Stream Site Assessment

WATER

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Stream Site
Assessment

Introduction

There are several reasons to conduct a stream site visual assessment. A landowner may want to look at several sections of a stream or creek and conduct the assessment about once a year to monitor changes. Someone about to make farm improvements, such as installation of a riparian buffer, could conduct a before-and-after assessment. Changes upstream, such as dams, channelization (straightening), and dredging (sand or gravel removal), can affect downstream reaches. Again, a before-and-after assessment would be useful. A student group may want to characterize several streams, or tributaries of a common river or lake and compare the assessment scores.

This assessment protocol is designed as a visual assessment, and does not require any tools or equipment other than this fact sheet, a clipboard and writing utensil. A visual assessment can complement the other physical, chemical, and biological monitoring techniques. We designed this series of assessment indicators specifically for Kansas but used previously published guides as a starting point, including the Stream Visual Assessment Protocol developed by the USDA for Natural Resource and Conservation Service (NRCS) field offices, and also the Rapid Stream Assessment Technique developed for a citizen project in Montgomery County, Md.

What you need to know

Many specialized terms are used to describe streams. These can be confusing at first, but they are worth learning because they explain complicated concepts. You will find them in the glossary at the end of this publication.

Where to conduct your assessment depends on the questions you would like to ask and what you intend to observe. One factor of interest is the size of the stream or river, which can be calculated as the depth and width of the water channel flowing through an area. You can estimate the velocity of flow in feet per second by using a floating ball or stick and a stopwatch.

To estimate flow, multiply the volume of the cross-section (square feet) by velocity (feet per second) to obtain the volume of flow (cubic feet per second). However, this measurement is not necessary in this visual assessment, and the flow rate will change over time. It is most interesting when evaluating floods or used by canoeists to determine if there is enough flow for a good float trip. The plot of flow rate over time is called a hydrograph. These are often measured at selected points on major streams, and a hydrograph for Kansas can be found at the Web site: *http://ks.water.usgs.gov/.*

Other pieces of information that may be useful are photographs of the site you are monitoring. This can include both ground and aerial photos. For the ground photos, take at least two: one looking upstream and another downstream. Some guides even recommend photographs of the right bank and the left bank in each direction for larger streams, for a total of four photos. Aerial photos are also interesting and can be obtained from your NRCS office, or from the Web site *www.terraserver.com*. Some of these may be several years out of date, however, and rivers and streams change paths frequently. Check the dates when you print the photos.

From an aerial photo, note the land use in the watershed, or area from which your stream receives water. If possible, estimate the amount of land covered by trees, perennial grass, annual crops, roads, and buildings or other human structures. If you are in an urban or suburban environment, the percent land covered by impervious surfaces (including roofs, roads, parking lots) will affect your stream.

On the photo also notice the amount and type of vegetation on the riparian area close to the stream that might protect it and filter runoff from nearby open areas. Record any livestock feeding facilities and grazing intensity (if known) upstream from your area.

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Getting started

Once you have selected your site or sites, find out about the history of your site and as much history as you can from upstream areas. This first section of the assessment will assign scores based on whether your stream is still in a natural state (pre-settlement), somewhat altered (perhaps unintentionally), or intentionally/drastically altered. Some alterations are not necessarily bad, but they may lead to other changes in the stream that may make it less suitable for fish or other aquatic organisms, leading to lower biodiversity. Some changes also can degrade water quality.

The section you will evaluate is called a reach. A practical length is 12 times the active channel width. Thus, for a small channel 20 feet wide, the length of the reach would be 240 feet, a 30-foot wide channel would have a reach of 360 feet, and a wider stream of 40 feet would be 480 feet. You can use measuring tape or wheel, or visually estimate using a familiar reference such as a football field (300 feet) to define your reach.

The scorecard in this guide sheet is based on a 1 through 4 rating system, where 4 is best, 3 is acceptable, 2 is below standard, and 1 is needs improvement. After you complete the 20 questions on the scorecard, you will then calculate the average score for your stream by dividing by the number of measurements. *(Note: Not all factors will fit all streams, so you may not need to complete all of them.)*

Things to know about your stream when you do the assessment

- Name of stream
- Detailed location information for the section of interest, for example the legal description of the farm property.
- Drainage area above the reach – record as acres or square miles (from NRCS office or USGS topographic map)
- Land use upstream in the drainage area (percent crops, pasture, woodlands, etc.)
- Stream gradient, especially on your property. (See local detailed topographical maps and compare elevation at the beginning of the stream to the elevation at the end on your property or section of interest.)
- Overall position in the landscape/ecoregion (upland, river bottom, etc.)
- History of any human changes on the stream (e.g. dams, weirs, stabilization, channelization, levees, etc.)

Record these on your data sheet, along with your scores. See the final section of this fact sheet for an explanation of how to use reference streams.

