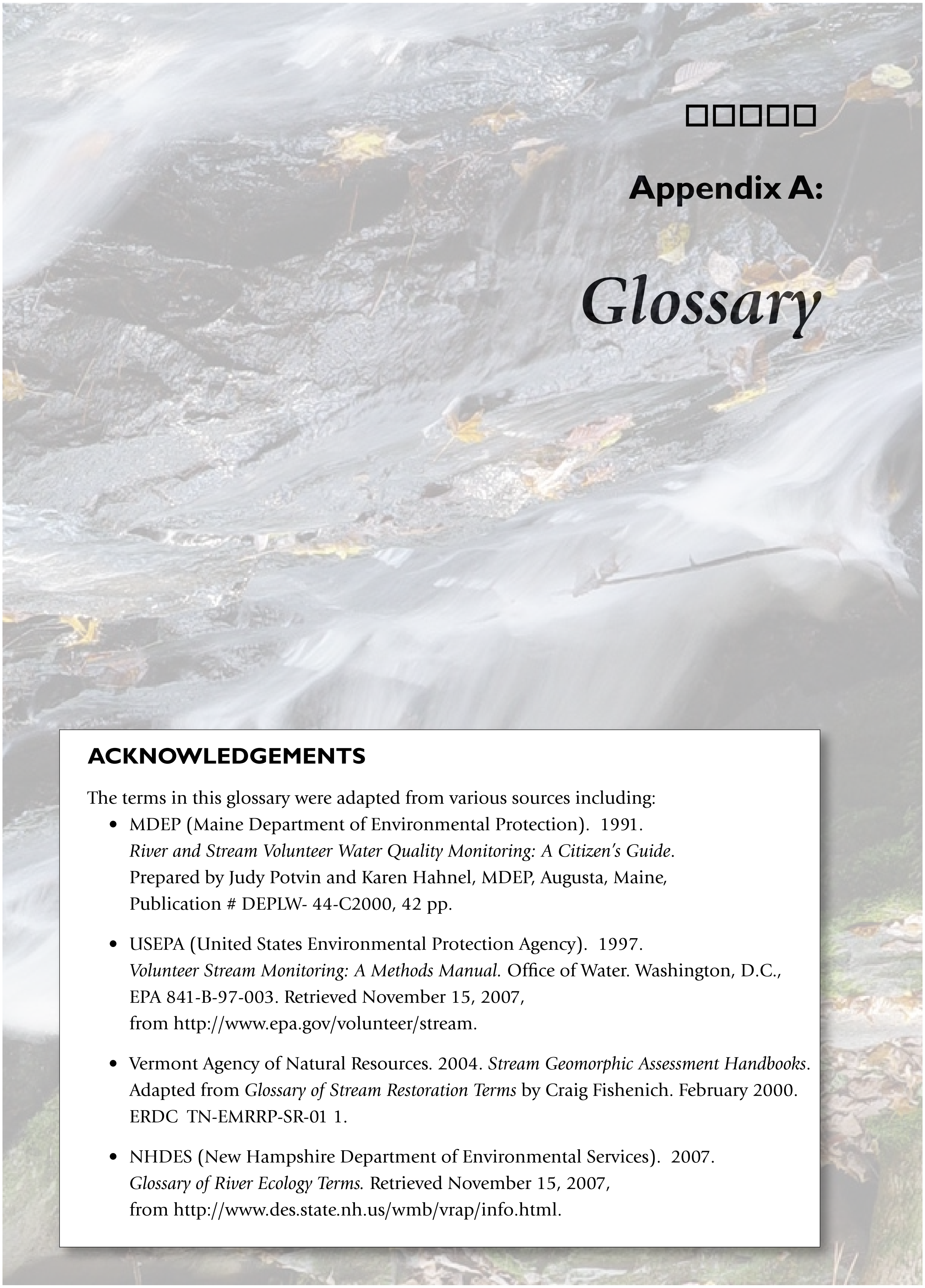


Appendix A:

Glossary

ACKNOWLEDGEMENTS

The terms in this glossary were adapted from various sources including:

- MDEP (Maine Department of Environmental Protection). 1991. *River and Stream Volunteer Water Quality Monitoring: A Citizen's Guide*. Prepared by Judy Potvin and Karen Hahnel, MDEP, Augusta, Maine, Publication # DEPLW- 44-C2000, 42 pp.

- USEPA (United States Environmental Protection Agency). 1997. *Volunteer Stream Monitoring: A Methods Manual.* Office of Water. Washington, D.C., EPA 841-B-97-003. Retrieved November 15, 2007, from http://www.epa.gov/volunteer/stream.

- Vermont Agency of Natural Resources. 2004. *Stream Geomorphic Assessment Handbooks*. Adapted from *Glossary of Stream Restoration Terms* by Craig Fishenich. February 2000. ERDC TN-EMRRP-SR-01 1.

- NHDES (New Hampshire Department of Environmental Services). 2007. *Glossary of River Ecology Terms.* Retrieved November 15, 2007, from http://www.des.state.nh.us/wmb/vrap/info.html.

A

ACCURACY: Ability to obtain the correct result or true value.

ACIDITY: A measure of the number of free hydrogen ions (H^+) in a solution that can chemically react with other substances.

ACUTE TOXICITY: An adverse effect such as mortality or debilitation caused by an exposure of (typically) 96 hours or less (i.e., short period of time) to a toxic substance.

AGGRADATION: A progressive buildup or raising of the channel bed and floodplain due to sediment deposition. The geologic process by which streambeds are raised in elevation and floodplains are formed. Aggradation indicates that stream discharge and/or bed-load characteristics are changing. Opposite of degradation.

ALGAE: A chlorophyll-containing plant, ranging from one to many cells in size, which lives in fresh or salt water.

ALGAL BLOOMS: Overgrowth of algae in a water body caused by excessive nutrient inputs; turns water a greenish color and reduces clarity; can cause fish kills in extreme situations.

ALKALINITY: A measure of the negative ions that are available to react and neutralize free hydrogen ions. Some of most common of these include hydroxide (OH^-), sulfate (SO_4^{-2}), phosphate (PO_4^{-3}), bicarbonate (HCO_3^-), and carbonate (CO_3^{-2}).

ALLUVIAL: Deposited by running water.

ALLUVIUM: An unconsolidated accumulation of stream-deposited sediments, including silts, clays, sands, or gravels.

AMBIENT: Pertaining to the current environmental condition.

ANADROMOUS: Fish that spend a part of their life cycle in the sea and return to freshwater streams to spawn.

ANOXIC: Referring to the absence of oxygen (less than 1 mg/l).

AQUATIC ECOSYSTEM: Any body of water, such as a stream, lake, or estuary, and all organisms and nonliving components within it, functioning as a natural system.

AQUATIC INSECT: Insect species whose larval and/or juvenile forms live in the water.

AQUATIC HABITAT: Habitat that occurs in water.

ARMORING: A natural process where an erosion-resistant layer of relatively large particles is established on the surface of the streambed through removal of finer particles by stream flow. A properly armored streambed generally resists movement of bed material at discharges up to approximately 3/4 bank-full depth.

AUTOTROPHS: Organisms that use energy from the sun or from the oxidation of inorganic substances to make organic molecules. They do not eat other organisms.

AVULSION: A change in channel course that occurs when a stream suddenly breaks through its banks.

B

BACKWATER: (1) A small, generally shallow body of water attached to the main channel, with little or no current of its own, or (2) A condition in subcritical flow where the water surface elevation is raised by downstream flow impediments.

BACKWATER POOL: A pool that formed as a result of an obstruction like a large tree, weir, dam, or boulder.

BANK STABILITY: The ability of a streambank to counteract erosion or gravity forces.

BANKFULL CHANNEL DEPTH: The maximum depth of a channel within a riffle segment when flowing at a bankfull discharge.

BANKFULL CHANNEL WIDTH: The top surface width of a stream channel when flowing at a bankfull discharge.

BANKFULL DISCHARGE: The stream discharge corresponding to the water stage that, in most scenarios, first overtops the natural banks onto a floodplain. This flow occurs, on average, about once every 1 to 2 years.

BANKFULL WIDTH: The width of a river or stream channel at bankfull stage, usually between the highest banks on either side of a stream.

BAR: An accumulation of alluvium (usually gravel or sand) caused by a decrease in sediment transport capacity on the inside of meander bends or in the center of an overwide channel.

BASE FLOW: The sustained portion of stream discharge that is drawn from natural storage sources (e.g., groundwater). Usually occurs in the dry summer months.

BEAVER DECEIVER: A structure built around the upstream end of culvert to prevent beavers from plugging up the culvert with debris. These structures are usually a combination of wooden or metal posts and large-mesh metal wiring/fencing.

BENTHIC: Bottom-dwelling. The plant and animal life whose habitat is the bottom of a sea, lake, river, or stream.

BIOCHEMICAL OXYGEN DEMAND (BOD): BOD is a laboratory test estimating the amount of oxygen-demanding substances in water samples. Examples of oxygen-demanding substances include naturally occuring organic matter (e.g., leaves, wood, dead aquatic organisms), organic matter discharged from wastewater treatment plants (e.g., sewage, industrial/processing wastes), and ammonia. These substances are usually decomposed or converted to other compounds by bacteria if there is sufficient oxygen present in the water. If the BOD level is high, it might reduce dissolved oxygen concentrations in a stream or river enough to stress aquatic organisms such as fish and macroinvertebrates. The oxygen depletion of a water sample is measured over a time increment -- typically a five-day test (BOD5).

BIOLOGICAL CRITERIA: Numerical values or narrative descriptions that depict the biological integrity of aquatic communities in that state. May be listed in state water quality standards.

BOULDER: A large substrate particle that is larger than cobble, (> 256 mm [10.1 in] in diameter).

BUFFER STRIP: A barrier of permanent vegetation, either forest or other vegetation, between waterways and land uses such as agriculture or urban development, designed to intercept and filter out pollution before it reaches the surface water resource.

BUFFERING CAPACITY: Surface water's ability to resist change in pH.

C

CANOPY: A layer of foliage in a forest stand. This most often refers to the uppermost layer of foliage, but it can be used to describe lower layers in a multistoried stand. Leaves, branches and vegetation that are above ground and/or water that provide shade and cover for fish and wildlife.

CATADROMOUS: Fish that spend a part of their life in fresh water and return to the ocean to spawn.

CELSIUS TEMPERATURE: °C + 17.78 x 1.8 = °F

CHLOROPHYLL-A: A green pigment found in plants; commonly used to measure the amount of algae.

CHANNEL: An area that contains continuously or periodically flowing water that is confined by banks and a streambed.

CHANNELIZATION: The process of changing (usually straightening) the natural path of a waterway. This often is a result of human activity.

CHRONIC TOXICITY: An adverse effect such as reduced reproductive success or growth, or poor survival of sensitive life stages, which occurs as a result of prolonged exposure (i.e., long period of time) to a toxic substance.

CLAY: Substrate particles that are smaller than silt and generally less than 0.062 mm (0.0024 in) in diameter.

COBBLE: Substrate particles that are smaller than boulders and larger than gravels, and are generally 64-256 mm (2.5-10.1 in) in diameter. Can be further classified as small and large cobble.

COLDWATER FISH: Salmonids such as salmon, lake trout (togue), and brook trout.

COMBINED SEWER OVERFLOW (CSO): Sewer systems in which sanitary waste and stormwater are combined in heavy rains; this is especially common in older cities. The discharge from CSOs is typically untreated.

COMMUNITY: All the living things that dwell interdependently in a particular place and share the available energy and resources.

COMPETITION: Rivalry for the same limited resource(s) by two ore more individuals or groups of individuals.

COMPREHENSIVE PLAN: An official document adopted by a town, city, or county that sets forth policies on how future growth should occur.

CONFLUENCE: (1) The act of flowing together; the meeting or junction of two or more streams; also, the place where these streams meet. (2) The stream or body of water formed by the junction of two or more streams.

COVER: "Cover" is the general term used to describe any structure that provides refugia for fish, reptiles or amphibians. These animals seek cover to hide from predators, to avoid warm water temperatures, and to rest (by avoiding higher velocity water). These animals come in all sizes, so even cobbles on the stream bottom that are not sedimented in with fine sands and silt can serve as cover for small fish and salamanders. Larger fish and reptiles often use large boulders, undercut banks, submerged logs, and snags for cover.

CREEL: Refers to the catch limit for fish.

CRITICAL SHEAR STRESS: The minimum amount of shear stress exerted by stream currents required to initiate soil/sediment particle motion. Because gravity also contributes to streambank particle movement but not on streambeds, critical shear stress along streambanks is less than for streambeds.

CUBIC FEET PER SECOND (CFS): A unit used to measure water flow. One cubic foot per second is equal to 449 gallons per minute.

CULVERT: Buried pipe that allows flows to pass under a road.

D

DEGRADATION: (1) A progressive lowering of the channel bed due to scour. Degradation is an indicator that the stream's discharge and/or sediment load is changing. The opposite of aggradation. (2) A decrease in value for a designated use.

DEIONIZED WATER: Water that has had all of the ions (atoms or molecules) other than hydrogen and oxygen removed.

DESIGNATED USES: State-established desirable uses that waters should support, such as fishing, swimming, and aquatic life. Listed in state water quality standards.

DETRITUS: The organic material, such as leaves, twigs, and other dead plant matter, that collects on the stream bottom. It may occur in clumps, such as leaf packs at the bottom of a pool, or as single pieces, such as a fallen tree branch.

DISSOLVED OXYGEN (DO): The amount of free (not chemically combined) oxygen dissolved in water, wastewater, or other liquid, usually expressed in milligrams per liter, parts per million, or percent of saturation.

DISTILLED WATER: Water that has had most of its impurities removed.

DITCH: Long narrow trench or furrow dug in the ground, as for irrigation, drainage, or a boundary line.

DRAINAGE BASIN: The total area of land from which water drains into a specific river.

DREDGING: Removing material (usually sediments) from wetlands or waterways, usually to make them deeper or wider.

DRIFT: Algae, bacteria, detritus, or invertebrates that are carried downstream by the current.

E

ECOLOGY: The study of the interrelationships of living organisms to one another and to their surroundings.

EMBANKMENT: An artificial deposit of material that is raised above the natural surface of the land and used to contain, divert, or store water, support roads or railways, or for other similar purposes.

EMBAYMENT: Formation of a bay; or a baylike conformation.

EMBEDDEDNESS: The measure of the amount of surface area of cobbles, boulders, loose gravels, snags and other stream bottom structures that is covered with sand and silt. An embedded streambed may be packed hard with sand and silt such that rocks in the stream bottom are difficult or impossible to pick up. The spaces between the rocks are filled with fine sediments, leaving little room for fish, amphibians, and bugs to use the structures for cover, resting, spawning, and feeding. A streambed that is not embedded has loose rocks that are easily removed from the stream bottom, and may even "roll" on one another when you walk on them.

EPHEMERAL STREAMS: Streams that flow only in direct response to precipitation and whose channel is at all times above the water table.

EROSION: The wearing away of the land surface by running water, wind, or ice.

EUTROPHICATION: The natural and artificial addition of nutrients to a waterbody, which may lead to depleted oxygen concentrations. Eutrophication is a natural process that is frequently accelerated and intensified by human activities.

F

FAHRENHEIT TEMPERATURE: $^{o}F - 32 \times 5/9 = {}^{o}C$

FECAL COLIFORM BACTERIA: A strain of bacteria (normally found in the intestines of warm-blooded animals) whose presence is an indicator of pollution of waters by human or animal wastes. High fecal coliform counts can lead to closure of shellfish beds (the bacteria do not harm the shellfish, but are an indicator of possible contamination by disease organisms).

FLASH FLOOD: A sudden flood of great volume, usually caused by a heavy rain. Also, a flood that crests in a short length of time and is often characterized by high velocity flows.

FLOCCULENT (FLOC): A mass of particles that form into a clump as a result of a chemical reaction.

FLOODPLAIN: Land built of sediment that is regularly covered with water as a result of the flooding of a nearby stream.

FLOODPLAIN (100-YEAR): The area adjacent to a stream that is on average inundated once a century.

FLOODPLAIN FUNCTION: Flood water access of floodplain which effects the velocity, depth, and slope (stream power) of the flood flow thereby influencing the sediment transport characteristics of the flood (i.e., loss of floodplain access and function may lead to higher stream power and erosion during flood).

FLOW: The amount of water passing a particular point in a stream or river, usually expressed in cubic feet per second (cfs).

FLUVIAL: Of or pertaining to streams or rivers.

FOOD CHAIN: A way of showing how nutrients and energy pass from producers through the various trophic levels in an ecosystem, such as from producers to herbivores, carnivores, and finally decomposers. (Arrangement of organisms in a community according to the order of predation.)

FOOD WEB: An integration of the many food chains existing in an ecosystem, showing the complex, interwoven pathways of energy flow between the organisms living in that environment.

FRY: A recently hatched fish.

G

GAUGING STATION: A particular site in a stream, lake, reservoir, etc., where hydrologic data are obtained.

GEOGRAPHIC INFORMATION SYSTEM (GIS): A computer system capable of storing and manipulating spatial data.

GEOMORPHOLOGY: A branch of both physiography and geology that deals with the form of the earth, the general configuration of its surface, and the changes that take place due to erosion of the primary elements and the buildup of erosional debris.

GLIDE/RUN: Section of a stream with a moderately high velocity and with little or no turbulence on the surface of the water.

GRADIENT: Vertical drop per unit of horizontal distance.

GRAVEL: Substrate particles that are larger than sand, smaller than cobbles, and which have a diameter between 2 - 64 mm (0.08 - 2.5 in).

GROUNDWATER: Subsurface water and underground streams that can be collected with wells, or that flow naturally to the earth's surface through springs.

H

HABITAT: The specific environment in which an organism lives and depends on for food and shelter.

HABITAT DIVERSITY: The variety of different types of habitat within a given area.

HEADWATERS: The beginning waters (springs and small streams) from which a river originates.

HIGH GRADIENT STREAMS: Steep streams that typically appear as cascading streams, step/pool streams, or streams that exhibit riffle/pool sequences.

HYDROGRAPH: A curve showing stream discharge over time.

HYDROLOGY: The scientific study of the water of the earth, its occurrence, circulation and distribution, its chemical and physical properties, and its interaction with its environment, including its relationship to living things.

HYPORHEIC ZONE: The area under the stream channel and floodplain where groundwater and the surface waters of the stream mix and form a unique environment.

I

IMPAIRMENT: Degradation.

IMPOUNDMENT: A body of water contained by a barrier, such as a dam.

INCISED RIVER: A river that erodes its channel by the process of degradation to a lower base level than existed previously or is consistent with the current hydrology.

