that temperature will not induce mortality, long term exposure can affect growth rate and other physiological factors. Consequently, we have selected a conservative temperature threshold of 78F and a stress band of >70F to consider trout health over the long-term. Short-term exposure to higher temperatures can be tolerated without adverse affects as long as fish can escape to cooler areas and the high temperatures are not prolonged.



The overall average temperatures between night and day, throughout the summer, in all streams were well within the preference range for trout (around 55-60 degrees). Chaney, Grove, Wilson and Lower West Fk. Loving creeks' temperatures never entered the stress range. However, several streams did show temperatures exceeding the threshold of 78 degrees for several days (particularly Upper Stalker), and temperatures in most streams fell within the stress range for many days.

Case Study

Stream Sediment

"Legacy" sediments were deposited during the earlier years of intensive livestock grazing when stream banks were trampled and riparian vegetation was removed. It was during these years that the greatest amounts of sediments accumulated in the streams. In time, as grazing has been nearly replaced by farming practices, the volume of sediments entering the streams has diminished. However, new sediments enter the streams each year as overland runoff during spring rain and snowmelt.

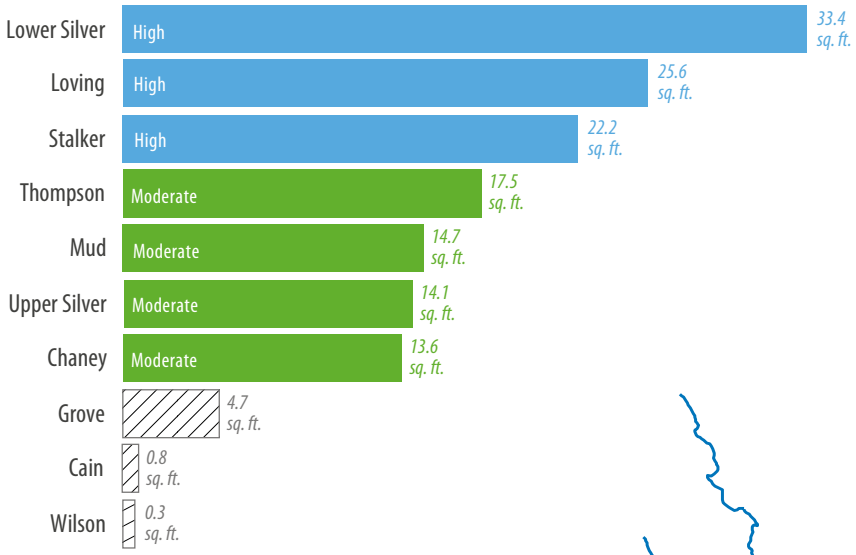
In order to characterize sediment conditions throughout the watershed, we established 60 cross channel transects in Silver Creek and all tributaries. The graphics on the facing page illustrate the 2011 sediment loading conditions throughout the watershed.

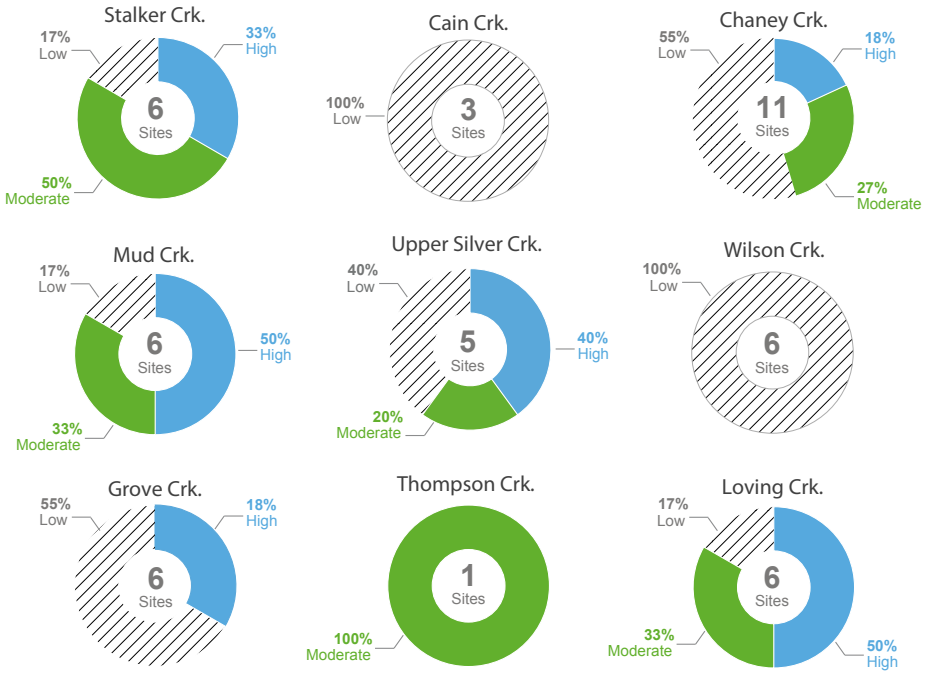
Wilson, Cain and Grove creeks have the lowest average sediment area per transect. Chaney, Upper Silver and Mud creeks fall into the moderate category, and Stalker, Loving and Lower Silver creeks have the highest area of accumulated sediments.