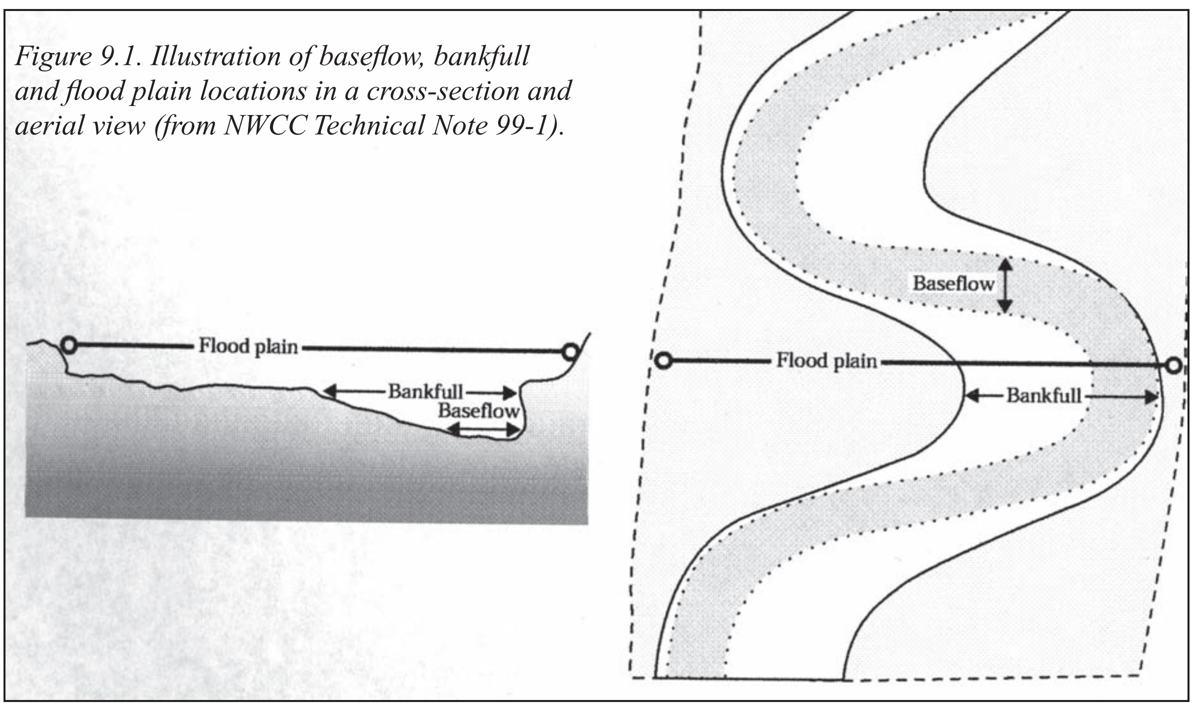

Figure 9.1. Illustration of baseflow, bankfull and flood plain locations in a cross-section and aerial view (from NWCC Technical Note 99-1).

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I. Stream physical structure and changes

Important concepts

The river channel and flood plain exist in dynamic equilibrium. This means that the energy of the water (velocity and depth) should be in balance with the bedload (volume and particle size of the sediment).

- Too much energy for the bedload (from confinement of the river) results in channel and bank erosion.
- Not enough energy, and/or increased sediment or bedload results in excess sediment deposition, channel widening and shallowing, and ultimately, in braiding of the channel.

The baseflow, bankfull, and flood plain all relate to the active channel width.

Baseflow is the low-water level, usually when the only inputs into the stream are groundwater seeping up from below or from the sides of the banks.

Bankfull is the flow rate that forms and controls the shape and size of the active channel. Bankfull discharge is expected every 1.5 years. Evidence of bankfull is determined by observing debris deposited by recent flood events or from personal knowledge of the height of the water in the stream after a major rainfall.

The floodplain is where the water will flow once it is out of the bank. This is nature's safety valve. If levees or other structures don't allow bankfull stream water access to a floodplain, excessive downstream flooding can result.

The next four questions ask whether a stream has been altered from its original condition. Some of these alterations may have taken place before the current landowner purchased the land. A combination of visual observation and asking questions of the current, and sometimes the previous landowners may be necessary. These changes may not be all "bad" or "good," but are often compromises between stabilizing a moving channel in a sensitive area — for example, near a housing development — and preserving habitat for wildlife and biodiversity. For the purposes of this assessment tool, our rating system is based on whether the changes affect wildlife habitat or compromise the long-term stability and ecological integrity of the stream.

Channel condition (Box 1)

Active downcutting and excessive lateral cutting are serious impairments to stream function. Both conditions indicate an unstable stream channel. These are often a result of events or changes upstream from where the downcutting is noted. For example, channelization upstream can increase stream velocity, scour away sediment, and cause downcutting downstream. Similarly, gravel or sand removal through dredging can cause miles of damage downstream from the removal site. Extensive bank-armoring of channels to stop lateral cutting usually leads to more problems, especially downstream.

Indicators of downcutting in the stream channel include nickpoints associated with headcuts in

1. Channel Condition[1]

4 – Best	3 – Acceptable	2 – Below Standard	1 – Needs Improvement
Natural channel; no structures, dikes, etc.	Evidence of past channel alteration, but with significant recovery of channel and banks. Any dikes or levees are set back to provide water access to an adequate flood plain.	Altered channel; less than 50% of the reach with riprap and/or channelization. Dikes or levees restrict flood plain width.	More than 50% of the reach with riprap or channelization. Dikes or levees prevent access to the flood plain.