INERT: Not chemically or physically active.

INFILTRATION: The movement of water through the soil surface into the soil.

INSECTICIDES: Chemicals designed to kill a variety of undesired insect species.

IN-STREAM COVER: The layers of vegetation, like trees, shrubs, and overhanging vegetation, that are in the stream or immediately adjacent to the wetted channel.

INTERMITTENT STREAM: Any nonpermanent flowing drainage feature having a definable channel and evidence of scour or deposition. This includes what are sometimes referred to as ephemeral streams if they meet these two criteria.

INVERTEBRATE: An animal lacking a backbone.

ISLANDS: Mid-channel bars that are above the average water level and have established woody vegetation.

L

LAND USES: Activities that take place on the land, such as construction, farming, or tree clearing.

LARGE WOODY DEBRIS (LWD): Large pieces of wood (e.g., fallen trees, roots) contained, at least partially, within the bankfull channel. These structures help create habitat diversity, cover for fish, trap food resources (e.g., leaves, twigs) for aquatic organisms, and trap fine sediments.

LARGE WOODY HABITAT (LWH): Another term for "large woody debris".

LEVEE: An embankment constructed to prevent a river from overflowing (flooding).

LOW GRADIENT STREAMS: Fairly flat streams that usually are slow moving and winding. They often have poorly defined riffles and pools or they may be dominated by pool/glide or (sand) dune/ripple channel systems.

M

MACROINVERTEBRATE: Organisms that lack a backbone and can be seen with the naked eye, such as aquatic insects, crayfish, mollusks, and worms.

MACROPHYTE: Aquatic plants that are large enough to be seen with the naked eye.

MAINSTEM: The principal channel of a drainage system into which other smaller streams or rivers flow.

MEANDER: The winding of a stream channel, usually in an erodible alluvial valley. A series of sine-generated curves characterized by curved flow and alternating banks and shoals (unvegetated deposits of gravels and cobbles adjacent to the banks that have a height less than the average water level [e.g., point bars]).

MID-CHANNEL BAR: Bars located in the channel away from the banks, generally found in areas where the channel runs straight. Mid-channel bars caused by recent channel instability are unvegetated.

MILLIGRAMS PER LITER (mg/l): The weight in milligrams of any substance dissolved in 1 liter of liquid; nearly the same as parts per million (ppm) by weight.

MONITOR: To measure a characteristic, such as streambank condition, dissolved oxygen, or fish population, over a period of time using uniform methods to evaluate change.

MORPHOLOGY: The form, shape, or structure of a stream or organism.

N

NONPOINT SOURCE (NPS) POLLUTION: Diffuse pollution, generated from large areas with no particular point of pollutant origin, but rather from many individual places.

NPDES: National Pollutant Discharge Elimination System, a national program in which pollution dischargers such as factories and sewage treatment plants are given permits to discharge. These permits contain limits on the pollutants they are allowed to discharge.

NTU: Nephelometric Turbidity Units. The Nephelometric Method measures turbidity by comparing the intensity of light seen through a standard versus the sample.

O

OUTFALL: The mouth or outlet of a river, stream, lake, drain or sewer.

OXBOW: An abandoned meander in a river or stream, caused by cutoff. Used to describe the U-shaped bend in the river or the land within such a bend of a river.

P

PATHOGENS: Disease-causing organisms.

PELAGIC: Referring to organism living in the water column.

PERCOLATE: The process of water seeping through the soil.

PERENNIAL STREAMS: Streams that flow continuously.

PERMEABILITY: The capability of soil or other geologic formations to transmit water.

PERMEABLE: Porous.

pH: The measure of the amount of acidity or alkalinity of water on a scale of 1-14. Acid waters are below 7, alkaline waters are above 7, and waters around 7 are neutral. Note that most Maine fresh surface waters are between 5.5 and 7.

PHOTOSYNTHESIS: The chemical reaction in plants that utilizes light energy from the sun to convert water and carbon dioxide into simple sugars. This reaction is facilitated by chlorophyll.

PLANKTON: Plants or animals that are freely moving about the water column.

POINT BAR: The accumulation of cobbles, gravels, sands, and silts deposited on the inside edge of a stream bend/meander.

POINT SOURCE POLLUTION: Pollution discharged directly from a specific site such as a municipal sewage treatment plant or industrial outfall pipe.

POLLUTION: The presence of matter or energy whose nature, location, or quantity produces undesired environmental effects.

POOL: A section of stream that is characterized by deep, low-velocity water and a smooth surface.

PRECISION: The ability to obtain the same result on the same sample.

PROTOCOL: Defined procedure.

R

RAPIDS: A reach of stream that is characterized by turbulent, high-velocity water (sometimes referred to as "whitewater").

REACH: A section of stream having relatively uniform physical attributes, such as valley confinement, valley slope, sinuosity, dominant bed material, and bed form.

REAGENT: A substance or chemical used to indicate the presence of a chemical or to induce a chemical reaction to determine the chemical characteristics of a solution.

REARING HABITAT: Areas in rivers or streams where juvenile fish find food and shelter to live and grow.

RESTORATION: The return of an ecosystem to a close approximation of its condition prior to disturbance.

RIFFLE: A reach of stream that is characterized by shallow, fast-moving water broken by the presence of rocks and boulders.

RIPARIAN BUFFER: The width of naturally vegetated (or recently planted) land adjacent to the stream between the top of the bank and the edge of other land uses. A buffer is largely undisturbed and consists of the trees, shrubs, groundcover plants, duff layer, and naturally uneven ground surface. The buffer serves to protect the water body from the impacts of adjacent land uses.

RIPARIAN ZONE: An area of land and vegetation adjacent to a stream that has a direct effect on the stream. This includes streambanks, woodlands, vegetation, and part (or all of) floodplains.

RIPPLE: (1) A specific undulated bed form found in sand bed streams. (2) Undulations or waves on the surface of flowing water.

RIPRAP: Rock or other material used to stabilize streambanks or riverbanks from erosion.

RIVER MILES: Generally, miles from the mouth of a river to a specific destination or, for upstream tributaries, from the confluence with the main river to a specific destination.

RIVER STAGE: The elevation of the water surface at a specified station above some arbitrary zero datum (level).

RIVERINE: Relating to, formed by, or resembling a river including tributaries, streams, brooks, etc.

ROOTWAD: The mass of roots associated with a tree adjacent to or in a stream that provides refuge for fish and other aquatic life.

RUN: A reach of stream characterized by moderately fast-flowing, low-turbulence water.

RUNOFF: The portion of rainfall, melted snow, or irrigation water that flows across the surface or through underground zones and eventually runs into streams.

S

SALMONIDS: Coldwater fish such as salmon, lake trout (togue), and brook trout.

SAND: Small substrate particles, generally from 0.062 to 2 mm (0.0024-0.08 in) in diameter. Sand is larger than silt and smaller than gravel.

SATURATED: Inundated; filled to the point of capacity or beyond.

SCOUR: The erosive action of running water in streams, which excavates and carries away material from the bed and banks. Scour may occur in both earth and solid rock material and can be classed as general, contraction, or local scour.

SEDIMENT: Soil or mineral material transported by water or wind and deposited in streams or other bodies of water.

SEDIMENTATION: (1) The combined processes of soil erosion, entrainment, transport, deposition, and consolidation. (2) Deposition of sediment.

SHEEN: The glimmering effect that oil has on water as light is reflected more sharply off the surface.

SILT: Substrate particles less then 0.062 mm (0.0024 in); smaller than sand.

SILTATION: The deposition or accumulation of fine soil particles.

SINUOSITY: The ratio of channel length to direct down-valley distance. Also may be expressed as the ratio of down-valley slope to channel slope. In other words, the degree to which a stream channel is "S" shaped.

SLOPE: The ratio of the change in elevation over distance.

SPAWNING: The depositing and fertilizing of eggs (or roe) by fish and other aquatic life.

STABLE CHANNEL: A stream channel with the right balance of slope, planform, and cross section to transport both the water and sediment load without net long-term bed or bank sediment deposition or erosion throughout the stream segment.

STRAIGHTENING: The removal of meander bends, often done in towns and along roadways, railroads, and agricultural fields.

STREAM: A general term for a body of water flowing by gravity; natural watercourse containing water at least part of the year.

STREAM BANKS: are features that define the channel sides and contain stream flow within the channel; this is the portion of the channel bank that is between the toe of the bank slope and the bankfull elevation. The banks are distinct from the streambed, which is normally wetted and provides a substrate that supports aquatic organisms. The top of bank is the point where an abrupt change in slope is evident, and where the stream is generally able to overflow the banks and enter the adjacent floodplain during flows at or exceeding the average annual high water.

STREAM CHANNEL: A long narrow depression shaped by the concentrated flow of a stream and covered continuously or periodically by water.

STREAM ORDER: A hydrologic system of stream classification. Each small unbranched tributary is a first-order* stream. Two first-order streams join to make a second-order stream. A third order stream has only first-and second-order tributaries, and so forth. *(Generally, these first-order streams typically are perennial, small, unbranched, solid-blue lines depicted on a U. S. Geological Survey 7.5 minute topographic map.)

STREAMBANK ARMORING: The installation of concrete walls, gabions, stone riprap, and other large erosion resistant material along stream banks.

STREAMBED: (1) The unvegetated portion of a channel boundary below the baseflow level. (2) The channel through which a natural stream of water runs or used to run, as a dry streambed.

SUBSTRATE: (1) The composition of a streambed, including either mineral or organic materials. (2) Material that forms an attachment medium for organisms.

SURFACE TENSION: The attraction of molecules to each other on a liquid's surface. Thus, a barrier is created between the air and the liquid.

SURFACE WATER: All waters whose surface is naturally exposed to the atmosphere, for example, rivers, lakes, reservoirs, ponds, streams, impoundments, seas, estuaries, etc., and all springs, wells, or other collectors directly influenced by surface water.

SUSPENDED SEDIMENT: Sediment suspended in a fluid by the upward components of turbulent currents, moving ice, or wind.

T

TAXON (plural: TAXA): A level of classification within a scientific system that categorizes living organisms based on their physical characteristics.

TAXONOMIC KEY: A quick reference guide used to identify organisms. They are available in varying degrees of complexity and detail.

THALWEG: (1) The middle, chief, or deepest part of a navigable channel or waterway. (2) The lowest thread along the axial part of a valley or stream channel.

TRIBUTARY: A stream that flows into another stream, river, or lake.

TURBIDITY: A measure of the content of suspended matter that interferes with the passage of light through the water or in which visual depth is restricted. Suspended sediments are only one component of turbidity.

W

WATER COLUMN: An imaginary, vertical column extending from just above its floor (benthic region) to its surface.

WATER QUALITY: A term used to describe the chemical, physical, and biological characteristics of water, usually in respect to its suitability for a particular purpose.

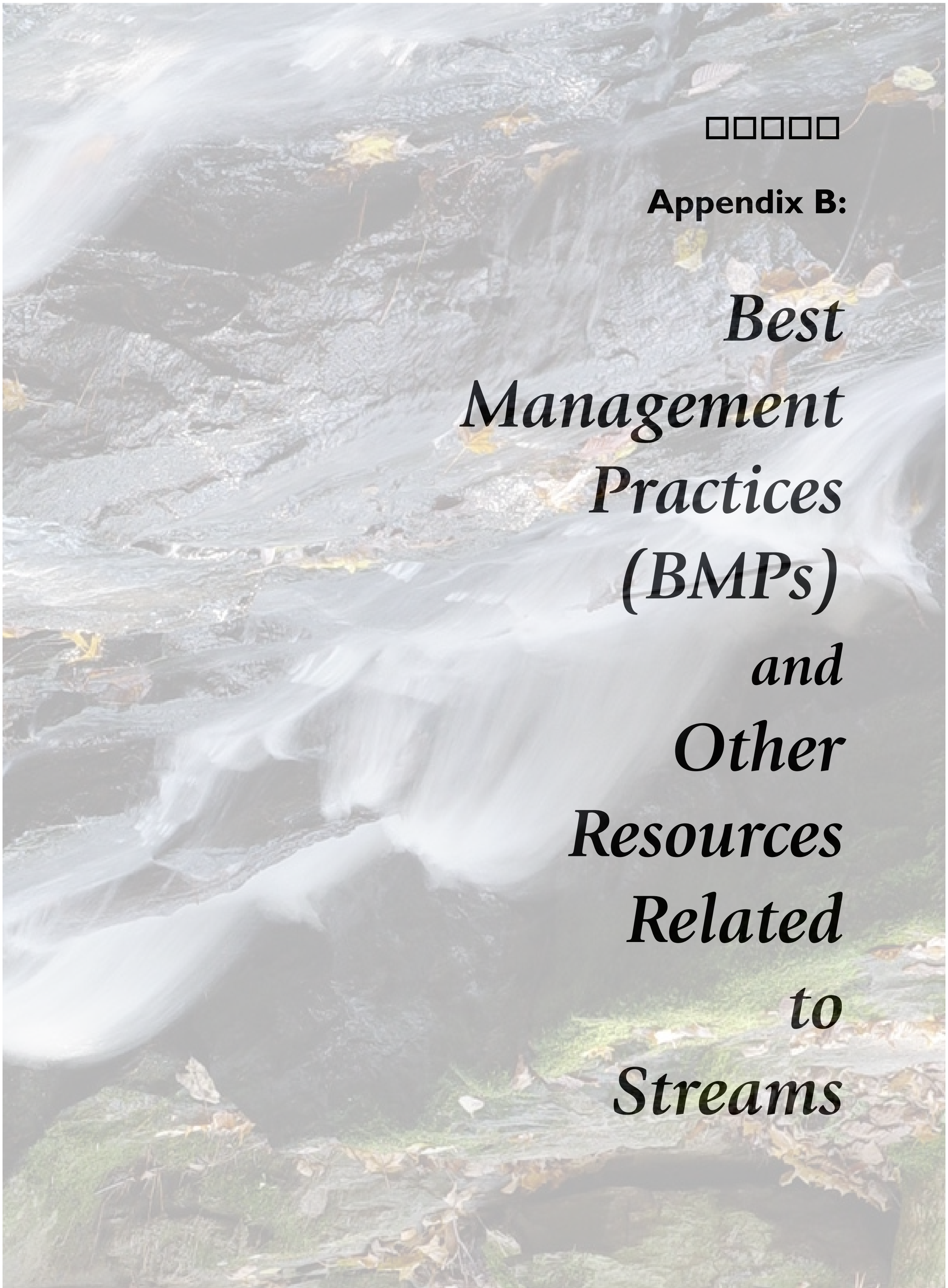
WATER QUALITY CRITERIA: Maximum concentrations of pollutants that are acceptable, if those waters are to meet water quality standards. Listed in state water quality standards.

WATER QUALITY STANDARDS: Written goals for state waters, established by each state and approved by EPA.

WATERFALL: A sudden, nearly vertical drop in a stream, as it flows over rock.

WATERSHED: The land area that drains into a given body of water.

WATERSHED MANAGEMENT: The analysis, protection, development, operation, or maintenance of the land, vegetation, and water resources of a drainage basin for the conservation of all its resources for the benefit of its residents.



Appendix B:

Best Management Practices (BMPs) and Other Resources Related to Streams

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Best Management Practices (BMPs) and Other Resources Related to Streams

Maine DEP: EROSION AND SEDIMENTATION CONTROL BMPS

Includes information on vegetated riparian buffers, erosion control, streambank stabilization, etc.

- http://www.maine.gov/dep/blwq/docstand/escbmps/index.htm

Maine DEP: RIPARIAN BUFFER RESOURCES PAGE

Links to a number of resources related to an important BMP: riparian buffers. Managed by the Maine Stream Team Program.

- http://www.maine.gov/dep/blwq/docstream/team/riparian.htm

Maine DEP: STORMWATER BEST MANAGEMENT PRACTICES MANUAL

Includes information on pollution prevention, low impact development, and stormwater design considerations.

- http://www.maine.gov/dep/blwq/docstand/stormwater/stormwaterbmps/index.htm

Maine DEP :WATERSHED PUBLICATIONS AND RELATED MATERIALS

Includes fact sheets and other resources related to conservation practices (including installation tips) for homeowners on issues such as construction BMPs, infiltration trenches, live taking (with plants), paths and walkways, planting vegetation, rain gardens, turnouts, waterbars, etc.

Also includes resources related to vegetated buffers and stormwater issues (www.ThinkBlueMaine.org).

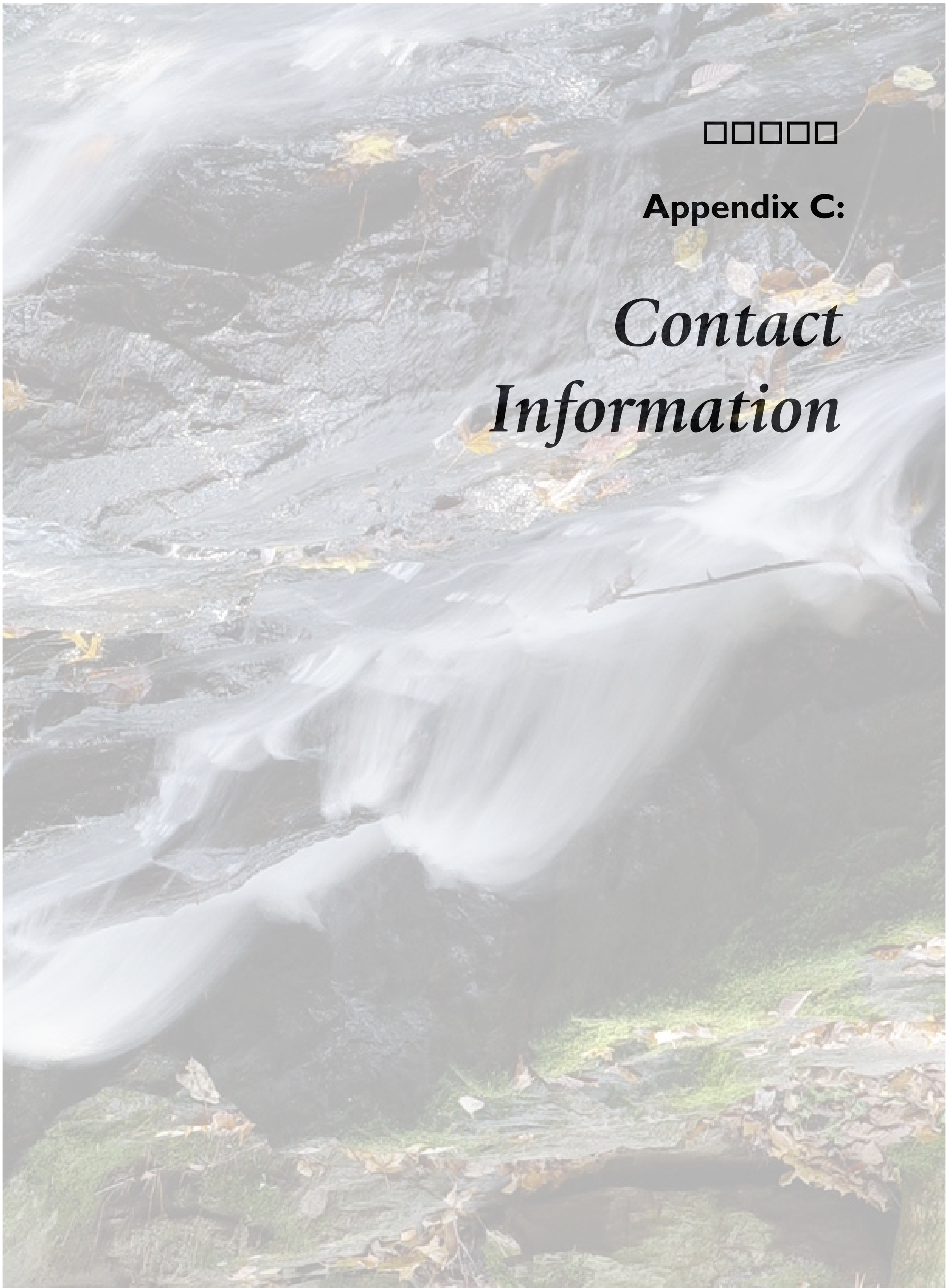
Links to other BMPs related to camp roads, boatyards, septic systems.