In order to determine if sediments are being exported, accumulating or simply in balance from one year to the next, we will measure annual changes at eight of the high yield sites on Chaney, Loving, Lower Silver, Butte and Stalker creeks. Our focus in 2012 will be to implement enhancement and restoration actions by integrating stream sediment data with temperature, flow and land use mapping to identify the sources of sediment inputs and thier effects. These "hot spots" will be prioritized and we will work with the landowners to implement buffer strips, or riparian plantings, or improve upon existing buffers to attenuate sediment inputs. •

Average Sediment Accumulated by Stream

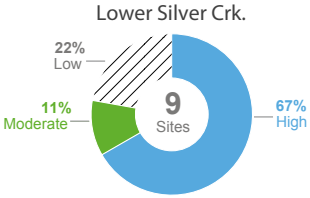
Total sediment area was measured on each of the 60 cross sections to estimate each stream's condition. Transects were averaged for each creek to categorize streams into high, medium and low. For example, the average area of sediments for all transects on Lower Silver is 33.4 square feet (sq. ft.).





Amount of Sediment per Transect by Stream

The sites are categorized to illustrate instream sediment conditions. Each stream transect site is categorized as high, moderate or low accumulation of sediment, and each stream graphic displays the percentage of each category per stream. For example, Stalker Creek has 6 transects overall, with 17% rated as low, 50% moderate and 33% as high accumulation of sediments. It should be noted that all the creeks vary in total size and flow and the graphics present area measurements that are not scaled to each creek. Future measurement will advance our knowledge of total sediment accumulations.



Stream Sediment Transect Sites in the Silver Creek System

60 stream sediment transects were established and evaluated in 2011. The stream map above illustrates the array of sites throughout the system. Sediment areas in all tributaries were measured. Long-term monitoring will continue on eight sites of high sediment accumulation while other sites may be re-measured every three to five years. Annual measurements at the eight permanent sites will determine if sediments are accumulating, being exported, or balanced.

Next Steps

Determining and prioritizing the most appropriate next steps requires careful data analysis. This year, with the data acquired, we are able to integrate stream temperature, flow, sediment and land cover mapping to isolate critical areas - stream reaches or sites where on-the-ground actions will improve temperature and sediment conditions.

The *Silver Creek Watershed Strategy* describes ecosystem thresholds beyond which stream degradation is accelerated. Analysis of the available data does not indicate that Silver Creek is in eminent danger of environmental collapse. However, the streams are approaching the levels at which additional stressors, such as extended drought periods, could cause rapid deterioration of the aquatic environment and have severe impacts on the fishery. Nevertheless, there is sufficient time to address the causes and implement actions to move the ecosystem away from these thresholds.

The work begun in 2011 and the knowledge gained will inform our work for 2012. We anticipate that we can now move forward with the first tier of on-the-ground enhancement and restoration actions described in the watershed plan. Our 2012 work plan will consist of the tasks described below.

Hot Spots

We will integrate the data collected in 2011 on sediment, temperature, flow, and land cover to identify “hot spots” throughout the watershed. Hot spots are specific areas, sites or stream reaches which represent the greatest sources of sediment inputs and heating. These are priority sites where first tier type restoration actions described in the watershed plan will be implemented.

Buffers

Riparian buffers are streamside vegetation that "buffer" the stream from the upland landscape. They are critical ecosystem components that provide shade, sediment and nutrient filters, and habitat for fish and wildlife. However, not all buffers are created equal. Width, height and species composition all influence the functionality and value of a riparian buffer. As watershed mapping is completed (quantifying the existing riparian buffers), the results can be referenced with temperature and sediment data to identify areas where riparian buffers can be enhanced for ecological benefits.

Groundwater Protection

The Silver Creek watershed is a spring-driven system. Thus, groundwater is the ecological driver for the entire watershed. If groundwater levels drop such that spring flows are diminished or stopped, the ecosystem faces collapse. While temperature thresholds and sedimentation are critical parameters that influence the health of the ecosystem, it is groundwater which determines whether there is an ecosystem or not. Consequently, establishing a program to protect Silver Creek's aquifer is of paramount importance.

Our current knowledge is that local aquifers may be recharged in wet years and may be depleted in dry years. If this is correct then a succession of dry years (drought periods) could result in the "mining" of the aquifers in which recharge is never able to replace what was lost. Severe drought could, in a short period of time, lead to the attenuation of spring flows with adverse ecological consequences to follow. Incremental increases in groundwater pumping in the upper watershed may also slowly deplete the aquifer over time.