[1] *Natural vs. altered.*

the stream bottom, and exposure of features such as pipelines that were initially buried, exposed footings in bridges, and culvert outlets that are higher than the water surface during low flows. **(Box 2)**

Remediation, or correcting the cause of downcutting through the use of structures such as barbs, jetties, deflectors, or weirs is often necessary before other stabilization techniques will work. For example, restoring the woody vegetation will be undermined if the water table drops below the root zone of the plants during their growing season.

Water withdrawals **(Box 3)** can cause similar problems when attempting to stabilize a bank through revegetation.

Frequency of flooding (Box 4)

Bankfull flows, as well as flooding, are important to maintaining channel shape and function (e.g. sediment transport) and maintaining the physical habitat for animals and plants. High flows scour fine sediment to keep gravel areas clean for fish and other aquatic organisms. The river channel and flood plain exist in dynamic equilibrium, having evolved in the present climatic regime and geomorphic

2. Recent Changes[1] in Channel Due to Erosion or Aggradation			
4 – Best	3 – Acceptable	2 – Below Standard	1 – Needs Improvement
No evidence of downcutting or excessive lateral cutting. Channel is stable – neither degrading or aggrading.	Some evidence of downcutting or aggradation.	Excess aggradation; braided channel.	Channel is actively downcutting or widening.
[1]In the last 10 years.			

3. Water Withdrawals[1]			
4 – Best	3 – Acceptable	2 – Below Standard	1 – Needs Improvement
This reach is not used for water withdrawal.	Withdrawals, although present, do not affect available habitat for biota.	Withdrawals significantly affect available low flow habitat for biota.	Withdrawals have caused severe loss of low flow habitat.
[1]For irrigation or other water use.			

4. Frequency of Flooding			
4 – Best	3 – Acceptable	2 – Below Standard	1 – Needs Improvement
Flooding every 1.5 to 2 years.	Flooding occurs only once every 3 to 5 years.	Flooding occurs only once every 6 to 10 years.	No flooding. Channel deeply incised or structures prevent access to flood plain, or dam operations prevent flood flows, OR flooding occurs more than once a year.

setting. If a river has access to its floodplain, the result is a decrease in the river's ability to transport sediment. If a river is confined away from its flood plain, the increase in energy available to transport sediment can result in bank and channel erosion. Clearly, a balance is needed. The landowner may be able to provide information about the frequency of flooding on the property. Other visual evidence of flooding includes high water marks such as water lines, sediment deposits, or stream debris. These may be found on the banks, bankside trees or rocks, or on other structures such as road pilings or culverts. A nearby flooded field may not always indicate stream access to the floodplain. The field could have flooded from a higher upland area, and then was unable to drain from the field.

II. Stream stability and integrity

This section is slightly different from Section I, but continues to focus on the physical structure of the stream. These factors can also be affected by humans, stream hydrology and geomorphology, but are also related to biological features of the stream. Definitions used in this section are listed in the Glossary.

Riparian zone vegetation (Box 5)

A healthy riparian vegetation zone is one of the most important elements for a healthy stream ecosystem. Riparian zone health depends on both the quantity and the quality of the vegetation. Natural vegetation (see glossary for definition) generally refers to perennial, not annual vegetation. If native species are not present, introduced species are acceptable, as long as they mimic the native vegetation in size and diversity. For example, cottonwood and hackberry trees may be replaced by elm, and understory plants may also be introduced. A common problem is the lack of shrubs and understory trees. Woody species will be present in most areas of Kansas, but in some ecosystems perennial grasses or marshland species may be dominant.

The quality of the riparian zone also increases with the width of the vegetation within it. If one side of the stream is lacking protective vegetative cover, the entire reach of the stream will be compromised. In doing the assessment, examine both sides of the stream and note on the diagram which side of the stream has problems. It is common to have different vegetation management on the two sides of the stream because of different landowners. You may only have direct control over the vegetation on your side of the stream, but conversations with neighboring landowners can be helpful in promoting riparian management and conservation on their land.

Vegetation in the riparian zone:

- reduces the amount of pollutants that reach the stream in surface runoff;
- helps control erosion;
- provides a microclimate that is cooler during the summer, providing cooler water for aquatic organisms;
- provides debris that form instream cover, creates pools, and provides habitat for stream biota;
- provides fish habitat in the form of undercut banks;
- dissipates energy during flood events; and
- provides refuge areas for fish during out-of-bank flows (behind stumps and logs).

5. Riparian Zone Vegetation			
4 – Best	3 – Acceptable	2 – Below Standard	1 – Needs Improvement
Natural vegetation extends at least two active channel widths on each side.	Natural vegetation extends one active channel width on each side.	Natural vegetation extends less than one active channel width on each side, or may be entirely missing on one side.	Little to no natural vegetation on one or both sides of stream.

Bank stability (Box 6)
Bank stability is affected by riparian zone vegetation. Even a healthy stream will have some bank erosion. Excessive bank erosion occurs where riparian zones are degraded or where the stream is unstable because of changes in hydrology, sediment load, or isolation from the flood plain. High and steep banks are more susceptible to erosion or collapse. All outside bends of streams erode, so even a stable stream may have 50 percent of its banks bare and eroding. A healthy riparian corridor contributes to bank stability. The roots of perennial grasses or woody vegetation typically extend to the baseflow elevation of water in streams that have bank heights of 6 feet or less. The type of vegetation is important. For example, trees, shrubs, sedges and rushes have the type of root masses capable of withstanding high streamflow events, while Kentucky bluegrass does not.