- http://www.maine.gov/dep/blwq/docwatershed/materials.htm

Project SHARE:
BMP GUIDELINES FOR ROADS IN ATLANTIC SALMON WATERSHEDS

Produced by Project SHARE.

- http://www.salmonhabitat.org/outreach/bmp_guide.html



Appendix C:

Contact Information

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Contact Information

This appendix lists websites containing contact information for various organizations that may be able to help you out with various aspects of a stream survey. This is not an exhaustive list. Contact the Maine Stream Team Program for additional organizations that may be located in your local area.

State Agencies

- **Maine Atlantic Salmon Commission**
  http://www.maine.gov/asc/

- **Maine Department of Environmental Protection (MDEP)**
  http://www.maine.gov/dep/
  - **Maine Stream Team Program**
    http://www.maine.gov/dep/blwq/docstream/team/streamteam.htm

- **Maine Department of Inland Fisheries and Wildlife**
  http://www.maine.gov/ifw/

- **Maine Department of Marine Resources**
  http://www.maine.gov/dmr/index.htm

- **Maine Geological Survey**
  http://www.maine.gov/doc/nrimc/mgs/mgs.htm

- **Maine Land Use Regulatory Commission**
  http://www.maine.gov/doc/lurc/index.shtml

- **Maine Office of GIS (Geographic Information Systems)**
  http://megis.maine.gov/

- **Maine Stream Team Program**
  See Maine Department of Environmental Protection.

Federal Agencies

- **US Environmental Protection Agency**
  http://www.epa.gov/

- **US Fish and Wildlife Service (Gulf of Maine Program)**
  http://www.fws.gov/northeast/gulfofmaine/

- **US Geological Survey**
  http://www.usgs.gov/

- **USDA Natural Resources Conservation Service (Maine Offices)**
  http://www.me.nrcs.usda.gov/

Regional and Non-Profit Organizations / Academic Resources

Additional Helpful Organizations (compiled by the Maine Stream Team Program)
http://www.maine.gov/dep/blwq/docstream/team/gateway.htm

- **Atlantic Salmon Federation**
  http://www.asf.ca/

- **(County) Soil & Water Conservation Districts / Maine Assoc. of Conservation Districts**
  http://maineswcds.org/

- **Downeast Salmon Federation**
  http://mainesalmonrivers.org/

- **Gulf of Maine Research Institute**
  http://octopus.gma.org/

- **Izaak Walton League of America**
  http://www.iwla.org/ -or- http://www.iwlamaine.org/

- **Maine Environmental Monitoring and Assessment Program Index (MEMAP)**
  http://memapindex.org/

- **Maine Rivers**
  http://www.mainerivers.org/

- **Maine Shore Stewards**
  http://www.umaine.edu/umext/ssteward/

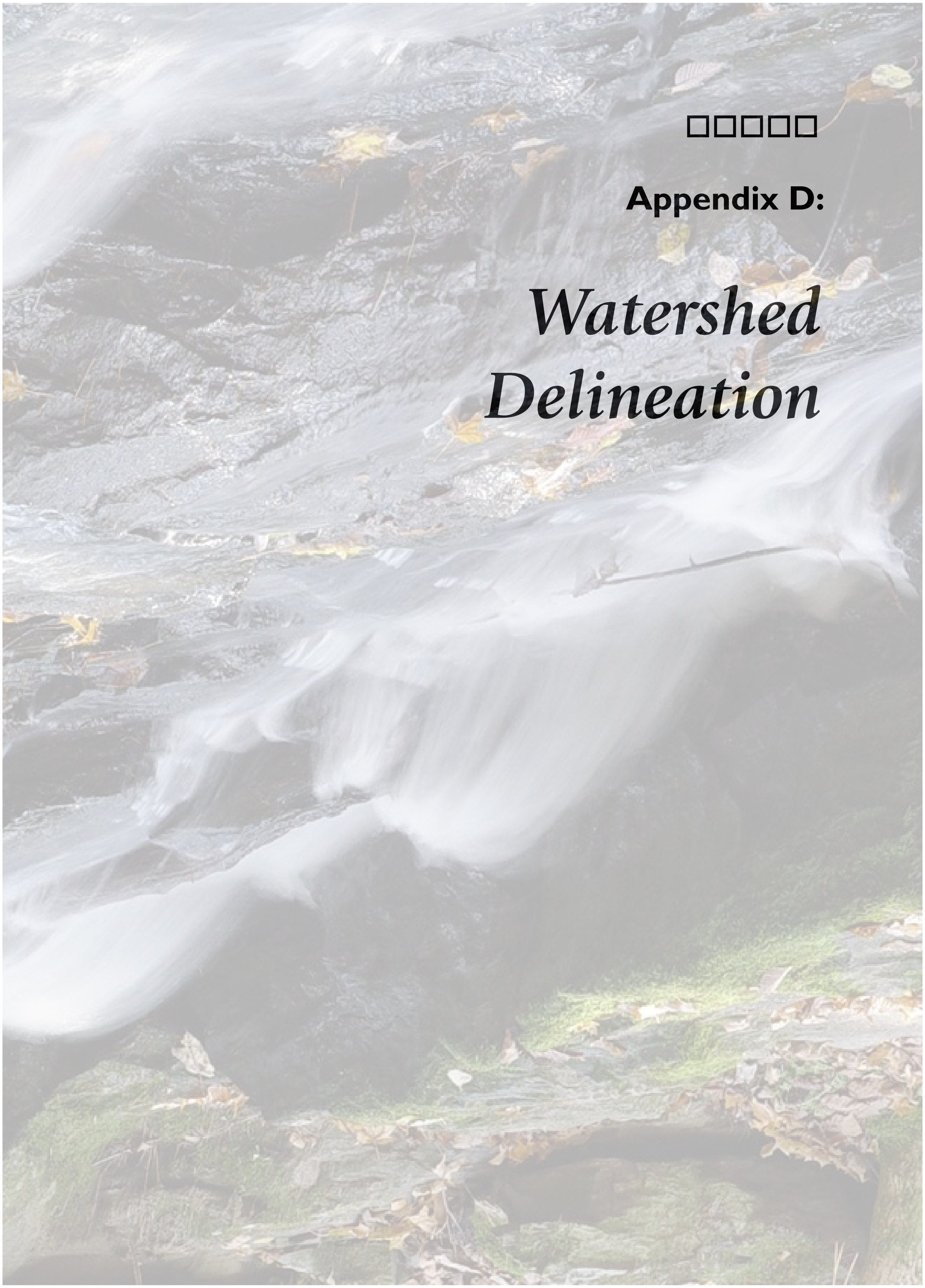
- **Maine Watershed Web (Bowdoin College)**
  http://learn.bowdoin.edu/apps/hydrology/watersheds/

- **Project SHARE — Salmon Habitat And River Enhancement**
  http://www.salmonhabitat.org/

- **Trout Unlimited**
  http://www.tu.org/ -or- http://tumaine.org/

- **University of Maine - Cooperative Extension — Water Quality**
  http://www.umaine.edu/waterquality/

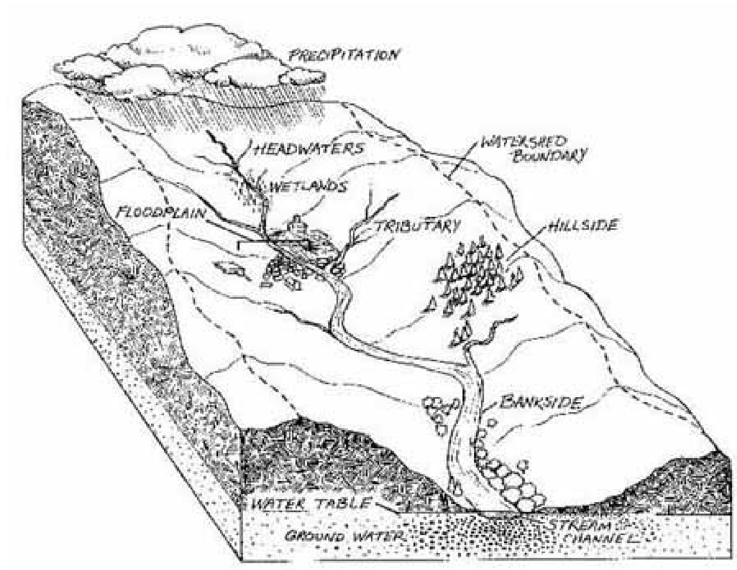
- **University of Maine — Senator George J. Mitchell Center**
  http://www.umaine.edu/WaterResearch/
    - **PEARL** (Environmental database hosted by the University of Maine, Senator George J. Mitchell Center)
      http://pearl.maine.edu/default.htm



Appendix D:

Watershed Delineation

Appendix D:
Watershed Delineation



Imagine a watershed as an enormous bowl. As water falls onto the bowl's rim, it either flows down the inside of the bowl or down the outside of the bowl.

The rim of the bowl or the watershed boundary is sometimes referred to as the ridgeline or watershed divide. This ridge line separates one watershed from another.

Topographic maps created by the United States Geological Survey (USGS 7.5 minute series) can help you to determine a watershed's boundaries.

Topographic maps have a **scale of 1:24,000** (which means that one inch measured on the map represents 24,000 inches [2000'] on the ground). They also have **contour lines** that are usually shown in increments of ten or twenty feet. ***Contour lines represent lines of equal elevation,*** which typically is expressed in terms of feet above mean sea level. As you imagine water flowing downhill, imagine it crossing the contour lines perpendicularly.

We describe basic topographic map concepts and symbols below, but more information can be found at the U. S. Geological Survey's website on Topographic Map Symbols:

- http://erg.usgs.gov/isb/pubs/booklets/symbols/index.html — or
- http://erg.usgs.gov/isb/pubs/booklets/symbols/topomapsymbols.pdf

Here's how you can delineate a watershed:

STEP 1:

Use a topographic map(s) to locate the river, lake, stream, wetland, or other waterbodies of interest. *(See the example, West Branch of Big River, in* ***Figure D-1.)***

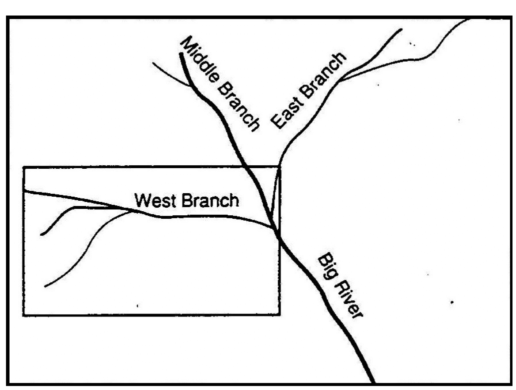


Figure D-1: West Branch of Big River

STEP 2:

Trace the watercourse from its source to its mouth, including the tributaries ***(Figure D-2).*** This step determines the general beginning and ending boundaries.

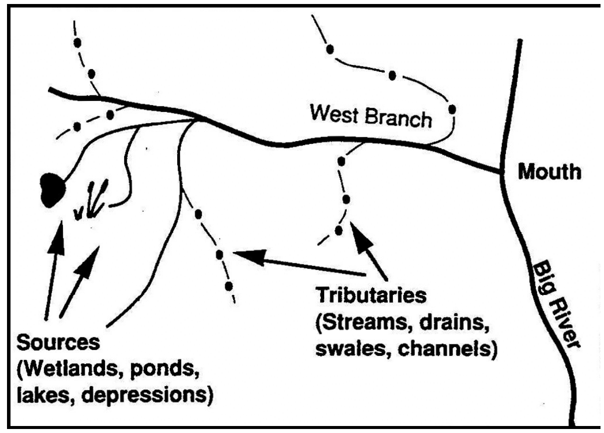


Figure D-2: West Branch subwatershed

STEP 3:

Examine the **brown lines** on the topographic map that are near the watercourse. These are referred to as contour lines. **Contour lines connect all points of equal elevation above or below a known reference elevation.**

• The dark brown contour lines (thick lines) will have a number associated with them, indicating the elevation.

• The light brown contour lines (thin lines) are usually mapped at 10 (or 20) foot intervals, and the dark brown (thick) lines are usually mapped at 50 (or 100) foot intervals. Be sure to check the map's legend for information on these intervals.

• To determine the final elevation of your location, simply add or subtract the appropriate contour interval for every light brown (thin) line, or the appropriate interval for every dark brown (thick) line. *Figure D-3* shows a point (X) at an elevation of 70 feet above mean sea level.

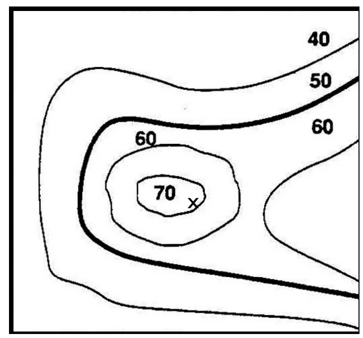


Figure D-3: Contour lines and an example point (X) at an elevation of 70 feet above sea level.

STEP 4:

• Contour lines spaced far apart indicate that the landscape is more level and gently sloping (i.e., they are flat areas). Contour lines spaced very close together indicate dramatic changes (rise or fall) in elevation over a short distance (i.e., they are steep areas) ***(Figure D-4)***.

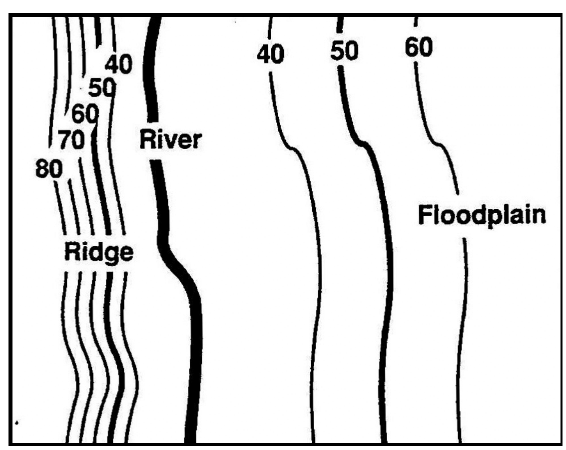


Figure D-4: Floodplains and ridges

STEP 5:

Check the slope of the landscape by locating two adjacent contour lines and determine their respective elevations. The slope is calculated as the change in elevation, along a straight line, divided by the distance between the endpoints of that line.

• A depressed area (valley, ravine, swale) is represented by a series of contour lines "pointing" towards the highest elevation *(Figure D-5).*

• A higher area (ridge, hill) is represented by a series of contour lines "pointing" towards the lowest elevation *(Figure D-6)*.

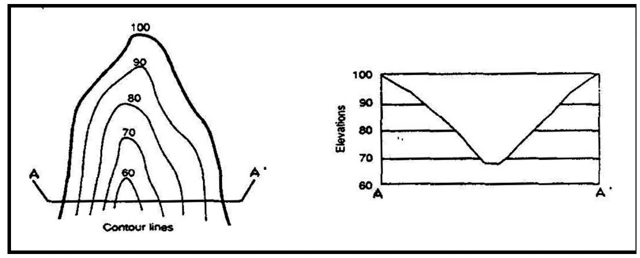


Figure D-5: Valley

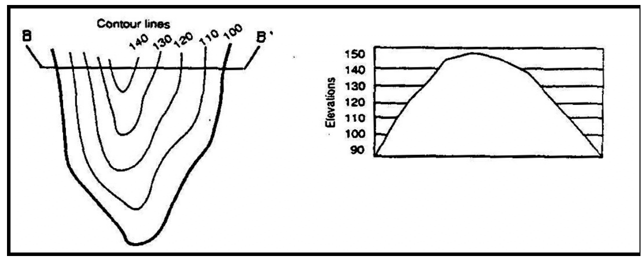


Figure D-6: Ridge

STEP 6:

Determine the direction of drainage in the area of the waterbody by drawing arrows perpendicular to a series of contour lines that decrease in elevation. Stormwater runoff seeks the path of least resistance as it travels downslope. The "path" is the shortest distance between contours, hence a perpendicular route *(Figure D-7)*.

Mark the break points surrounding the waterbody. The "break points" are the highest elevations where half of the runoff would drain towards one body of water, and the other half would drain towards another body of water **(Figure D-8)**.

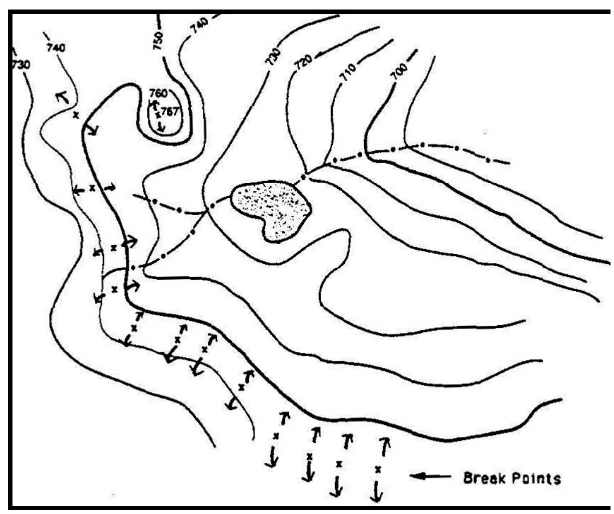


Figure D-7: Direction of drainage

STEP 8: IDENTIFY BREAK POINTS

Connect the break points with a line following the highest elevations in the area. The completed line represents the boundary of the watershed ***(Figures D-8 and D-9)***.