A major action item for 2012 is to install an array of piezometers that will measure the change in depth to groundwater over time. The Nature Conservancy supported a groundwater research effort which, we hope, will provide a foundation for linking stream temperature, groundwater flow, and groundwater recharge as a decision-making tool for stream and watershed management through time.

ArcHydro Model

To complement and enhance all efforts we plan to build an ArcHydro data model for the Silver Creek Watershed. ArcHydro is a suite of tools employed with ArcGIS 10 (Geographic Information System) that derives several data sets to collectively describe the drainage pattern of a watershed. ArcHydro contains tools that aid in the delineation of watersheds, creation of time series (i.e. temperature and flow over time), delineation of shortest flow paths, culvert flow modeling and the creation of hydrologic networks. In 2012, we plan to employ ArcHydro to delineate the watersheds (Surface Water Drainage Areas) of each tributary to Silver Creek. Defining the drainage areas of each tributary watershed allows for further scientific inquiry by comparing the similarities and differences of the each tributary watershed. The model also has groundwater specific suite of tools. The Groundwater Data Model will allow us to derive continuous datasets that describe

the groundwater conditions of an area, such as depth to groundwater, direction of flow, and aquifer delineation. These tools will enable managers to further understand the complex relationship between groundwater and surface water in the watershed.

Fish Habitat Mapping

The Silver Creek watershed restoration and enhancement plan includes a detailed map of fish habitat from Stalker Creek to Kilpatrick Pond; primarily on TNC's preserve. The map delineated trout spawning areas, early rearing and nursery areas within Silver Creek and in side channels, pools (deep and shallow), undercut banks, resting and feeding zones, sediment conditions, beaver ponds, riparian vegetation and stream bank conditions, areas of reed canary grass growth, channel constrictions, and over-widened reaches. Users of the plan found the map so useful that we have been asked to continue this below Kilpatrick Pond to the confluence with the Little Wood River.

Watershed Health

The critical environmental issues throughout the Silver Creek watershed are temperature, sediments, and flow. These parameters are indicators of the health of the watershed. Consequently it is important to maintain our temperature logger arrays throughout the streams and measure flows seasonally in all the streams to alert us to changes that indicate a serious issue with the functioning of the ecosystem. Sediment tracking requires less intensive work now that we have defined conditions for Silver Creek and the tributaries. A few sites will be selected from the data to track the long-term trends in sediment inputs and outputs.

Winter Icing Conditions

Water temperatures are warmer in the upper reaches near spring inflows and cool considerably downstream. Of particular importance in spring-driven systems like Silver Creek is the effect of ice. The detrimental effects of ice formation in combination with sediment deposition are evident in some lower

reaches of Silver Creek. Sediment depositions reduce channel capacity and icing increases the stage (height) of the water surface in deposition areas, such that stream flow over tops the stream banks in local sites; ice then forms on top of the bank undercuts and continues to build-up until the over-hanging banks cannot support the weight of the ice and the stream banks collapse. Sites where sediment deposits induce icing impacts will be identified during winter field visits and evaluated for restoration actions.

Grants

The Silver Creek watershed plan listed all of the 30+ funding sources that landowners in the watershed can pursue individually, collectively, or through partnerships with organizations such as the Silver Creek Alliance. These sources include local, state and federal agencies as well as private funding institutions. We will work with landowners to secure funding for on-the-ground projects like buffers, riparian plantings, and sediment control. •

Data & Methods

In order for data to have scientific validity, it must be collected in prescribed ways. It is not enough to simply take a single temperature, sediment or flow reading at a point in time. Rather data must be collected over time in multiple locations with collection methods that ensure consistency and accuracy.

Temperature data was collected from loggers placed throughout the watershed at strategic locations with continuous recording. Sediment data collected via topographic survey were established on 60 channel sites, creating sufficient data sets for statistical analysis. Stream flow data for all tributaries was measured repeatedly throughout the year to capture seasonal differences.

The data was analyzed using GIS platforms and statistical software. Both sediment data and temperature data has been compiled and displayed using Google Earth. These data are visually displayed on the www.savesilvercreek website. Users have access to most of the data or can obtain it by contacting us and requesting digital copies. All watershed data will be warehoused on the Silver Creek Alliance web site. The protocols used to establish sampling sites, collected data, and methods of analysis follow established criteria and methodologies.

Generally, only scientists, research universities and government agencies are interested in these details, but the intent is, with landowner approval, to make data equally accessible to all who request it.

The data collected this year will not only inform our work in 2012 and allow us to go forward with on-the-ground enhancement and restoration actions, but will also be the baseline from which future analyses of change in stream sediments, flows and temperatures can be evaluated. •

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Don't hesitate. Get in touch!

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