Diversity of habitat (Box 7)
Habitat diversity reflects natural stream hydrology and encourages diversity of fish and other aquatic life in the stream. The next section will cover this in more detail.

6. Bank Stability			
4 – Excellent	3 – Good	2 – Fair	1 – Poor
Banks are stable. Banks are low and/or at least ⅓ of the eroding surface area of banks in outside bends is protected by roots that extend to the base-flow elevation.	Moderately stable. Banks are low and/or less than ⅓ of the eroding surface area of the banks in the outside bends is protected by roots that extend to the base-flow elevation.	Moderately unstable. Banks are typically high, outside bends are actively eroding, evidence of overhanging vegetation at top of bank, some mature trees falling into stream, some slope failures apparent.	Unstable. Banks are typically high, some straight reaches and inside edges of bends are actively eroding as well as outside bends, evidence of overhanging vegetation at top of bare bank, numerous slope failures apparent.

7. Diversity of Habitat			
4 – Excellent	3 – Good	2 – Fair	1 – Poor
Riffles, runs, and pool habitat present an optimal condition, diverse velocity and depth of flow present (i.e. slow, fast, shallow and deep water).	Good mix between riffles, runs, and pools, relatively diverse velocity and depth of flow conditions.	Few pools present, riffles and runs dominant, velocity and depth generally slow-shallow.	Dominated by one habitat type (usually runs) and by one velocity/depth condition (slow-shallow).

III. Suitability of the stream for fish (Boxes 8-12)

The following ratings pertain to fish habitat, and the suitability or quality of the stream for this purpose. In Kansas, only perennial streams would be considered as possible fish habitat. If your stream is not a perennial stream, you may skip questions 8-12.

Fish have several requirements for survival, and the questions 8-12 address some of the requirements relating to habitat. Water quality is another requirement, and this is addressed elsewhere in this and other fact sheets that are part of the Citizen Science program.

8. Barriers to Fish Movement			
4 – Excellent	3 – Good	2 – Fair	1 – Poor
No barriers.	Drop structures (culverts, dams, or diversions with less than 1 foot drop) within the reach.	Drop structures (culverts, dams, or diversions with more than 1 foot drop) within 3 miles upstream or downstream from the reach.	Drop structures (culverts, dams, or diversions with more than 1 foot drop) within the reach.

9. In-stream Fish Cover[1]			
4 – Excellent	3 – Good	2 – Fair	1 – Poor
At least six or more cover types available.	Between four and six cover types available.	Between two and four cover types available.	No or one cover type available.
[1]Includes logs/large woody debris, deep pools, overhanging vegetation, boulders/cobble, riffles, undercut banks, thick root mats, dense mat of aquatic plants, isolated backwater pools, other (please list here) ____.			

10. Pools – Depth and Quantity[1]			
4 – Excellent	3 – Good	2 – Fair	1 – Poor
More than three pools in assessment reach. Average depth 3 to 5 feet.	Two to three pools in reach. Average pool depth 1 to 3 feet.	One or two pools in reach. Pool depth less than 1 foot.	No pools in reach.
[1]Number of pools in reach ____________			

11. Canopy Cover[1]			
4 – Excellent	3 – Good	2 – Fair	1 – Poor
More than 90% of water surface shaded; mixture of conditions.	50 to 90% shaded; full canopy; same shading condition throughout the reach.	25 to 50% shade.	Less than 25% water surface shaded in reach.
[1]Estimate cover as if leaves are out, at approximately noon, or with the sun overhead, even if these are not the conditions under which you are observing the stream.			

Water temperature (Box 12)

This water temperature rating is based on conditions that are ideal for fish. In fact sheet W-2, another water temperature criteria is used based on changes that might be created in water temperature due to farming or other practices, and the ambient temperature at the time of sampling is used to interpret other data. Both temperature criteria are valid, and you should record both if you are doing both the chemical stream assessment and the visual stream assessment portions of Citizen Science.

12. Water Temperature[1]			
4 – Excellent	3 – Good	2 – Fair	1 – Poor
Water temperature is less than 68°F.	Water temperature between 68 and 75°F.	Water temperature between 75 and 80°F.	Water temperature is more than 80°F.
[1]*Summer afternoon from 2 to 4 p.m., or the warmest part of the day.*			

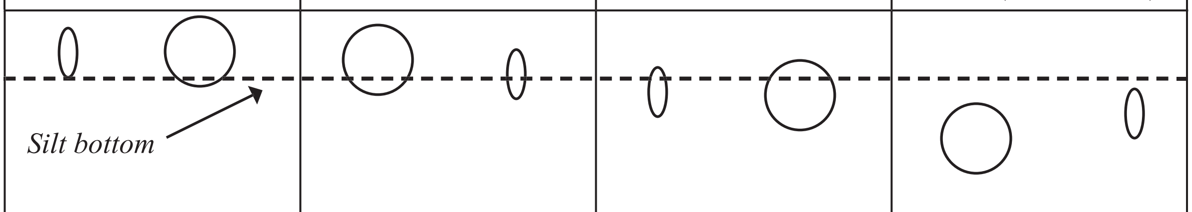
IV. Insect/invertebrate habitat (Boxes 13-15)

The following ratings pertain to the suitability of the stream for insects and other invertebrates such as crayfish. These are often food sources for fish and other animals higher on the food chain and important indicators of stream biodiversity. Fact sheet W-8 includes a detailed plan of invertebrate assessment if you would like to know more about these creatures.