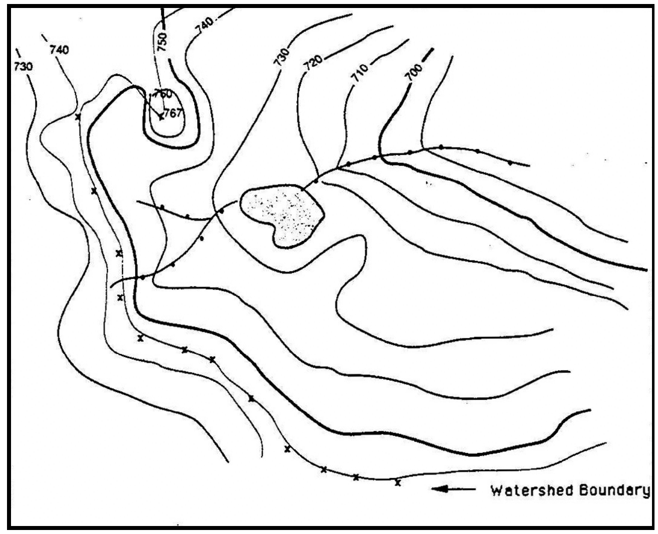


Figure D-8: Watershed Boundary

STEP 9:

Once you've outlined the watershed boundaries on your map, imagine a drop of rain falling on the surface of the map. Imagine the water flowing down the slopes as it crosses contour lines at right angles.

Follow its path to the nearest stream that flows to the water body you are studying. Imagine this water drop starting at different points on the watershed boundaries to verify that the boundaries are correct.

STEP 10:

Distribute copies of your watershed map to your group.

STEP 11:

Watersheds sometimes have what are termed subwatersheds within them. Rivers, large streams, lake, and wetland watershed often have more than one subwatershed (usually smaller tributary watersheds) within them.

Generally, the larger the waterbody you are examining, the more subwatersheds you will find. Your watershed map can be further divided into smaller sections or subwatersheds if it helps organize your study better.

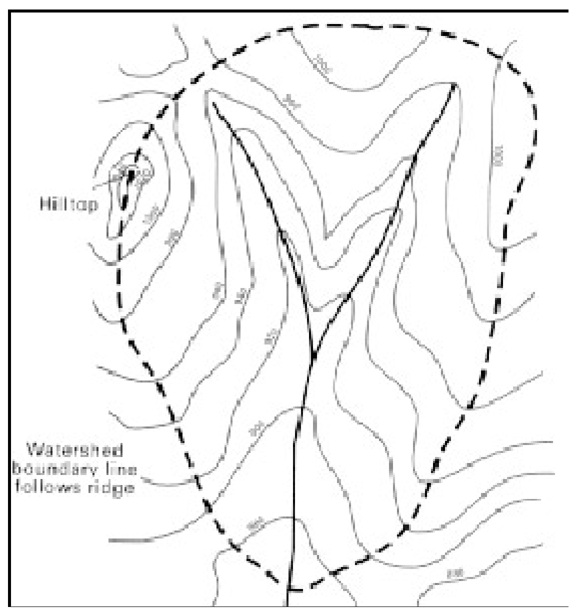
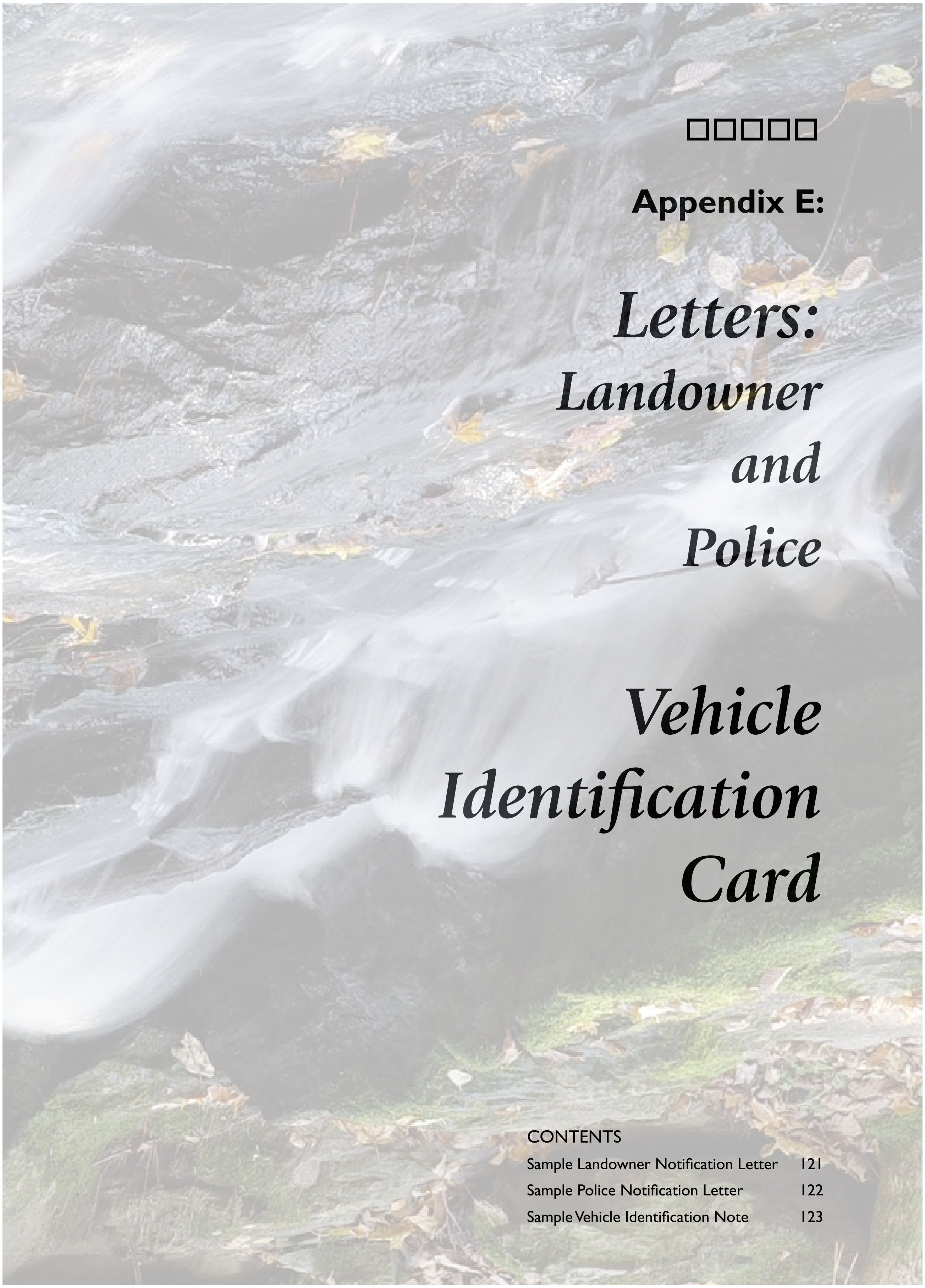


Figure D-9: Idealized Watershed Boundary

(Adapted from Ammann, Allen, and Amanda Lindley Stone, Method for the Comparative Evaluation of Nontidal Wetlands in New Hampshire. 1991, from New Hampshire Department of Environmental Services.)

STEP 12:

Once the watershed and subwatershed (optional) boundaries have been delineated on the map, your team can verify them in the field, if necessary.



Appendix E:

Letters: Landowner and Police

Vehicle Identification Card

CONTENTS

Appendix E:

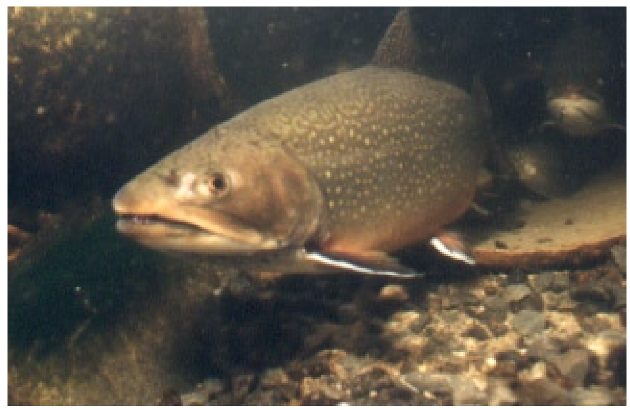
Letters: Landowners, Police Vehicle Identification Note

These sample outreach materials can help volunteer groups get the word out about survey events to landowners, police, and other relevant authorities.

This appendix also provides a sample note for placing on volunteers' vehicles in order to inform the public about the event.

These materials can help reduce the chances of landowners and others getting upset about volunteers trekking around the watershed by providing educational information about the event.

This outreach may also sometimes generate additional volunteers for the project.



SAMPLE
LANDOWNER NOTIFICATION LETTER

Useful for either a Stream Corridor Survey or Stream Watershed Survey:

- **SCS** = language to use for a Stream Corridor Survey;
- **WS** = language to use for a stream Watershed Survey.

(Modify this letter to fit your own situation.)

Date

Dear Landowner:

The Wilson Stream Association is working with the county's Soil and Water Conservation District to address water quality issues in the Wilson Stream watershed. Soil and polluted stormwater runoff entering the stream, and lack of vegetation along the stream, are having a negative impact on water quality and stream habitats.

The association, district, and volunteers will be conducting a [[(for SCS) Stream Corridor Survey / (for WS) Watershed Survey]] of Wilson Stream. The anticipated dates of this survey are September 14-15, barring significant rain. The rain-dates are September 21-22.

The purpose of the survey is to document threats to water quality [[(for SCS) and potentially high-quality or degraded stream habitats]]. This information will be used to prioritize protection efforts, work with landowners to develop solutions, and ultimately protect and improve water quality and aquatic habitat. We will conduct this field work over the next couple of months and then work with our partners to evaluate the information and prioritize sites. A report should be completed by next spring.

[for SCS]

This letter is a notification that, as an abutter, you may see people walking in and around the stream. If you do not want us to cross your land, please contact me at the address below or call me at 555-1212.

[for WS]

We would like to include your land in the survey, but we will respect your property lines if your do not wish to participate. Please contact me at the address below or call me at 555-1212 if you do not want us to cross your land.

Please feel free to contact me if you have any questions about the project, or would like to know how you can become involved.

Sincerely,

Wilson Stream Association
ADDRESS...

SAMPLE
POLICE NOTIFICATION LETTER

Useful for either a Stream Corridor Survey or Stream Watershed Survey:

- **SCS** = language to use for a Stream Corridor Survey;
- **WS** = language to use for a stream Watershed Survey.

(Modify this letter to fit your own situation.)

Date

Dear Chief of Police *(or whatever is appropriate):*

The Wilson Stream Association is working with the county's Soil and Water Conservation District to address water quality issues in the Wilson Stream watershed. Soil and polluted stormwater runoff entering the stream, and lack of vegetation along the stream, are having a negative impact on water quality and stream habitats.

We wanted to notify your department of the following activity in order to reduce confusion or apprehension in the town. The association, district, and volunteers will be conducting a [**(for SCS)** Stream Corridor Survey / **(for WS)** Watershed Survey] of Wilson Stream. The anticipated dates of this survey are September 14-15, barring significant rain. The rain-dates are September 21-22.

The purpose of the survey is to document threats to water quality [[(for SCS) and potentially high-quality or degraded stream habitats]]. This information will be used to prioritize protection efforts, work with landowners to develop solutions, and ultimately protect and improve water quality and aquatic habitat. We will conduct this field work over the next couple of months and then work with our partners to evaluate the information and prioritize sites. A report should be completed by next spring.

Town residents may see people walking in and around the stream or nearby properties. We have sent out notification letters to landowners in the region. We hope that they have reached everybody and we hope that they will read them. We gave these folks our phone number and an opportunity to have us not cross their land. If you have any questions, feel free to contact me at the address below or call me at 555-1212.

Sincerely,

Wilson Stream Association
ADDRESS...

SAMPLE
VEHICLE IDENTIFICATION CARD

NEQUASSET BROOK SURVEY

IN PROGRESS

October 19, 2007

THE OWNER OF THIS CAR IS INVOLVED WITH THE SURVEY.

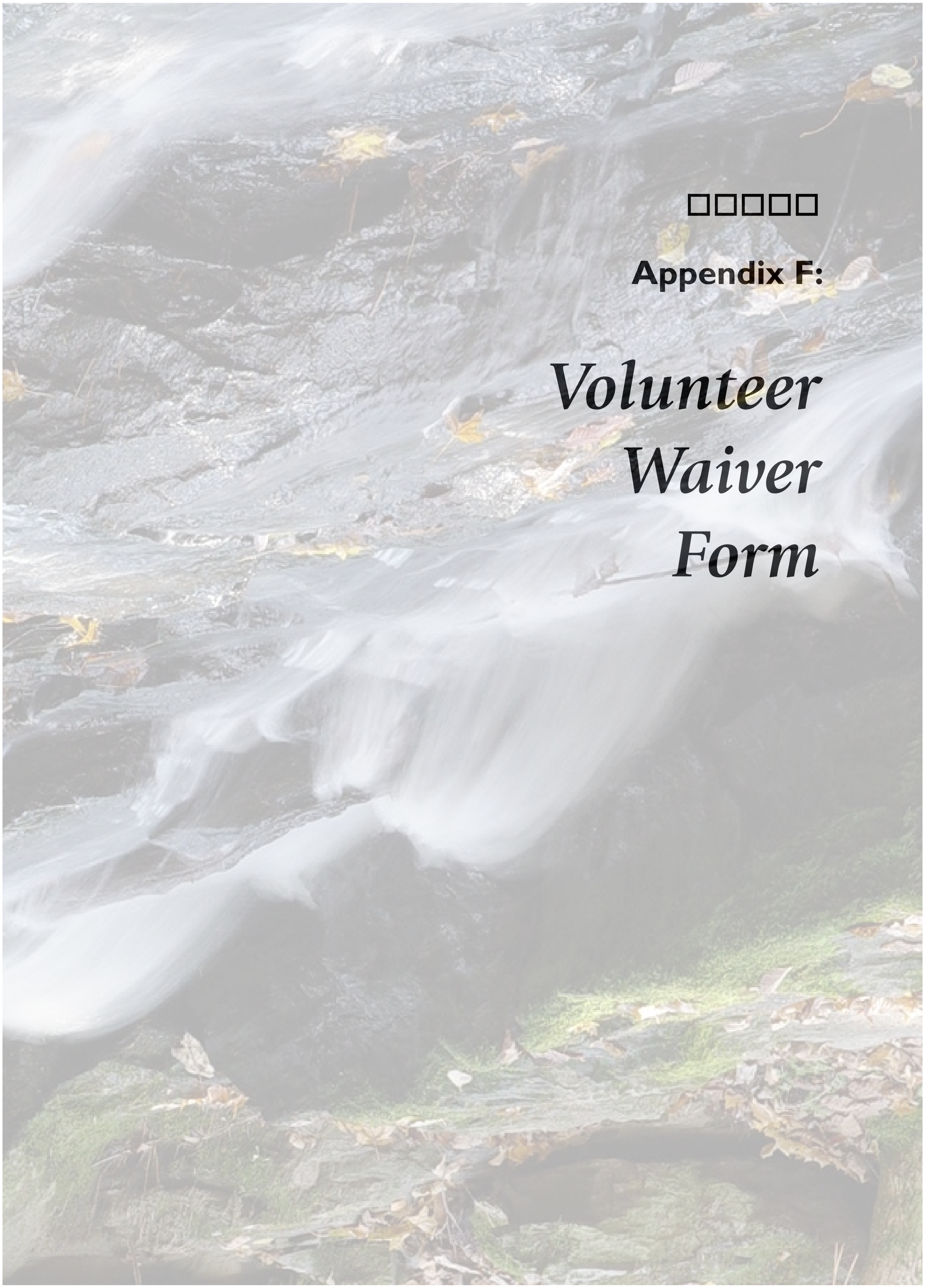
PARTNER ORGANIZATIONS INVOLVED:

Nequasset Lake Stakeholders

Androscoggin Valley Soil & Water Conservation District

Maine DEP

Community Volunteers



Appendix F:

Volunteer Waiver Form

Appendix F

Sample Volunteer Waiver Form

WAIVER OF LIABLILITY

(Association/Group)

Participant Information and Hold Harmless Form

Your Name: ______________________________ Survey Area: ____________________________

Address: ____

Dates of Survey: ___________________________

The watershed survey in which you are invited to participate has inherent risks associated with it. Although *(Association/Group)* has taken steps to assure that the survey is conducted in a safe manner, it is imperative that you take personal responsibility for your safety. We ask that you take the following steps:

1. Provide the (Association/Group) with relevant information about your skill level, capability and health.
2. Follow the direction of the (Association/Group) in their efforts to ensure a goal of safety for everyone involved. This may require changing plans or possibly canceling the survey.
3. Provide the information requested below to the (Association/Group) prior to participation in the survey.
4. If the (Association/Group) asks that you do not participate in an activity, please understand that this decision is made to protect you, other participants, and (Association/Group).

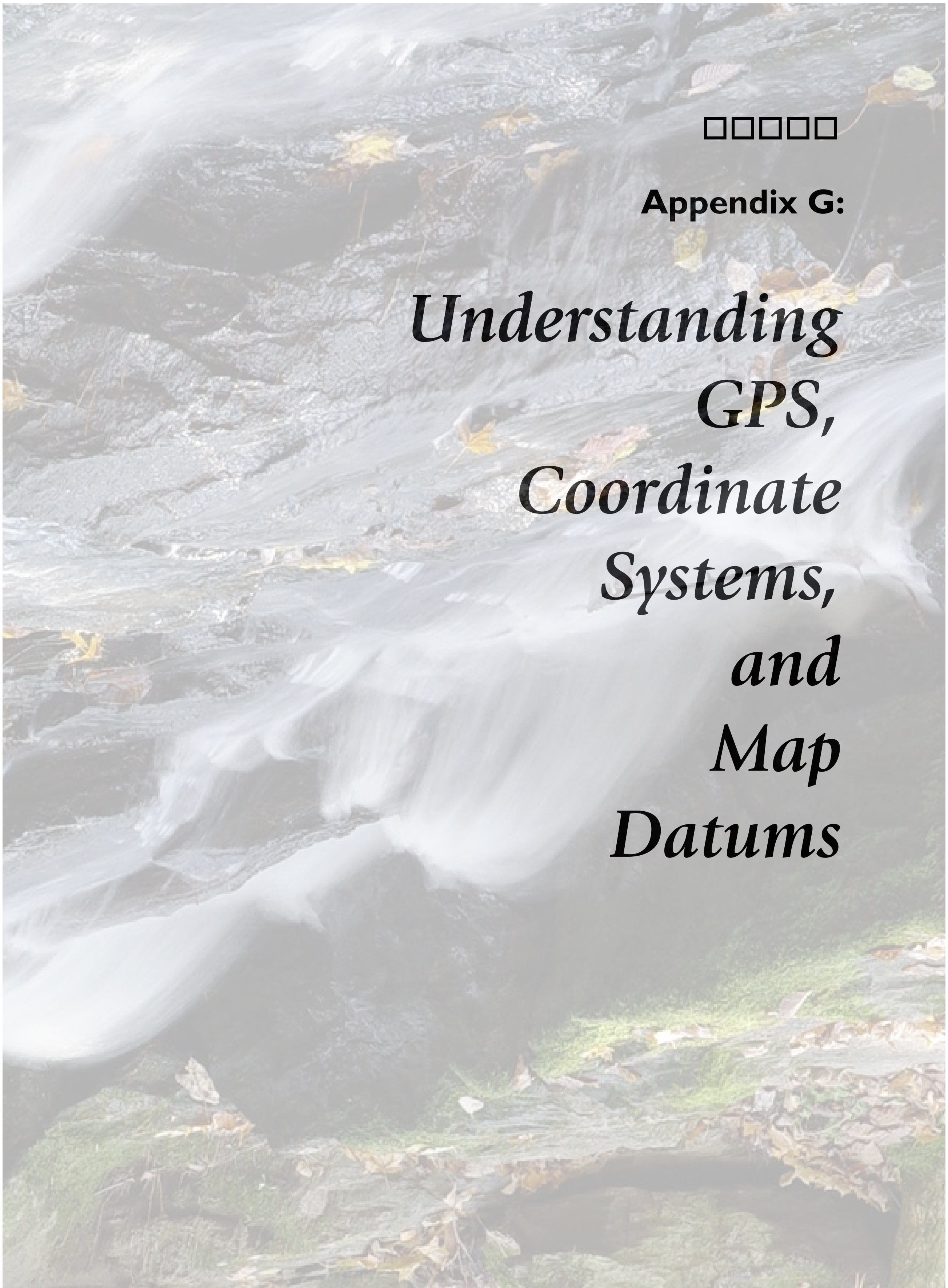
I hereby hold (Association/Group) , its agents and employees harmless from and all liability for damages from my action, including, but not limited to, my selection and use of equipment, and I hereby accept full responsibility for any and all such damages or injury which may result.

Signature ____ Date _________________________

Relevant Information:

1. Do you have personal medical insurance? [] Yes [] No
   If "Yes," Name of Company ____
2. Whom should (Association/Group) contact in an emergency?
   Name _________________________________ Name ________________________________
   Phone Numbers ________________________ Phone Numbers________________________
   Relationship ___________________________ Relationship ___________________________
3. Pertinent Medical History:
   - Do you have any known allergies? Describe. ____
   - Are you currently taking any medication? Describe ____
   - Do you have a history of medical problems? Describe ____

   Physical agility ***(Initial all that apply to you):***
   - I am capable of walking on relatively smooth, even terrain, such as gently sloping lawns and dirt roads. ______
   - I am capable of climbing down (and back up) short sections of relatively steep or uneven terrain such as stream banks, drainage ditches, or furrowed fields. ______
   - I am capable of hiking up and down long sections of uneven or relatively steep terrain such as hillsides. ______
   - I am capable of walking along slippery, shifting, and/or highly uneven terrain such as rocky stream bottoms. ______



Appendix G:

Understanding GPS, Coordinate Systems, and Map Datums

Appendix G

Understanding GPS, Coordinate Systems, and Map Datums

If you are going to bring a GPS (global positioning system) unit with you when you do your stream habitat survey, make sure to familiarize yourself with its functions. The owner's manual should provide you with some good information.

- **Make sure that your GPS's map *datum*[1] is set to WGS84a.** (NAD83 is a fairly acceptable alternative, but NAD27 will cause coordinates to be erroneous.) This is the default setting on many GPS units nowadays, although it is important to check your model and user's manual.
- **Make sure that your GPS's geographic coordinate system is set to either the UTM (Universal Transverse Mercator) or Latitude & Longitude system**. Some examples of what UTM and Lat/Long readings look like are provided in Table G-1 below. **The most important thing you can do is to be sure to write down all the coordinate numbers that are shown on your GPS unit.** If you round off your numbers, we might not be able to tell whether you're in Kittery or Presque Isle.
- **The UTM zone for the state of Maine is Zone 19 (north).** Some units may display a "T" after the "19". These coordinates are simply the number of meters in each direction from the southwest corner (coordinates 0 E / 0 N) of a rectangle that defines the extent of UTM Zone 19 North.

SCS DATASHEET TYPES:

There are two SCS datasheet set types available: UTM Zone 19 and Latitude/ Longitude. The **UTM system is preferred** because that is what most Maine state agencies use (including Maine DEP and Maine DIF&W), however Lat/Long is still an option.

GPS ERROR:

All GPS units have some error associated with them. The older and less expensive the unit, the greater the room for error (consult with your user's manual). Additionally, if someone is measuring in units of degrees-minutes-seconds *(Latitude and Longitude)*, accuracy is decreased by an additional (roughly) 100 feet unless decimal seconds are used (e.g., coordinates having one decimal place after the "seconds" number). A good method to reduce error is to wait as long as possible after powering up so your unit can be receiving as many satellites as possible. Most models indicate how many satellites they are receiving at any given time.

GPS users should be forewarned that in dense tree canopies, ravines, or canyons, more time is needed to acquire satellites and, thus, geographic coordinates.

FOR MORE INFORMATION:

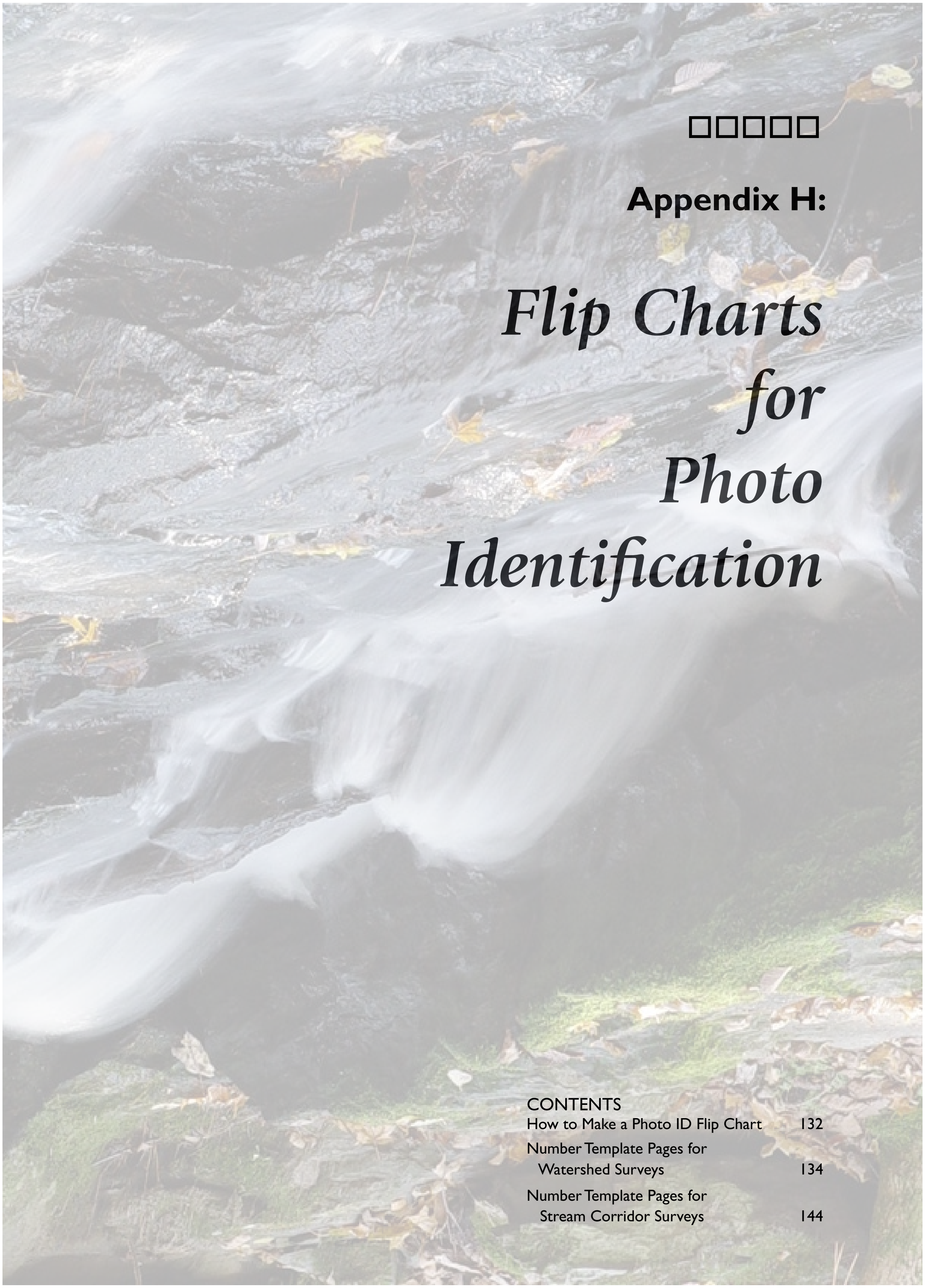
For more information about coordinate systems, mapping, projections, and GPS basics, visit these websites (and click on exercises such as Intro to GPS, Topographic Maps, or GIS Primer):

- http://education.usgs.gov/
- http://geology.isu.edu/geostac/
- http://infodome.sdsu.edu/research/guides/maps/basics.shtml.

Table G-1:
Examples of Latitude/Longitude and UTM coordinate data

X COORDINATE	Y COORDINATE	COORDINATE SYSTEM
70º 16′ 49.3″ (W; longitude)	43º 41′ 18.0″ (N; latitude)	Latitude/Longitude (degrees/minutes/seconds)
70º 16.822′ (W; longitude)	43º 41.300 (N; latitude)	Latitude/Longitude (degrees/decimal minutes)
0396812 (easting)	4838054 (northing)	UTM, Zone 19

[1]A datum describes the model that was used to match the location of features on the ground to coordinates and locations on the map. The Global Positioning System uses an earth centered datum called the World Geodetic System 1984 or WGS 84. WGS 84 was adopted as a world standard from a datum called the North American Datum of 1983 or NAD 83. Most USGS topographic maps are based on an earlier datum called the North American Datum of 1927 or NAD 27. In the Continental United States the difference between WGS 84 and NAD 27 can be as much as 200 meters.



□□□□□

Appendix H:

Flip Charts for Photo Identification

CONTENTS

Appendix H:

Flip Charts for Photo Identification

How to Make a Photo ID Flip Chart

Linking watershed survey or stream corridor survey photographs with the site or reach where they were taken is much simplified by including the site or reach number in each picture. This also has the added benefit of providing scale to the picture. These photo-tracking flip charts involve a few simple steps to make:

- Print out one copy of the photo flip chart pages for each volunteer group. Use heavy paper so that you can use the flipchart multiple times. Laminating the sheets may help them last longer. *(Section WS in this Appendix includes Watershed Surveys. Section SCS includes templates for Stream Corridor Surveys.)*
- Have each set of numbers bound with a plastic comb binding (check with participating schools, businesses, or local printing/copying companies for availability) with two layers of cardboard (so it will stand upright when placed on the ground and also be more durable).
- Cut all layers of numbers (not cardboard) apart in thin strips, where indicated by dotted (or gray) lines in ***Figure 1***, so that each strip can be turned independent of its neighbors.

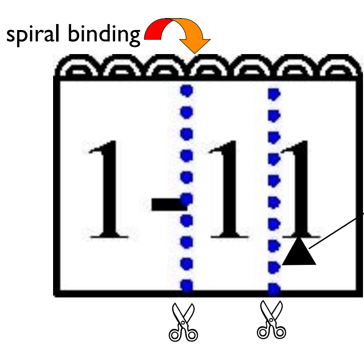
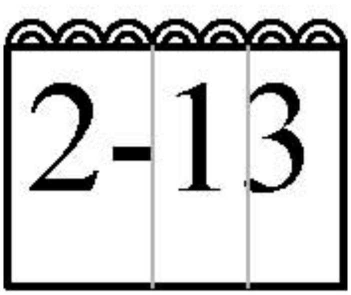


Figure 1.
Dotted (or gray) lines indicate where to make cuts on each sheet of numbers.

To use the flip chart:

WATERSHED SURVEY STYLE

The first number (before the dash) represents the sector number in which the picture was taken. The number after the dash represents the site number within that sector. So for example, if volunteers assigned to Sector 2 were writing up their 13th site within the sector, EACH picture they took at that particular site would include the flip chart set as shown in the ***Figure 2.***



NOTE: Because the flipchart number represents a site number and not a photograph number, you may have multiple photographs identified with the same flipchart numbers (and therefore associated with the same site). Volunteers should make a note on their site datasheet of the number and content of photographs taken at that given site.

Figure 2.
An example of a (watershed survey) photo flip chart used in Sector 13 at Site 13.

STREAM CORRIDOR SURVEY STYLE

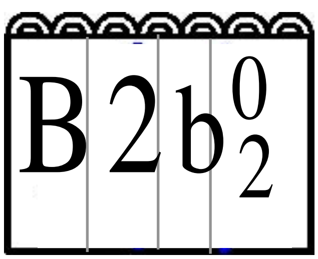


Figure 3 shows an example of a photo flip chart used to indicate a photo taken at Tributary B, Reach 2, Subreach b, Photo # 02. See Unit 3 for a detailed description of what these various terms mean and how various stream reaches are named or coded.

Figure 3.
An example of a (stream corridor survey) photo flip chart used for a site at Tributary B, Reach 2, Sub reach* b, (Photo # 02).

*(**NOTE:** Sub-reaches are only needed every once in a while, so this letter will only be needed occasionally, thus making the flip chart look simpler.)

Watershed Survey Number Templates

1-11

2-22

3-33

4-44

5-55

99-9

7-77

∞

∞

|

∞

9-99

00-0

Stream Corridor Survey Number Templates

Mainstem / Tributary ID	Reach #	Subreach	Photo #
A	1	a	-01

Mainstem / Tributary ID	Reach #	Subreach	Photo #
B	2	b-	02

Mainstem / Tributary ID	Reach #	Subreach	Photo #
C	3	c	-03

Mainstem / Tributary ID	Reach #	Subreach	Photo #
D	4	d	-04

Mainstem / Tributary ID	Reach #	Subreach	Photo #
E	5	e	-05

Mainstem / Tributary ID	Reach #	Subreach	Photo #
F	6	f	-06

G	7	g	-07
Mainstem / Tributary ID	Reach #	Subreach	Photo #

Mainstem / Tributary ID	Reach #	Subreach	Photo #
H	8	h	-088

Mainstem / Tributary ID	Reach #	Subreach	Photo #
I	9	i	-09

Mainstem / Tributary ID	Reach #	Subreach	Photo #
J	10	j	-10

Mainstem / Tributary ID	Reach #	Subreach	Photo #
K	11	k	-11

L	12	-	1 2
Mainstem / Tributary ID	Reach #		Photo #

M	13	-	13
Mainstem / Tributary ID	Reach #		Photo #

N	14	-	14
Mainstem / Tributary ID	Reach #		Photo #

P	15	-	15
Mainstem / Tributary ID	Reach #		Photo #

Mainstem / Tributary ID	Reach #		Photo #
Q	16	-	16

Mainstem / Tributary ID	Reach #		Photo #
R	17	-	17

S	18	-	108
Mainstem / Tributary ID	Reach #		Photo #

Mainstem / Tributary ID	Reach #		Photo #
T	19	-	19

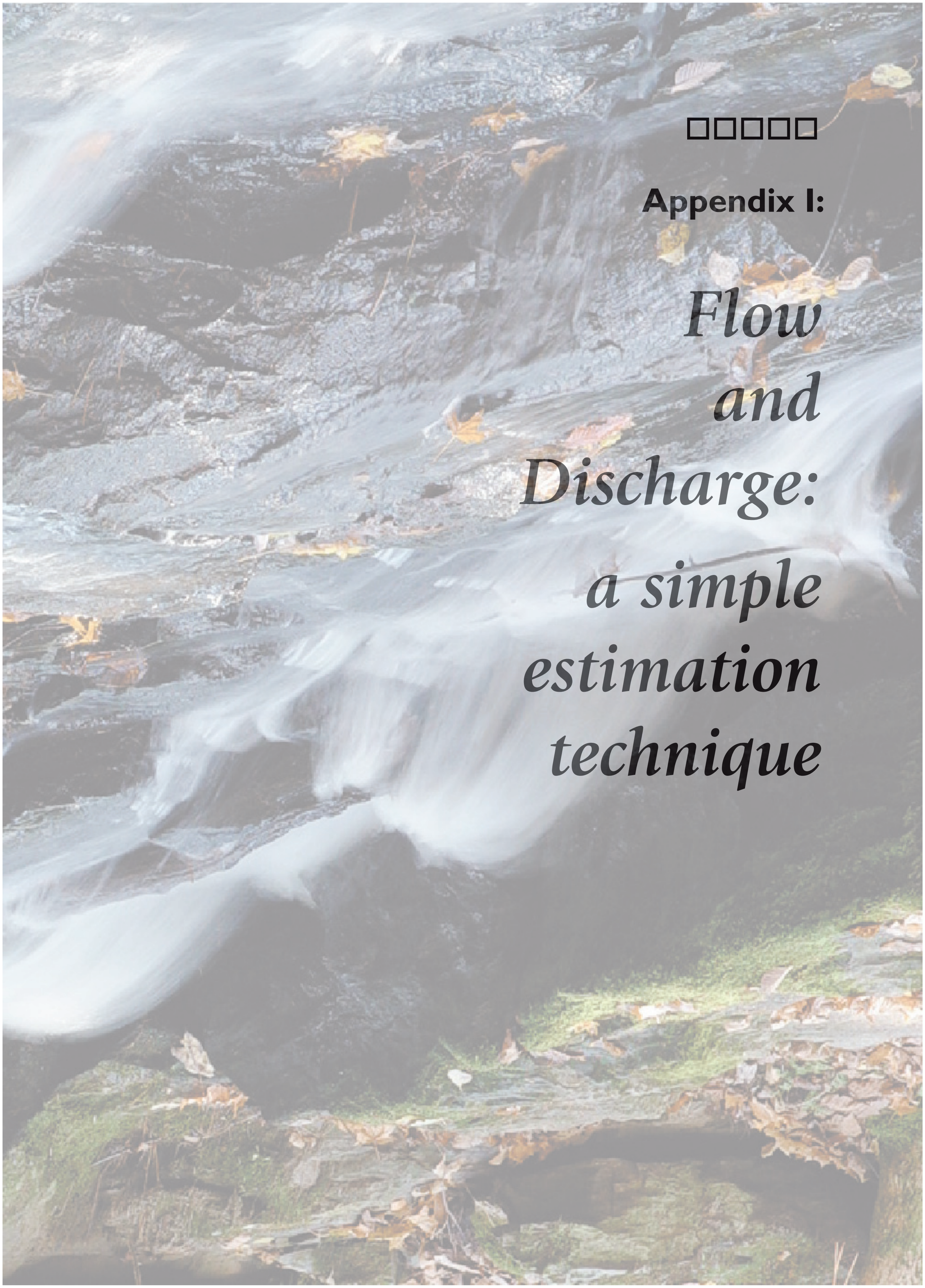
U	20	-	20
Mainstem / Tributary ID	Reach #		Photo #

V	<u>21</u>	-	21
Mainstem / Tributary ID	Reach #		Photo #

Mainstem / Tributary ID	Reach #		Photo #
W	22	-	22

X	23	-	23
Mainstem / Tributary ID	Reach #		Photo #

Y	24	-	24
Mainstem / Tributary ID	Reach #		Photo #



Appendix I:

Flow and Discharge: a simple estimation technique

APPENDIX I

Flow and Discharge
A Simple Estimation Technique

1. "Simple Method" Volunteers Can Use for Estimating Flow

[Adapted from USEPA (1997)]

This section describes one method for estimating flow in a specific area or reach of a stream. *(Refer to Volume 2 of this manual series for background information about stream flow and discharge.)* It is adapted from techniques used by several volunteer monitoring programs and uses a float (an object such as an orange, ping-pong ball, pine cone, etc.) to measure stream velocity. Calculating flow involves solving an equation that examines the relationship among several variables including stream cross-sectional area, stream length, and water velocity.