Riffle embeddedness (Box 13)
Riffle embeddedness is an important factor because exposed rocks and gravel are excellent habitat for macroinvertabrates. Streams without exposed rocks and gravel may be carrying too much silt load and sediment leaving the invertebrates exposed to predators. Riffles also provide areas for fish spawning and egg incubation. Some Kansas streams are naturally mud bottomed.

13. Riffle Embeddedness[1]

4 – Excellent	3 – Good	2 – Fair	1 – Poor
Gravel or cobble particles are less than 20% embedded	Gravel or cobble particles are 20 to 40% embedded.	Gravel or cobble particles are more than 40% embedded.	There is no rock or gravel exposed on the bottom (mud bottom).



[1]Diagram shows cobbles or rocks as circles in relationship to the silt on the bottom of the stream bed.

14. Insect/invertebrate Habitat[1]

4 – Excellent	3 – Good	2 – Fair	1 – Poor
At least five types of habitat available. Habitat is at a stage to allow full insect colonization (woody debris and logs not freshly fallen).	Three to four types of habitat. Some potential habitat exists, such as overhanging trees, which will provide habitat, but have not yet entered the stream.	One to two types of habitat. The substrate is often disturbed, covered, or removed by high stream velocities and scour or by sediment deposition.	One type of habitat or none present.

[1]May include fine woody debris, submerged logs, leaf packs, undercut banks, cobble, boulders, coarse gravel, other (please list here) ____

15. Invertebrate Assessment Scoring[1]

4 – Excellent	3 – Good	2 – Fair	1 – Poor
Community dominated by Group I or intolerant species with good species diversity. Examples include caddisflies, mayflies, stoneflies, and hellgrammites.	Community dominated by Group II or facultative species, such as damselflies, dragonflies, aquatic sowbugs, blackflies, and crayfish.	Community dominated by Group III or tolerant species such as midges, craneflies, horseflies, leeches, aquatic earthworms, tubificid worms.	Very reduced number of species or near absence of all macroinvertebrates.

[1]See fact sheet W-8 for more details and sampling methods.

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V. Other factors to assess

These are covered in more detail in other fact sheets. If you are only doing the visual assessment, score these based on the visual ratings. You are encouraged to perform the chemical and biological tests explained in the other fact sheets if time allows.

Water appearance (Box 16)

Question 16 is a visual assessment of a measurement called turbidity and color. The depth to which an object can be clearly seen is a measure of turbidity. Turbidity is caused mostly by particles of soil, organic matter and algae suspended in the water. Storms can increase turbidity because soil and other particles from storm runoff are carried into the stream or suspended by turbulence.

The ideal color of water is clear, or slightly brown, similar to the color of the region's soil if the water is carrying sediment. The water in some streams may be naturally tea-colored, especially in bogs or wetland areas due to tannins and other natural substances in the plants. Water that has slight nutrient enrichment may support communities of algae, which create a greenish color in the water. Streams with heavy loads of nutrients have a thick coating of algae attached to the rocks and other submerged objects. In degraded streams you will find floating algal mats, surface scum, or other pollutants such as dyes, oil, or other floating debris. Questions 16 and 17 are similar, with question 17 focusing mostly on signs of nutrient contamination, and question 16 including factors such as turbidity and other pollutants.

16. Water Appearance			
4 – Excellent	3 – Good	2 – Fair	1 – Poor
Very clear, or clear but tea-colored; objects visible at depth of 3 to 6 feet, no oil sheen on surface; no noticeable film on submerged objects or rocks.	Occasionally cloudy, especially after storm event, but clears rapidly; objects visible at depth of 1.5 to 3 feet; may have slightly green color; no oil sheen on water surface.	Considerable cloudiness most of the time; objects visible to depth of 0.5 to 1.5 feet; slow sections may appear pea-green; bottom rocks or submerged objects covered with heavy green or olive-green film; moderate odor of ammonia or rotten eggs possible.	Very turbid or muddy appearance most of the time; objects visible to depth less than 0.5 feet; slow moving water may be bright-green; other obvious water pollutants; floating algal mats, surface scum, sheen or heavy coat of foam on surface, strong odor of chemicals, oil, wastewater, or other pollutants.

Nutrient enrichment (Box 17)

High nutrient levels are dangerous for fish and other aquatic life because they promote algal growth that removes oxygen from the water. The presence of some aquatic vegetation is normal in streams, and algae and macrophytes (plants) provide habitat and food for all stream animals. But excessive amounts are not beneficial.

Live plant respiration and decomposition of dead plants consume dissolved oxygen in the water, which creates stress for all aquatic organisms and can cause fish kills. If you see fish gulping for air at the water's surface during warm weather, this indicates a lack of dissolved oxygen.

Manure is one source of nutrients in streams and is probably the greatest contributor in Kansas. Other sources of nutrients include fertilizer runoff from fields, topsoil erosion (carrying nutrients attached to the soil), and leaching through tile drains. Feeding area runoff is also nutrient rich and even though the actual manure may not reach the stream, nutrients can cause problems in the stream and on the farm. Nutrients are contributing to hypoxia (the dead zone) in the Gulf of Mexico.

17. Nutrient Enrichment[1]			
4 – Excellent	3 – Good	2 – Fair	1 – Poor
Clear or nearly clear water along entire reach; diverse aquatic plant community includes low quantities of many species of macrophytes (water plants), little algal growth present.	Fairly clear or slightly greenish water along entire reach; moderate algal growth on stream substrates.	Greenish water along entire reach; overabundance of lush green macrophytes; abundant algal growth, especially during warmer months.	Pea green, gray, or brown water along entire reach; dense stands of macrophytes clog stream; severe algal blooms create thick algal mats in stream.
[1]*Visible signs – see fact sheets W-4 and W-5 for more information.*			

Manure presence (Box 18)

Fresh manure contamination of streams and ponds can also cause problems with *E. coli* and other bacterial and protozoan contamination, which could result in health problems for young animals or humans that may drink the water downstream. Livestock are often attracted to streams, not only as water sources, but because of the shade and windbreak protection offered. Several options are available for reducing the amount of manure in and near the stream, including providing alternative shade and watering areas for livestock, fencing or allowing only limited access to the stream. Healthy riparian vegetation is also helpful in filtering out nutrients from manure near the stream, but not in the stream. Human waste system disposal near streams may be a factor to consider and remediate.

18. Manure Presence[1]			
4 – Excellent	3 – Good	2 – Fair	1 – Poor
No livestock present. No human waste system nearby.	Evidence of livestock access to riparian zone (within 100 feet of surface water).	Occasional manure in stream, or waste storage structure or household onsite system located on the flood plain.	Extensive amount of manure on banks or in stream, or household waste discharge pipes present and active.
[1]*Or presence of active manure sources in or near surface water.*			

Salinity (Box 19)

For the most part, salinity is considered to be a negative factor in stream evaluations if there is a human source or cause because some steams in arid regions of the country are naturally saline. Human sources of salinity include areas with high irrigation requirements or oil and gas well operations. Salt accumulation in soil causes a breakdown of soil structure, decreased infiltration of water and potential toxicity. It also affects aquatic vegetation, macroinvertebrates and fish.

19. Salinity[1]			
4 – Best	3 – Acceptable	2 – Below Standard	1 – Needs Improvement
No evidence of salinity in the assessment reach.	Minimal evidence of salt effects such as wilting, bleaching leaf burn, or stunting of sensitive aquatic vegetation. Some salt-tolerant streamside vegetation (such as tamarisk or salt cedar).	Sensitive aquatic vegetation may show significant wilting, bleaching, leaf burn, or stunting; considerable salt-tolerant streamside vegetation.	Severe wilting, bleaching, leaf burn, or stunting of sensitive plants; most streamside vegetation salt tolerant; presence of only salt-tolerant aquatic vegetation.
[1]May be present on or near naturally saline soils, as a result of repeated collection and evaporation of irrigation or other runoff, or from nearby oil or gas well operations.			

Aesthetic (Box 20)

The final stream visual rating is aesthetic. This was not found in other stream assessment worksheets, but it is one of the easiest to score, and one of the first thing you notice when visiting a stream site. A low aesthetic rating could reduce value of the land if it is sold as a hunting preserve or agro-tourism site. A low rating could also indicate risk from buried trash from previous landowners. It used to be a common practice on farms to bury trash on site or dump it into the creek before landfills, recycling, and other trash-handling systems became available. Owners probably did not distinguish between toxic and non-toxic waste.

20. Aesthetic[1]			
4 – Excellent	3 – Good	2 – Fair	1 – Poor
No trash or human impacts visible in the assessment reach.	Small amount of trash which could have been wind carried; could be collected with minimal effort; little other human impacts.	Significant trash or evidence of human impacts present; would require major effort to remove (such as appliances, construction trash, concrete, bricks, etc.) Trash appears to be non-toxic.	Trash of potentially dangerous or toxic nature (such as discarded barrels, batteries, pesticide containers, car bodies or other materials that would require removal by an expert.
[1]The presence of trash or other human impacts not required for normal agricultural practices or municipal uses that detracts from the natural environment.			

Using reference sites

(Box 21)

A reference site is useful when comparing the score of the stream of interest to a minimally impacted stream for your area or bio-region. When possible, reference streams should be located in the same climatic zone and possess similar topography and geology, similar plant ecological zone, and similar size (watershed drainage basin) and slope. Reference streams for Kansas may be found at: *www.oznet.ksu.edu/kswater/referencestreams*. Reference streams should reflect the most natural or historical conditions possible, with little or no human disturbance. Fill out a survey sheet for the nearest or most similar reference stream to your site. The score will probably not be a perfect 4.0. Take your stream score and divide it by the reference stream score. For example, if your stream scored a 3.1, and the reference stream score was 3.8, your comparison percentage is 3.1 ÷ 3.8= 81.6%. Compare the percentage you find using the guide on page 12.