One way to measure flow is to solve the following equation *(a modification of the equation described above)*: **Flow = ALC / T**

WHERE:

A = **Average cross-sectional area of the stream** (stream width multiplied by average water depth).

L = **Length of the stream reach measured** (usually 20 ft.)

C = **A coefficient or correction factor** (0.8 for rocky-bottom streams or 0.9 for muddy-bottom streams). This allows you to correct for the fact that water at the surface travels faster than near the stream bottom due to resistance from gravel, cobble, etc. Multiplying the surface velocity by a correction coefficient decreases the value and gives a better measure of the stream's overall velocity.

T = **Time, in seconds, for the float to travel the length of L**

TASK 1: Prepare before leaving for the sampling site

Refer to *Volume I: Unit 4* of this manual series for details on basic field gear, apparel, and safety considerations. When measuring and calculating flow, include the following equipment:

- Ball of heavy-duty string, four stakes, and a hammer to drive the stakes into the ground. The string will be stretched across the width of the stream perpendicular to shore at two locations. The stakes are to anchor the string on each bank to form a transect line.
- Tape measure (at least 20 feet)
- Waterproof yardstick or other implement to measure water depth
- Twist ties (to mark off intervals on the string of the transect line)
- An orange and a fishing net (to scoop the orange out of the stream)
- Stopwatch (or watch with a second hand)
- Calculator (optional)

TASK 2: Select a stretch of stream

The stream stretch chosen for the measurement of discharge should be straight (no bends), at least 6 inches deep, and should not contain an area of slow water such as a pool. Unobstructed riffles or runs are ideal. The length that you select will be equal to L in solving the flow equation. Twenty feet is the standard length most frequently used.

Measure your length and mark the upper and lower end by running a transect line across the stream perpendicular to the shore using the string and stakes ***(Figure I-1).*** The string should be taut and near the water surface.

The upstream transect is Transect #1 and the downstream one is Transect #2.

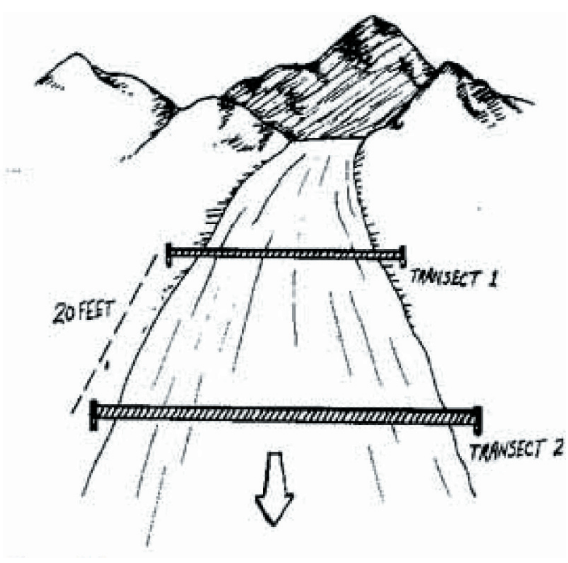


Figure I-1: Diagram of a 20-foot transect [from USEPA (1997)].

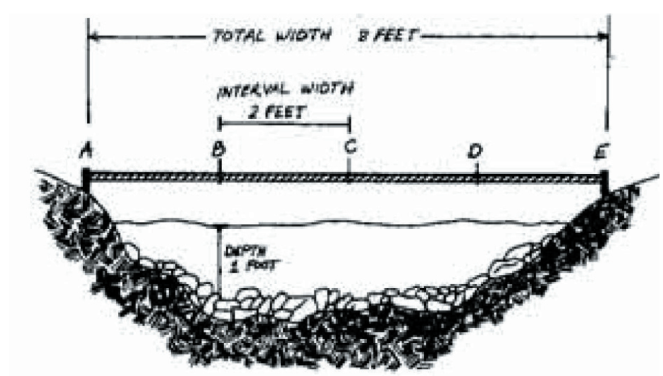


Figure I-2: A cross-section view of stream width and depth [from USEPA (1997)].

TASK 3: Calculate the average cross-sectional area

Cross-sectional area (A in the formula) is the product of stream width multiplied by average water depth. To calculate the average cross-sectional area for the study stream reach, volunteers should determine the cross-sectional area for each transect, add the results together, and then divide by 2 to determine the average cross-sectional area for the stream reach.

To measure cross-sectional area:

1. Determine the average depth along the transect by marking off equal intervals along the string with the twist ties. The intervals can be one-fourth, one-half, and three-fourths of the distance across the stream. Measure the water's depth at each interval point ***(Figure I-2)***. To calculate average depth for each transect, divide the total of the three depth measurements by 4. (You divide by 4 instead of 3 because you need to account for the 0 depths that occur at the shores.) In the example shown in ***Figure I-3***, the average depth of Transect #1 is 0.575 feet and the average depth of Transect #2 is 0.625 feet.
2. Determine the width of each transect by measuring the distance from shoreline to shoreline. Simply add together all the interval widths for each transect to determine its width. In the ***Figure I-3*** example, the width of Transect #1 is 8 feet and the width of Transect #2 is 10 feet.
3. Calculate the cross-sectional area of each transect by multiplying width times average depth. The example given in ***Figure I-3*** shows that the average cross-sectional area of Transect #1 is 4.60 square feet and the average cross-sectional area of Transect #2 is 6.25 square feet.
4. To determine the average cross-sectional area of the entire stream reach (A in the formula), add together the average cross-sectional area of each transect and then divide by 2. The average cross-sectional area for the stream reach in ***Figure I-3*** is 5.42 square feet.

Figure I-3:
Simple Calculation

Determining Average Cross-Sectional Area (A)

	Transect #1 (upstream)				**Transect #2 (downstream)**			
	Interal width (feet)		Depth (feet)		Interal width (feet)		Depth (feet)	
	A to B =	2.0	1.0	(at B)	A to B =	2.5	1.1	(at B)
	B to C =	2.0	0.8	(at C)	B to C =	2.5	1.0	(at C)
	C to D =	2.0	0.5	(at D)	C to D =	2.5	0.4	(at D)
	D to E =	2.0 ----	0.0 ----	(shoreline)	D to E =	2.5 ----	0.0 ----	(shoreline)
Totals		8.0	2.3			10.0	2.5	

Average depth = 2.3/4 = 0.575 feet

Average depth = 2.5/4 = 0.625 feet

Cross-sectional area of Transect #1

= Total width X Average depth
= 8.0 ft X 0.575
= 4.60 ft^2

Cross-sectional area of Transect #2

= Total width X Average depth
= 10.0 ft X 0.625
= 6.25 ft^2

Average area = (Cross-sectional area of Transect #1 + Cross-sectional area of Transect #2)/2

= (4.60 ft^2 + 6.25 ft^2)/2
=5.42 ft^2

TASK 4: Measure travel time

Volunteers should time with a stopwatch how long it takes for an orange (or some other object) to float from the upstream to the downstream transect. An orange is a good object to use because it has enough buoyancy to float just below the water surface. It is at this position that maximum velocity typically occurs.

The volunteer who lets the orange go at the upstream transect should position it so it flows into the fastest current. The clock stops when the orange passes fully under the downstream transect line. Once under the transect line, the orange can be scooped out of the water with the fishing net. This "time of travel" measurement should be conducted at least three times and the results averaged--the more trials you do, the more accurate your results will be. The averaged results are equal to "T" in the formula. It is a good idea to float the orange at different distances from the bank to get various velocity estimates.

You should discard any float trials if the object gets hung up in the stream (by cobbles, roots, debris, etc.)

TASK 5: Calculate flow

Recall that flow can be calculated using the equation: Flow = ALC / T

• Continuing the example in ***Figure I-3:***

Say the average time of travel for the orange between Transect #1 and #2 is 15 seconds and the stream had a rocky bottom.

The calculation of flow would be:

WHERE:

A = 5.42 ft^2
L = 20 ft
C = 0.8 (coefficient for a rocky-bottom stream)
T = 15 seconds
Flow = 15 seconds (5.42 ft^2) (20 ft) (0.8) / 15 sec.
Flow = 86.72 ft^3/ 15 sec.
Flow = 5.78 ft^3/sec.

TASK 6: Record flow on the data form

On the last page of this appendix is a form volunteers can use to calculate flow of a stream.

DATA FORM FOR CALCULATING FLOW

Solving the equation: $\text{Flow} = \dfrac{A\,L\,C}{T}$

Where:

A = Average cross-sectional area of the stream. L = Length of the stream reach measured (usually 20 ft.).
C = A coefficient or correction factor (0.8 for rocky-bottom streams or 0.9 for muddy-bottom streams). T = Time, in seconds, for the float to travel the length of L.

A: Average Cross-Sectional Area

Transect #1 (upstream)

Interval width (feet)		Depth (feet)	
A to B	= ____	____	(at B)
B to C	= ____	____	(at C)
C to D	= ____	____	(at D)
D to E	= ____	____	(shoreline)
Totals	☐	☐	÷ 4

= Avg. depth ☐ ft

Cross-sectional area of Transect #1

= Total width (ft) X Avg. depth (ft)

☐ X ☐ = ☐ ft^2

Transect #2 (downstream)

Interval width (feet)		Depth (feet)	
A to B	= ____	____	(at B)
B to C	= ____	____	(at C)
C to D	= ____	____	(at D)
D to E	= ____	____	(shoreline)
Totals	☐	☐	÷ 4

= Avg. depth ☐ ft

Cross-sectional area of Transect #2

= Total width (ft) X Avg. depth (ft)

☐ X ☐ = ☐ ft^2

(Cross-sectional area of Transect #1 + Cross-sectional area of Transect #2) ÷ 2 **= Average Cross-sectional area**

A = (☐ ft^2 + ☐ ft^2) ÷ 2 = ☐ ft^2

L: Length of Stream Reach

☐ ft

C: Coefficient

☐

T: Travel Time

	Travel Time of Float (sec.)
Trial #1	____
Trial #2	____
Trial #3	____
Total	☐ ÷ 3

= Avg. time ☐ sec.

Flow = $\dfrac{A\,L\,C}{T}$ = $\dfrac{☐\ ☐\ ☐}{☐}$ = ☐ ft^3/sec.

Appendix J:

Stream Corridor Survey (Level 1) Field Sheets

ACKNOWLEDGEMENTS

The methods contained in this appendix are based on the following documents:

- United States Environmental Protection Agency (USEPA). 1997. Volunteer Stream Monitoring: A Methods Manual. Office of Water, Washington, D.C. EPA 841- B-97-003. http://www.epa.gov/volunteer/stream.
- Parish Geomorphic Ltd. (Georgetown, Ontario, Canada). 2003. Rapid Geomorphic Assessment (RGA). Adapted from the RGA method described in: Ontario (Canada) Ministry of the Environment. 2003. Stormwater Management Planning and Design Manual. Document # 4329e. Queen's Printer for Ontario; Ontario, Canada.
- Other contributors to this section included: Merry Gallagher (Maine Department of Inland Fisheries & Wildlife) and Jeff Varricchione and Erin Crowley (Maine Department of Environmental Protection).

Appendix J-1:

Appendix J

Stream Corridor Survey (Level 1)
Field Sheets and Instructions

CONTENTS

Acknowledgements

The methods contained in this appendix are based on the following documents:

- United States Environmental Protection Agency (USEPA). 1997. Volunteer Stream Monitoring: A Methods Manual. Office of Water, Washington, D.C. EPA 841-B-97-003. < http://www.epa.gov/volunteer/stream >.
- Parish Geomorphic Ltd. (Georgetown, Ontario, Canada). 2003. Rapid Geomorphic Assessment (RGA). Adapted from the RGA method described in: Ontario (Canada) Ministry of the Environment. 2003. Stormwater Management Planning and Design Manual. Document # 4329e. Queen's Printer for Ontario; Ontario, Canada.
- Other contributors to this section included: Merry Gallagher (Maine Department of Inland Fisheries & Wildlife) and Jeff Varricchione and Erin Crowley (Maine Department of Environmental Protection).

Appendix J

Stream Corridor Survey (Level 1) Field Sheets and Instructions

Target Audience

This appendix has been designed to serve as an abbreviated set of instructions for people interested in performing Stream Corridor Surveys (Level 1) and who have either been trained by a representative of the Maine Department of Environmental Protection's Maine Stream Team Program or Maine Department of Inland Fisheries and Wildlife.

More detailed information intended for people wishing to organize (with the assistance of the Maine Stream Team Program) a training session and survey involving a group of volunteers can be found in Unit 5 of *Stream Survey Manual [Volume 1]: A Citizen's Guide to Basic Watershed, Habitat, and Geomorphology Surveys in Stream & River Watersheds* (Maine Stream Team Program, 2008) available at http://www.maine.gov/dep/blwq/docstream/team/streamteam.htm.

Introduction

The Stream Corridor Survey (SCS) (Level 1) is an easy-to-use approach for identifying and assessing the elements of a stream's habitat. It is based on a simple protocol known as *Streamwalk,* developed by EPA's Regional Office in Seattle, Washington and modified by MDIFW's *Fisheries Research Section* (Bangor, ME) and MDEP's *Maine Stream Team Program*. The protocol consists primarily of visual observation of stream habitat characteristics, wildlife present, and gross physical attributes. A simple in-stream macroinvertebrate evaluation is also performed. This approach requires little in the way of equipment and training and is a useful tool for assessing a stream's overall biological and physical integrity. The SCS consists of two primary components: a stream habitat survey and a rapid geomorphic assessment.

The Stream Habitat Survey is most useful as:

- A screening tool to identify high-quality coldwater habitat as well as severe habitat or water quality problems;
- A vehicle for learning about stream ecosystems and environmental stewardship.

The Stream Habitat Survey's ease of use, adaptability, and low cost make it a highly attractive approach for many programs whose primary focus is public awareness, recording baseline habitat conditions, fostering citizen involvement for large scale habitat survey, and identification of environmentally stressed stream reaches.

Fluvial geomorphology is the science that assesses the shape and form of watercourses (particularly streams and rivers) and the associated contributing physical processes related to water and sediment transport. In addition, this science applies natural channel design for restoring or rehabilitating channel reaches and provides integration with aquatic biology to enhance habitat or community structure. This contributes greatly towards a more comprehensive understanding of channel stability, condition and flow dynamics.

The Rapid Geomorphic Assessment (RGA) is most useful for:

- Screening the gross stability and overall condition of stream reaches;
- Identifying significant sediment sources through excessive runoff, bank erosion or slumping;
- Targeting reaches for further assessment or restoration planning.

Preparation Step 1 – Getting Organized

TASK 1: Understanding GPS, coordinate systems, and map datums

If you are going to bring a GPS (global positioning system) unit with you when you do your stream habitat survey, make sure to familiarize yourself with its functions. The owner's manual should provide you with some good information.

- Make sure that your GPS's map *datum*[a] is set to WGS84. (NAD83 is a fairly acceptable alternative, but NAD27 will cause coordinates to be erroneous.) This is the default setting on many GPS units nowadays, although it is important to check your model and user's manual.
- Make sure that your GPS's geographic coordinate system is set to either the UTM (Universal Transverse Mercator) or Latitude & Longitude system. Some examples of what UTM and Lat/Long readings look like are provided in the Table J-1. The most important thing you can do is to be sure to write down all the coordinate numbers that are shown on your GPS unit. If you round off your numbers, we might not be able to tell whether you're in Kittery or Presque Isle.
- The UTM zone for the state of Maine is Zone 19 (north). Some units may display a "T" after the "19". These coordinates are simply the number of meters in each direction from the southwest corner (coordinates 0 E / 0 N) of a rectangle that defines the extent of UTM Zone 19 North.

[a] A datum describes the model that was used to match the location of features on the ground to coordinates and locations on the map. The Global Positioning System uses an earth centered datum called the World Geodetic System 1984 or WGS 84. WGS 84 was adopted as a world standard from a datum called the North American Datum of 1983 or NAD 83. Most USGS topographic maps are based on an earlier datum called the North American Datum of 1927 or NAD 27. In the Continental United States the difference between WGS 84 and NAD 27 can be as much as 200 meters.