Other measures of a healthy stream

Streams provide habitat for many living creatures. The assessment in this fact sheet only looks at the physical structure of the stream, its suitability as fish habitat, macroinvertebrate ratings, and potential to provide diverse and healthy habitat for other living creatures. Other assessments that might be of interest in your area would be diversity and counts of frogs, reptiles, birds and mammals.

The Kansas Anuran Monitoring Program is a volunteer program coordinated by the Kansas Department of Wildlife and Parks. It was initiated in 1998 to help determine the status and population trends of Kansas' 22 species of frogs and toads. Survey data are collected annually by cooperators who note the distinctive calls of each species along permanent roadside routes. Photographs, recorded frog calls, and information on how to participate are found at their Web site: *www.cnah.org/kamp/*.

Birds can be identified by their calls as well as by sight, and by working closely with an experienced birder or receiving this training yourself, you can determine if your stream is home to a diverse and numerous high-quality bird population. A high-quality stream should support a large number of bird species, including those native to your ecoregion and sensitive to disturbance and/or polluted water. A disturbed area might only support birds that are abundant throughout Kansas and the United States (house sparrows for example). These generalizations do not always hold true, but one can gain from learning to recognize birds by sight and sound and keeping lists from year to year. Participation in your local Audubon Association will help you meet other birders, and a Minnesota project workbook is available online with more information about how to conduct on-farm bird counts (see *www.minnesotaproject.org*).

Reptiles and mammals are more elusive for the purposes of monitoring and also more mobile, and may not be associated directly with a stream area. Some mammals are not always welcome on farms, such as coyotes on a sheep farm, or raccoons on a chicken farm. However, they too are part of the web of life, all of which depends on fresh, clean water for its survival.

21. Reference Score Comparison			
4 – Excellent	3 – Good	2 – Fair	1 – Poor
More than 90%. Comparable to the best habitat conditions to be expected within an ecoregion.	From 75 to 90%. Habitat structure slightly impaired.	From 60 to 75%. Significant loss of habitat and stream function compared with reference reach.	Less than 60%. Severe loss of habitat and impairment of stream function.

WATER

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Stream Site
Assessment

Conclusion

Stream assessment can be a valuable tool for landowners and managers and an educational adventure for students. Repeated measurements over time, such as a period of years, help to document improvements that are being made on the farm. Participation in a monitoring network can help landowners work together to improve an entire watershed or ecoregion. Financial and technical assistance is widely available to help in these efforts. See fact sheet W-10, *Starting a Water Monitoring Team*, for a list of stream and water-quality related networks and national efforts. Visit your local K-State Research and Extension office or watershed specialist for more information on programs available in your area, and see your USDA Farm Services Agency to sign up for available cost-share programs.

Credits

Material was adapted from the "Stream Visual Assessment Protocol," National Water and Climate Center Technical Note 99-1, USDA/ NRCS, and from the "Rapid Stream Assessment Technique" developed for Montgomery County Maryland in 1992 (*www.cwsp.org/tools_ assessment.htm*). Additional ideas were found in "River Voices," Vol 12 No. 4 2002, a publication of the River Network (*www.rivernetwork.org*).

Glossary

Active channel width: The width of the stream at the bankfull discharge. Permanent vegetation generally does not become well established in the active channel.

Active flood plain: The flat area of land adjacent to a stream that is formed by recent flood processes.

Aggradation: Geologic process by which a stream bottom or flood plain is raised in elevation by the deposition of material. Evidence includes depositional features such as bars, especially those composed of fine sediment.

Bank armoring: Lining the stream bank with rip rap (rocks) or other nonsoluble, heavy material.

Bankfull discharge: The stream discharge that forms and controls the shape and size of the active channel. This discharge generally occurs on average about once every 1.5 years.

Bankfull stage: The stage at which water starts to flow over the flood plain; the elevation of the water surface at bankfull discharge.

Baseflow: The stream flow derived from natural storage; average stream discharge during low flow conditions.

Benthos: Bottom-dwelling or substrate-oriented organisms.

Braiding: A stream with three or more smaller channels. These smaller channels are extremely unstable, rarely have woody vegetation along their banks, and provide poor habitat for stream biota.

Channel: A natural or artificial waterway of perceptible extent that periodically or continuously contains moving water. It has a definite bed and bank that serve to confine the water.

Channelization: Straightening or shortening of a stream channel that usually increases the gradient and causes the water to flow faster.

Cobbles: Medium-sized rocks which measure 2.5 to 10 inches across.

Confined channel: A channel that does not have access to a flood plain.

Cubic feet per second (cfs): The rate of flow of a creek, river, or flood measured by quantity over time or volume of water that passes a given point in a given amount of time. This is often referred to as "discharge." Plotting this data over time is called a hydrograph.

Degradation: A geological process by which a stream bottom is lowered in elevation due to the net loss of substrate material. Often called downcutting. Evidence includes high banks, loss of structural material underneath bridges or other human made constructions.

Embeddedness: The degree to which an object is buried in stream sediment.

Emergent plants: Aquatic plants that extend out of the water.

Geomorphology: The study of the evolution and configuration of landforms.

Glide: A fast water habitat type that has low to moderate velocities, no surface agitation, no defined thalweg, and a U-shaped smooth, wide bottom. Does not exist in all streams.

Gradient: Slope calculated as the amount of vertical rise over horizontal run expressed as ft/ft or as a percent (ft/ft × 100).