- **SCS Datasheet Types:** There are two SCS datasheet set types available: UTM Zone 19 and Latitude/ Longitude. The UTM system is preferred because that is what most Maine state agencies use (including Maine DEP and Maine DIF&W), however Lat/Long is still an option.
- **GPS Error**: All GPS units have some error associated with them. The older and less expensive the unit, the greater the room for error (consult with your user's manual). Additionally, if someone is measuring in units of degrees-minutes-seconds (Latitude and Longitude), accuracy is decreased by an additional (roughly) 100 feet unless decimal seconds are used (e.g., coordinates having one decimal place after the "seconds" number). A good method to reduce error is to wait as long as possible after powering up so your unit can be receiving as many satellites as possible. Most models indicate how many satellites they are receiving at any given time.
- **For More Information**: For more information about coordinate systems, mapping, projections, and GPS basics, visit these websites:
    - http://education.usgs.gov/ ;
    - http://geology.isu.edu/geostac/ [*and click on exercises such as Intro to GPS, Topographic Maps, or GIS Primer*] ;
    - http://infodome.sdsu.edu/research/guides/maps/basics.shtml.

Table J-1. Examples of different geographic coordinate systems.

X Coordinate	Y Coordinate	Coordinate System
70^{o} 16' 49.3" (W; longitude)	43^{o} 41' 18.0" (N; latitude)	Latitude/Longitude (degrees/minutes/seconds)
70^{o} 16.822' (W; longitude)	43^{o} 41.300' (N; latitude)	Latitude/Longitude (degrees/decimal minutes)
0396812 (easting)	4838054 (northing)	UTM, Zone 19

TASK 2: Obtain a U.S. Geological Survey (USGS) topographic map of your area

One of the most valuable tools for conducting stream survey work is a U.S. Geological Survey (USGS) topographic map. These "topo" maps display many important features of the landscape including elevations, waterways, roads, and buildings. They are critical tools for defining the watershed of your study stream.

TASK 3: Select and mark the Habitat Survey location(s)

Choosing the location for a stream survey is a task defined by the goals of your individual program. Program managers may select sites themselves or in collaboration with local or state water quality personnel. Other programs allow their volunteers to choose the site based on their personal interests. Once a survey site is chosen, it should be marked on the topographic map. This will document the location and serve as a record in case future volunteers or data users need to find the site.

TASK 4: Become familiar with safety procedures

Volunteers must always keep safety in mind while conducting any stream activity. Provide all Stream Corridor Survey participants with a list of safety do's and don'ts and have them review this list thoroughly. Remember, volunteer safety is more important than the data. Some reminders include:

- Let someone know where you're going and when you expect to return. Make sure you have an "in case of emergency" phone number with you before leaving for the field.
- Do not enter streams in high flows.
- Be careful walking around and in streams and rivers – hillsides, streambanks, and stream bottoms are often slippery.
- Never go into the field alone; always work in teams of at least two people.
- Assume stream water is unsafe to drink. If you have put your hands in the water, wash your hands before handling food or water, especially near urban, suburban, and agricultural areas.
- Never cross private property without permission of the landowner.
- If for any reason you feel unsafe, do not attempt to survey on that day.

TASK 5: Gather equipment and tools for the Stream Corridor Survey

There is nothing more frustrating than arriving at a field survey site and not having all your equipment and supplies. Providing volunteers with a checklist of necessary items will help keep them organized. You will need basic field equipment, as well as, the following for the Stream Corridor Survey.

For locating the site:

- U.S. Geological Survey (USGS) topographic map of the stream area (supplemented by regular street map or DeLorme's *Maine Atlas and Gazetteer* if needed)
- GPS unit

For recording observations:

- Stream Corridor Survey field data sheets and a pencil

For marking-off the stream stretch of study:

- Tape measure, string, or twine (25 yards)

For taking stream depth measurements:

- A meter or yard stick

For working in and around the stream:

- Thermometer for measuring water temperature. (Scientific supply houses sell armored thermometers that are best suited for this purpose, although you can obtain a good thermometer from an aquarium store. Some thermometers need to be calibrated before use.)
- Watch with a second hand or a stopwatch

For observing macroinvertebrates:

- A small bucket

- A shallow white pan. (Alternatives: white plastic plate or the bottom of a white plastic detergent jug)
- Tweezers or soft brush
- Ice cube trays (for sorting macroinvertebrates)
- Magnifying glass
- Macroinvertebrate identification keys (search the Internet or check with organizations such as the Izaak Walton League of America, River Network, Adopt-A-Stream Foundation, etc. for field guides and other resources)

TASK 6: Become familiar with the Stream Corridor Survey field data sheet and the definitions of its elements

It is important to become familiar with the Stream Corridor Survey field data sheet and its instructions before you begin your Stream Corridor Survey. If you are unclear about any instructions when you are conducting your Survey, just leave that space blank and keep going. You might wish to contact your volunteer program coordinator for further explanation after you have completed your Survey.

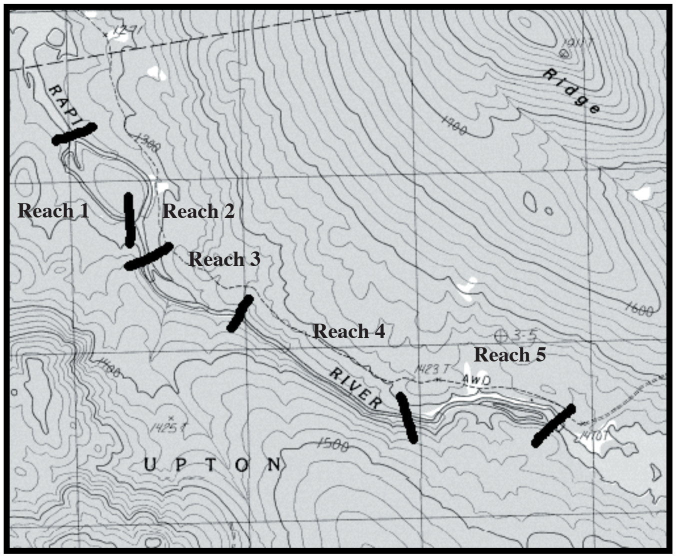
When you fill out your field data sheet, base your responses on your best judgment of conditions in a stretch of stream that you have selected. If you identify features and problems beyond your chosen reach, feel free to note them on your map and form. You might want to conduct additional Walks in the area where those features are found.

Instructions on how to fill out the field data sheet are included right on the form. They are also covered in an expanded format, with illustrations, in this text. Although many of the required measures are relatively self-explanatory, it might be a good idea to make copies of these instructions for all volunteer teams to take into the field as an additional training tool.

Preparation Step 2 - Delineate Your Site(s)

TASK 1: Delineate the site

To delineate the site obtain a topographic map for the stream you intend to survey. From the topo map determine a stream reach - a relatively homogeneous stretch of a stream having a repetitious sequence of physical characteristics and habitat types. Look for areas on the map having similar stream gradients (slope), straight sections or meanders, and/or differences in the surrounding riparian habitat types. Generally, noticeable changes in stream slope will designate most reach breaks; however, extreme changes in meander form and channel or valley width are also good indicators to use. Designate the different reaches selected on the topographic map (Fig. J-1). (Note: In some cases, you might be working with a group that has planned to do surveys on multiple reaches within a watershed. If that is the case, follow the instructions of the group's coordinator.)



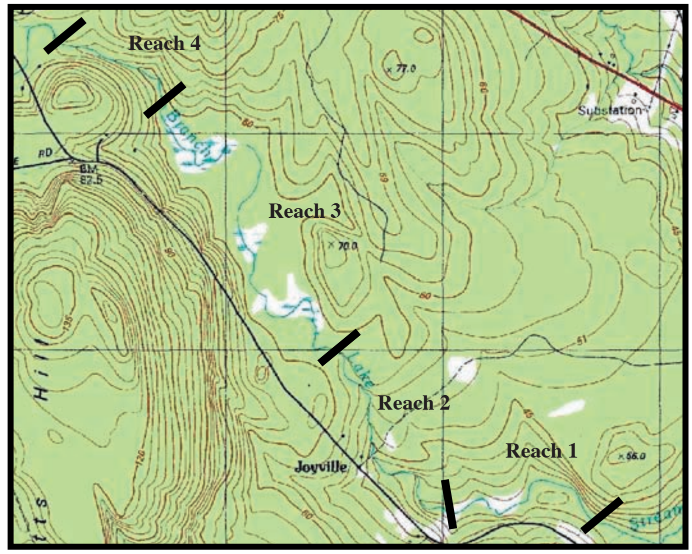


Figure J-1.
Reach designations based on changes and differences in topographic features.

Instructions for Completing the Stream Habitat Survey Portion of the SCS Data Sheets

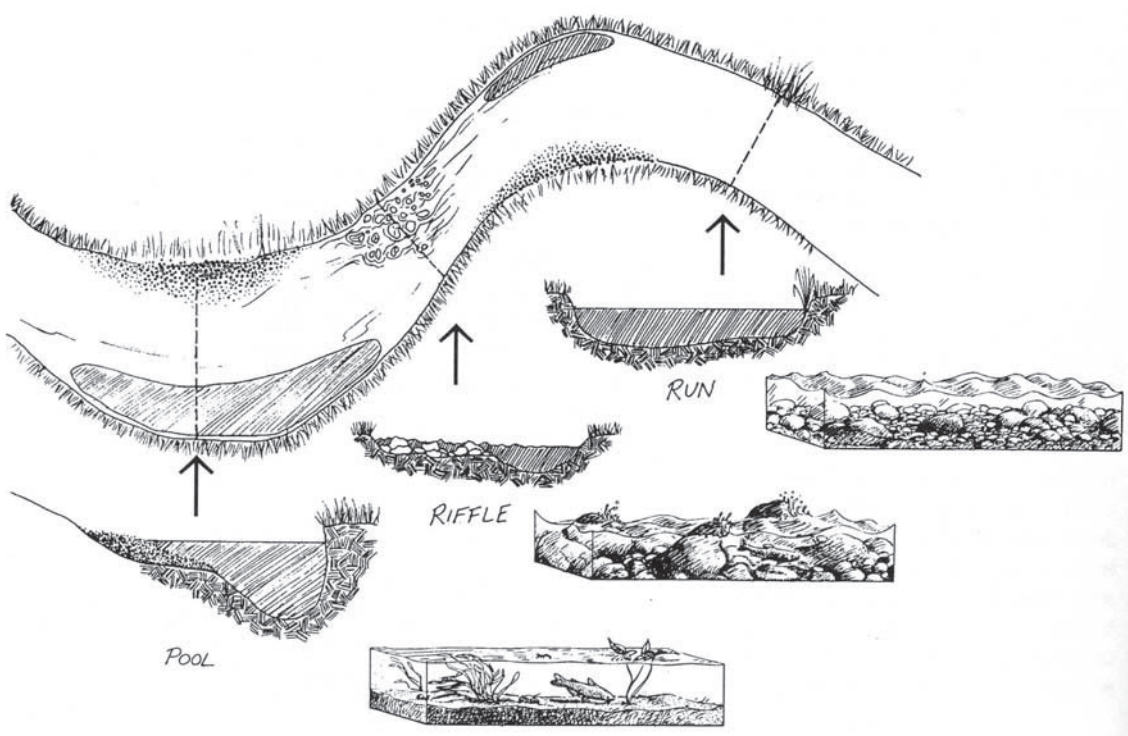


Figure J-2.
Overview and cross sections of a pool, riffle, and run
Varying flows and depths create a variety of habitats for fish and macroinvertebrates.

Cover Sheet

1. *Reach ID*.

- If you are doing a single stream reach and are not working with others to survey other parts of the stream, you may leave this line blank.

- If you are doing more than one reach of a particular stream or stream system, or you are part of a group that is conducting surveys of multiple stream reaches, please assign an ID number to each reach you survey (e.g., Reach # 1, etc.). Also, if you are part of a group, please coordinate with your group leader in advance to avoid having duplicate reach ID numbers. It is generally preferred to delineate reaches and assign reach IDs using maps prior going into the field. To obtain detailed instructions regarding how to create and assign reach ID numbers, please refer to Unit 5 of *Stream Survey Manual (Volume 1): A Citizen's Guide to Basic Watershed, Habitat, and Geomorphology Surveys in Stream & River Watersheds* (Maine Stream Team Program, 2008).

- When you are working in the field, you may encounter a situation where you believe a reach that was delineated in your office/home using a map or aerial photo actually needs to be broken into smaller reaches. An example where this might occur would be that you encounter noticeable, drastic differences in channel or valley form between upstream and downstream sections of a given reach when you are in the field. In this case, it suggested that you fill out a set of datasheets for each of these new "sub-reaches" and then assign a letter to the end of the reach ID codes to distinguish between them (e.g., Reach 1 is slit into Reach 1-a and Reach 1-b). Again, for more details refer to Unit 5 of *Stream Survey Manual (Volume 1): A Citizen's Guide to Basic Watershed, Habitat, and Geomorphology Surveys in Stream & River Watersheds* (Maine Stream Team Program, 2008).

2. *Stream name* is the name of your stream derived either from maps (preferably USGS topographic maps), an atlas, or from local knowledge.

3. *County* is the county in which your reach is located.

4. *Town* is the town in which your reach is located. (You may cross town or county lines as you walk your reach. If so, record the town and/or county in which most of your reach is located.)

5. *Investigators* are the people, including yourself, who performed the survey of this particular reach.

6. *Site description* is a summary of interesting features of your stream reach such as whether the stream has a steep, moderate, or low gradient; the general land-use type in the area; the presence of dams and road crossings; the presence of numerous little cold water seeps and springs that feed into your stream; and any other characteristics you feel may be important.

<u>*GPS Location*</u>

7. *Start* and *End*
    - Either *Easting* and *Northing* (UTM) or *Latitude* and *Longitude* are the GPS coordinates of where you begin to survey your stream reach. There are two SCS datasheet set types available: UTM Zone 19 and Latitude/Longitude. The UTM system is preferred because that is what most Maine state agencies use (including Maine DEP and Maine DIF&W), but Lat/Long is still an option. (If you do not have a GPS unit, then please submit a map indicating where your reach began and ended.)
    - *Error* is the GPS estimated error in feet.
    - *Position in Reach* is either "upstream" (if the start location is the highest, most-upstream point within the reach) or "downstream" (if the start location is the lowest, most-downstream point within the reach).

8. *Map datum*. If you are using a GPS unit, please tell us what datum the unit is using. This is most likely NAD83 or WGS 84. Refer to the owner's manual of your unit for more information.

9. *Date* is the date on which you completed the survey.

10. *Time* is the time of day when you began your survey. Your reach will probably not take more than 1-2 hours to complete. If you do spend more than 1 hour completing your reach survey, please indicate when you finished your survey.

11. *Weather in past 24 hours* and *Weather now* are designed to aid in data interpretation. Storms (heavy rains), Rain (steady rain), and Showers (sporadic rain) currently or within the past 24 hours may affect storm flows, turbidity, water levels, and temperature among other things. In the absence of precipitation, Overcast or Clear/Partly Sunny weather could impact water temperature and water levels.

Photograph Log

Please follow the directions on the photograph log sheet.

(Note: For ease of use, the following numbered instructions correspond to the numbers on the field data sheets.)

In-Stream Characteristics

1. *Pools, riffles, runs, cascades, rapids, deadwaters*. A mixture of flows and depth provide a variety of habitats to support fish and invertebrate life. Pools are deep with slow water. Riffles are shallow with fast, turbulent water running over rocks. Runs are deep with fast water and little or no surface turbulence. Cascades are a series of small steps consisting of waterfalls and pools. Rapids have steep but uniform gradient, turbulent surface (i.e., standing waves), current (>50 cm/sec; 1.64 ft/sec). Deadwaters are deep reaches with little visible flow due to a natural sill, beaver dam, or other structure impounding flow. (See Fig. J-2 for illustrations of some of these habitat types.)

2. *Stream bottom (substrate)* is the material on the stream bottom. Identify what substrate types are present.

   Substrate types include:

Size Class	Millimeters	Inches	Approximate Relative Size
Bedrock	> 2048	> 80	Bigger than a car ; (a.k.a. ledge)
Boulder*	> 256	> 10.1	Bigger than a basketball
Cobble	64 – 256	2.5 - 10.1	Tennis ball to basketball
Gravel	2 – 64	0.08 – 2.5	Peppercorn to tennis ball
Sand	0.06 – 2.00	0.002 – 0.08	Salt to peppercorn
Silt	< 0.06	< 0.002	Finer than salt

* Some scientists break out another group within the boulder category as “Rubble”, which range from approximately from 10 to 20 inches in diameter (i.e., small boulders; larger than a basketball but smaller than a beach ball).

3. *Embeddedness* is the extent to which rocks (gravel, cobbles, and boulders) are sunken into the silt, sand, or mud of the stream bottom (Fig. J-3). Generally, the more rocks are embedded, the less rock surface or space between rocks is available as habitat for aquatic macroinvertebrates and for fish spawning. Excessive silty runoff from erosion can increase a stream's embeddedness. To estimate embeddedness, observe the amount of silt or finer sediments overlying, in between, and surrounding the rocks.

4. *Presence of logs or woody debris (not twigs and leaves) in stream* can slow or divert water to provide important fish habitat such as pools and hiding places. Note the presence of large woody debris within the bankfull channel of your survey reach. This includes tree trunks, root wads, tree boles, large branches, and milled lumber. Write notes in the comments section of your data sheets if a significant portion of the wood appears to have not originated from natural sources (i.e., construction debris).

5. *Naturally-occurring organic material in stream*. This material includes leaves and twigs. Mark the box that describes the general amount of organic matter in the stream reach.

6. *Water appearance* can be a physical indicator of water pollution.

   - *Clear* - colorless, transparent
   - *Milky* - cloudy-white or grey, not transparent; might be natural or due to pollution
   - *Foamy* - might be natural or due to pollution, generally detergents or nutrients (foam that is several inches high and does not brush apart easily is generally due to some sort of pollution)
   - *Turbid* - cloudy brown due to suspended silt or organic material
   - *Dark brown (or tea colored)* - might indicate that acids are being released into the stream due to decaying plants
   - *Oily sheen* - multicolored reflection might indicate oil floating in the stream, although some sheens are natural
   - *Orange* - might indicate acid drainage
   - *Green* - might indicate excess nutrients being released into the stream

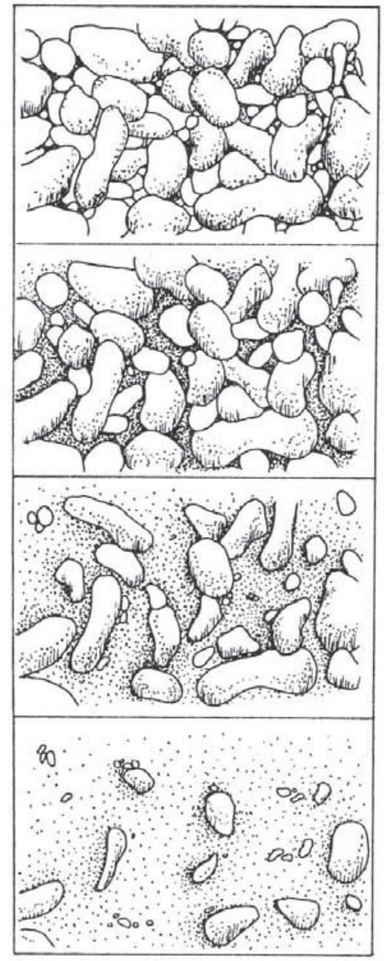


Figure J-3.
Differing degrees of substrate embeddedness.
In this example, embeddedness ranges from approximately 0 - 25%, 50%, 75%, and nearly 100%, moving from the top frame to the bottom frame.