Gravel: Small rocks measuring 0.25 to 2.5 inches across.

Habitat: The area or environment in which an organism lives.

Headcutting: Erosion point of the stream bottom that is gradually moving upstream.

Hydrology: The study of the properties, distribution, and effects of water on the Earth's surface, soil, and atmosphere.

Incised channel: A channel with a streambed lower in elevation than its historic elevation in relation to the flood plain.

Intermittent stream: A stream in contact with the groundwater table that flows only certain times of the year, such as when the groundwater table is high or when it receives water from surface sources.

Macroinvertebrate: A spineless animal visible to the naked eye or larger than 0.5 millimeters. This would include aquatic insects, as well as crayfish, mussels, snails, etc.

Macrophyte bed: A section of stream covered by a dense mat of aquatic plants.

Meander: A normal winding section of stream with bends that is at least 1.2 times longer, following the centerline of the channel, than its straight-line distance.

Natural vegetation: Plant communities with (1) all appropriate structural components and (2) species native to the site or introduced species that function similar to native species at reference sites.

Nickpoint: The point where a stream is actively eroding (downcutting) to a new base elevation. Nickpoints migrate upstream through a process called headcutting.

Perennial stream: A stream that flows continuously throughout the year. It is not normally dry.

Point bar: A gravel or sand deposit on the inside of a meander; an actively mobile stream feature.

Pool: Deeper area of a stream with slow-moving water.

Reach: A section of stream. A specified length of stream, usually of consistent quality for purposes of assessment. A practical length is 12 times the active channel width.

Riffle: A shallow section in a stream where water is breaking over gravel, rocks, wood, or other partly submerged debris and producing surface agitation.

Riparian: The zone adjacent to a stream or any other waterbody (from the Latin word *ripa*, pertaining to the bank of a river, pond, or lake.

Riparian zone: The natural (or intentionally planted) vegetation zone from the edge of the active channel out onto the flood plain.

Run: A fast-moving section of a stream with a defined thalwag and little surface agitation.

Split channel: Has two or more smaller channels (called side channels).

Substrate: The mineral or organic material that forms the bed of the stream; the surface on which aquatic organisms live.

Thalwag: The line followed by the majority of the stream flow. The line connecting the lowest or deepest points along the streambed.

Turbidity: Murkiness or cloudiness of water caused by particles, such as fine sediment (silts, clays) and algae.

Watershed: The land area draining to a waterbody or point in a river system; catchment area or drainage area.

Watershed divide: A ridge of land dividing areas that are drained by different streams.

Stream Assessment Scorecard

Land owner's name: ____ Date:________________

Evaluator's name: ____

Name of stream: ____

Ecoregion and overall position in the landscape: ____
(for example, upland prairie upper stream reach, or tall-grass prairie, oak dominant lowland woodland)

Reach location description (how to get to it, length, etc): ____________________________________

____

Legal description (township, range, section): T:____, R:____, S:____, ____ Qtr of ____Qtr

Drainage area of the stream: ____

Stream gradient (of the reach you assess; also on your property – get from NRCS office or topographical map): ________________: _________________

Land use upstream in the drainage area (% crops, pasture, woodlands, etc.)

% row crops	**_____**	**% forest**	**_____**
% perennial/hay crops	**_____**	**% residential**	**_____**
% permanent pasture	**_____**	**% road or parking lot**	**_____**

Location of nearest livestock feeding unit? ____

Active channel width? _____________________

Dominant substrate: boulder ____ gravel____ sand____ silt____ mud____

History of any human changes on the stream; e.g. dams, weirs, stabilization, channelization, levees, etc. ____

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Site Diagram

Stream Site Assessment Data Sheet

Question	Score/Rating
I. Stream physical structure and changes	
1. Channel condition	
2. Recent changes in channel due to erosion or aggradation	
3. Water withdrawals (for irrigation)	
4. Frequency of flooding	
II. Stream stability and integrity	
5. Riparian zone vegetation	
6. Bank stability	
7. Diversity of habitat	
III. Suitability of the stream for fish (only rate for perennial streams)	
8. Barriers to fish movement	
9. Instream fish cover	
10. Pools – depth and quantity	
11. Canopy cover	
12. Water temperature	
IV. Insect/invertebrate habitat	
13. Riffle embeddedness	
14. Insect/invertebrate habitat	
15. Invertebrate assessment scoring	
V. Other factors to assess	
16. Water appearance	
17. Nutrient enrichment	
18. Manure presence	
19. Salinity	
20. Aesthetic	
Total Score	
Average Score (total score divided by the number of indicators)	
21. Comparison to reference stream	

Summary

Overall condition of this stream reach? ____

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Suspected causes of observed problems? ____

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Further testing that may be helpful? ____

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Action plan, or next steps?

For example:

Contact ____________________(agency or person) for more information or technical assistance

____

____

____

Contact __________________________ (agency or person) for information on cost share opportunities for remediation if needed ____

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Participate in whole-farm planning program, such as the River Friendly Farms assessment. Contact ____________________ for more information, or see the Web site *www.oznet.ksu.edu/rff*

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Steps that can be taken now without technical or financial assistance? ______________________

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Kansas State University Agricultural Experiment Station and Cooperative Extension Service

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