7. *Water odor* can be a physical indicator of water pollution

    - No smell or a natural odor
    - *Sewage* - might indicate the release of human waste material
    - *Chlorine* - might indicate over-chlorinated sewage treatment/water treatment plant or swimming pool discharges
    - *Fishy* - might indicate excessive algal growth or dead fish
    - *Rotten eggs* - might indicate sewage pollution (the presence of methane from anaerobic conditions)

8. *Water temperature* can be particularly important for determining the suitability of the stream as aquatic habitat for some species of fish and macroinvertebrates that have distinct temperature requirements. Temperature also has a direct effect on the amount of dissolved oxygen available to the aquatic organisms. Measure temperature by submerging a thermometer for at least 2 minutes in a typical stream run. Repeat once and average the results.

Stream Bank and Channel Characteristics

9. *Depth of runs and pools* should be determined by measuring the vertical distance from the surface to the stream bottom at a representative depth for each of the two habitats. For each habitat type, record the average depth for your reach calculated from 3 – 5 individual depth observations from randomly chosen locations along your Survey.

10. *The width of the stream channel* can be determined by measuring the width of the streambed that is covered by water from bank top to bank top. Estimate an average width from 3 – 5 randomly chosen locations along your Survey.

11. *Stream velocity* can have a direct influence on the health, variety, and abundance of aquatic communities. If water flows too quickly, organisms might be unable to maintain their hold on rocks and vegetation and be washed downstream; if water flows too slowly, it might provide insufficient aeration for species needing high levels of dissolved oxygen. Stream velocity can be affected by dams, channelization, terrain, runoff, and other factors. To measure stream velocity, mark off a 20-foot section of stream run and measure the time it takes a stick, leaf, or other floating biodegradable object to float the 20 feet. Repeat 3 times and pick the average time. Divide the distance (20 feet) by the average time (seconds) to determine the velocity in feet per second.

12. *The shape of the stream bank, the extent of artificial modifications, and the shape of the stream channel* are determined by standing at the downstream end of the section and looking upstream.

    - The shape of the stream bank (Fig. J-4) may include:

- *Vertical or undercut bank* - a bank that rises vertically or overhangs the stream. This type of bank generally provides good cover for macroinvertebrates and fish and is resistant to erosion. However, if seriously undercut, it might be vulnerable to collapse.
- *Steeply sloping* - a bank that slopes at more than a 30 degree angle. This type of bank is very vulnerable to erosion.
- *Gradual sloping* - a bank that has a slope of 30 degrees or less. This type of stream bank is highly resistant to erosion, but does not provide much streamside cover.

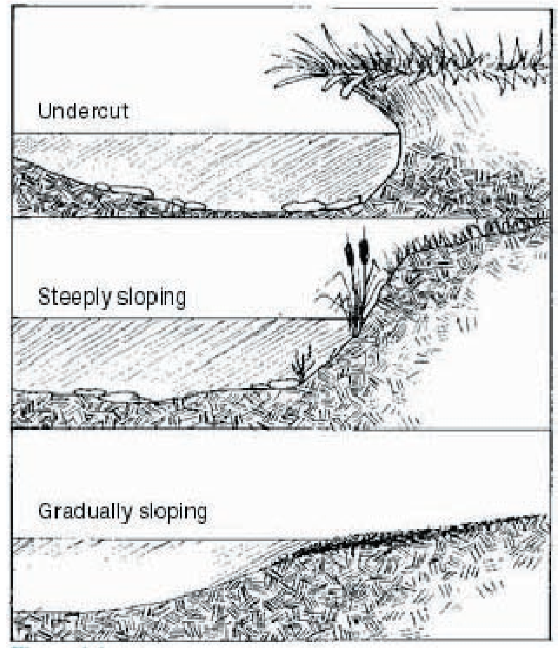


Figure J-4
Types of streambank shapes
Undercut banks provide good cover for fish

- *Artificial bank modifications* include all artificial structural changes to the stream bank such as riprap (broken rock, cobbles, or boulders placed on earth surfaces such as the face of a dam or the bank of a stream, for protection against the action of the water) and bulkheads. Determine the approximate percentage of each bank (both the left and right) that is artificially covered by the placement of rocks, wood, or concrete.

- *The shape of the stream channel* can be described as narrow (less than 6 feet wide from bank to bank), wide (more than 6 feet from bank to bank), shallow (less than 3 feet deep from the stream substrate to the top of the banks) or deep (more than 3 feet from the stream substrate to the top of the banks). Choose the category that best describes the channel.
  - Narrow, deep
  - Narrow, shallow
  - Wide, deep
  - Wide, shallow

13. *Streamside cover* information helps determine the quality and extent of the stream's riparian zone. This information is important at the stream bank itself and for a distance away from the stream bank. For example, trees, bushes, and tall grass can contribute shade and cover for fish and wildlife and can provide the stream with needed organic material such as leaves and twigs. Lawns indicate that the stream's riparian zone has been altered, that pesticides and grass clippings are a possible problem, and that little habitat and shading are available. Bare soil and pavement might indicate problems with erosion and runoff. Looking upstream, provide this information for the left and right banks of the stream.

- *Evergreen trees (conifers)* - cone-bearing trees that do not lose their leaves in winter.

- *Hardwood trees (deciduous)* - in general, trees that shed their leaves at the end of the growing season.
- *Bushes, shrubs* - conifers or deciduous bushes less than 15 feet high.
- *Tall grass, ferns, etc*. - includes tall natural grasses, ferns, vines, and mosses.
- *Lawn* - cultivated and maintained short grass.
- *Boulders* - rocks larger than 20 inches.
- *Cobbles/gravel/sand* - rocks smaller than 10 inches; sand.
- *Bare soil*.
- *Pavement, structure* - any structures or paved areas, including paths, roads, bridges, houses, etc.

14. *Stream shading* is a measurement of the extent to which the stream itself is overhung and shaded by the cover identified in 13 above. This shade (or overhead canopy) provides several important functions in the stream habitat. The canopy cools the water; offers habitat, protection, and refuge for aquatic organisms; and provides a direct source of beneficial organic matter and insects to the stream. Determine the extent to which vegetation shades the stream at your site.

15. *General conditions of the stream bank and stream channel, and other conditions* that might be affecting the stream are determined by standing at the downstream end of the section and looking upstream. Provide observations for the right and left banks of the stream.

- *Stream bank conditions* that might be affecting the stream.
    - *Natural plant cover degraded*. Note whether streamside vegetation is trampled or missing or has been replaced by landscaping, cultivation, or pavement. (These conditions could lead to erosion.)
    - *Banks collapsed/eroded*. Note whether banks or parts of banks have been washed away or worn down. (These conditions could limit habitats in the area).
    - *Garbage/junk adjacent to the stream*. Note the presence of litter, tires, appliances, car bodies, shopping carts, and garbage dumps.
    - *Foam or sheen on bank*. Note whether there is foam or an oily sheen on the stream bank. Sheen may indicate an oil spill or leak, and foam may indicate the presence of detergent, or it may be a natural condition.

- *Stream channel conditions* that might be affecting the stream.
    - *Mud/silt/sand on bottom/entering stream*. Excessive mud or silt can interfere with the ability of fish to sight potential prey. It can clog fish gills and smother fish eggs in spawning areas in the stream bottom. It can be an indication of poor construction practices, urban area runoff, silviculture (forestry-related activities), or agriculture in the watershed. It can also be a normal condition, especially in a slow-moving, muddy-bottom stream.
    - *Garbage or junk in stream*. Note the presence of litter, tires, appliances, car bodies, shopping carts, and garbage.

- Other general conditions that might be affecting the stream.
    - *Yard waste* (e.g., grass clippings) - is there evidence that grass clippings, cut branches, and other types of yard waste have been dumped into the stream?

- *Livestock in or with unrestricted access to stream* - are livestock present, or is there an obvious path that livestock use to get to the water from adjacent fields? Is there streamside degradation caused by livestock?
- *Actively discharging pipes* - are there pipes with visible openings discharging fluids or water into the stream? Note such pipes even though you may not be able to tell where they come from or what they are discharging.
- *Other pipes* - are there pipes near or entering the stream? Note such pipes even if you cannot find an opening or see matter being discharged.
- *Ditches* - are there ditches, draining the surrounding land and leading into the stream?

Local Watershed Characteristics

Adjacent land uses can potentially have a great impact on the quality and state of the stream and riparian areas. Determine the land uses, based on your own judgment of the activities in the watershed surrounding your site within a quarter of a mile. Enter a "1" if a land use is present and a "2" if it is clearly having a negative impact on the stream.

Visual Biological Survey

17. *Wildlife* in the stream area might indicate it is of sufficient quality to support animals with food, water, and habitat. Look for signs of frogs, turtles, snakes, ducks, deer, beaver, etc.

18. Are *fish* present in the stream? Fish can indicate that the stream is of sufficient quality for other organisms. Indicate the average size and note any potential barriers to the movement of fish in the stream (obstructions that might keep fish from moving freely upstream or downstream).

19. *Aquatic plants* provide food and cover for aquatic organisms. Plants also might provide very general indications of stream quality. For example, streams that are overgrown with plants could be over enriched by nutrients. Streams devoid of plants could be affected by extreme acidity or toxic pollutants. Aquatic plants may also be an indicator of stream velocity because plants cannot take root in fast-flowing streams.

20. *Algae* are simple plants that do not grow true roots, stems, or leaves and that mainly live in water, providing food for the food chain. Algae may grow on rocks, twigs, or other submerged materials, or float on the surface of the water. Algae naturally occurs in green and brown colors. Excessive algal growth may indicate excessive nutrients (organic matter or a pollutant such as fertilizer) in the stream.

Macroinvertebrate Survey

21. *Macroinvertebrates* are organisms that lack a backbone and can be seen with the naked eye such as clams, mussels, snails, worms, crayfish, and larval insects. To locate macroinvertebrates in the stream, use one or more of the following methods.

- *Rock-rubbing method*. (Use this method in streams with riffle areas and rocky bottoms.)
  - Remove several rocks from within a riffle area of your stream site (e.g., randomly pick 1 rock from each side of the stream, 1 rock from the middle, and 1 rock from in between). Try to choose rocks that are submerged during normal flow conditions. Each rock should be about 4-6 inches in diameter and should be easily moved (not

embedded).

- Either inspect the rock's surface for any living organisms or place the rock in a light-colored bucket or shallow pan, add some stream water, and brush the rock with a soft brush or your hands. Try to dislodge the foreign particles from the rock's surface. Also look for clumps of gravel or leaves stuck to the rock. These clumps may be caddisfly houses and should be dislodged as well.

- *Stick-picking method*. (Use this method in streams without riffles or without a rock bottom.)
  - Collect several sticks (approximately 1 inch in diameter and relatively short) from inside the stream site, and place then in a bucket filled with stream water. Select partially decomposed objects that have soft, pulpy wood and a lot of crevices and are found in the flowing water, not buried in the bottom. Pick the loose bark from the sticks to find organisms.

  - Fill the shallow pan with water from the stream and remove one of the sticks from the bucket. Examine the stick making sure you hold it over the pan so no organisms are lost. Remember that the organisms will have sought shelter, and they could be hiding in loose bark or crevices. After examining the sticks, it might be helpful to break up the woody material. Examine each stick carefully. Using tweezers or a soft brush, carefully remove anything that resembles a living organism and place it in the pan. Also examine the bucket contents for anything that has fallen off the sticks.

- *Leaf pack-sorting method*. (This method can be used in streams with or without a rock bottom.)
  - Remove several handfuls of submerged leaves from the stream and place them into a bucket. Remove the leaves one at a time and look closely for the presence of insects. Using tweezers or soft brush, carefully remove anything that resembles a living organism and place it in a pan containing stream water. Also examine the bucket contents to see if anything has fallen off the leaves.

22. Note whether you have found any macroinvertebrates using one of the above methods.

23. After collecting macroinvertebrates using any of the above methods, examine the types of organisms by gross morphological features (e.g., snails or worm-like). Use a magnifying glass to observe the organisms in water so you can clearly see the legs, gills, and tails. Note the relative abundance of each type on the field data sheet. When finished, return all the organisms to the stream. Many types of *macroinvertebrates* can be found in a healthy stream. Because different species can tolerate different levels of pollution, observing the variety and abundance of macroinvertebrates can give you a sense of the stream's health. For example, if pollution tolerant organisms are plentiful and pollution intolerant ones are found only occasionally, this might indicate a problem in the stream. Types of organisms you find may include:

- *Worm-like organisms* (like worms and leeches) either adhere to rocks or sticks or move
- *Crayfish* look like lobsters or shrimp. They are generally somewhat tolerant of pollution.
- *Snail-like organisms* include snails and clam-like organisms. They range from somewhat tolerant of pollution to somewhat intolerant of pollution.

- *Insects* include a wide variety of organisms that generally have distinct legs, head, bodies, and tails and often move quickly over rocks or sticks. They come in many sizes and shapes as well as a wide range of pollution-tolerance levels.

When finished, return all organisms to the same stream from which you collected them.

24. *Approximate slope of stream reach* affects the types of habitats present. Runs and deadwaters may be more common of flat reaches. Riffles may be more common in medium and higher-sloped reaches. Cascades and waterfalls may be more common in high-sloped reaches.

Map/Sketch of Site

On the field data sheet, sketch the reach of the stream being surveyed. (For an example, see Fig. J-5.) Drawing the map will familiarize you with the terrain and stream features and provide you and other volunteers with a visual record of your habitat walk. You should walk the reach from at least one bank.

On your sketch, note features such as riffles, runs, pools, ditches, wetlands, dams, riprap, outfalls, tributaries, landscape features, large trees which have fallen in the stream, jogging paths, vegetation, and roads. Use your topo map or a compass to determine which direction is north and mark it on your sketch. If you see important features outside your stream section, mark them on your sketch but note that they are outside the stream reach. Remember to use pencil or waterproof ink when drawing your map or filling out the field data sheets because regular ink will run if wet.

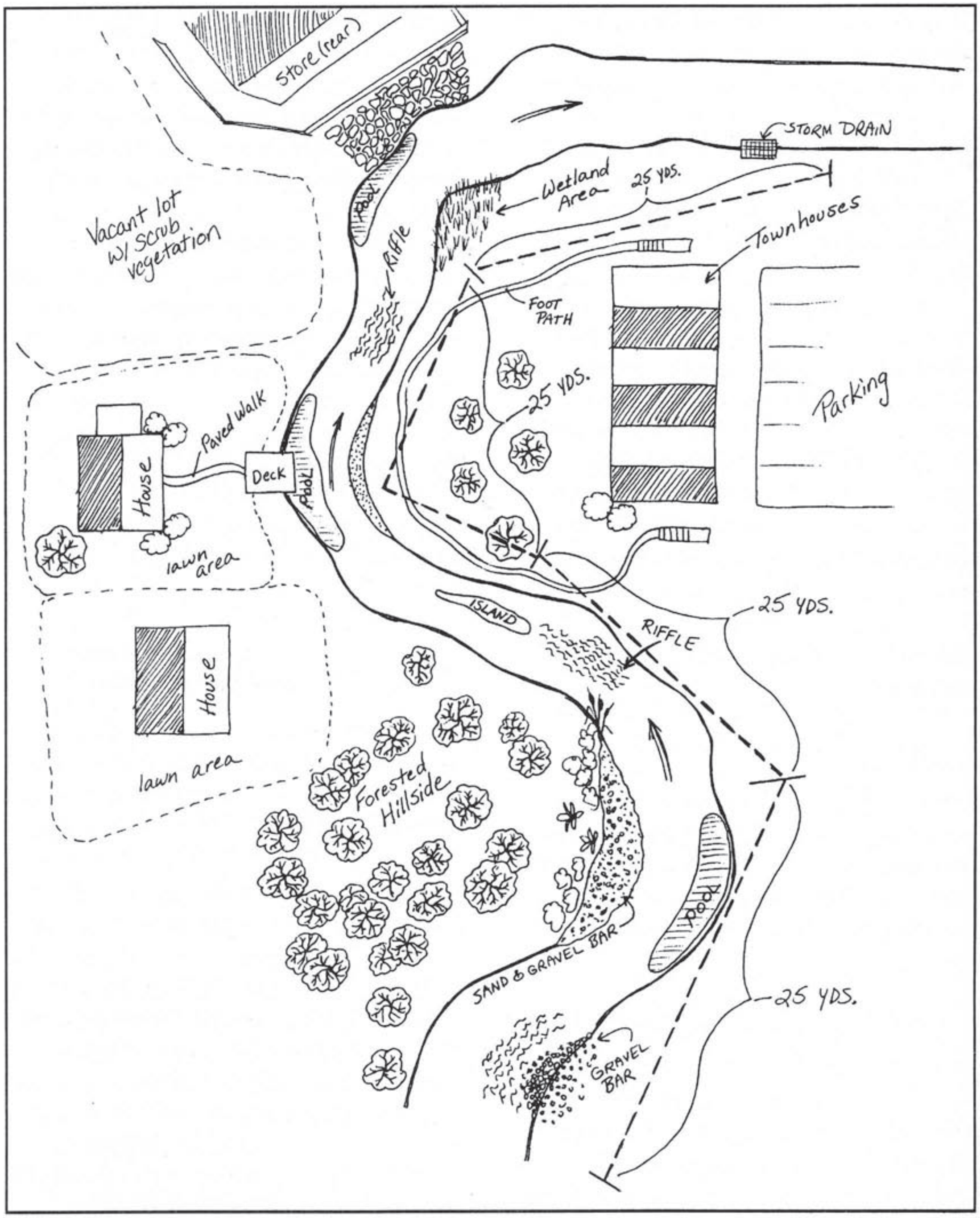


Figure J-5.
Example of stream sketch
Volunteers should note important stream features on their sketch including riffles and pools.

Instructions for Completing the Rapid Geomorphic Assessment (RGA) Portion of the SCS Data Sheets

For ease of use, the following numbered instructions correspond to the numbers on the field data sheet. A feature is **PRESENT** if it is easily recognizable or is obviously dominant.

Evidence of Aggradation – the geologic process in which inorganic materials carried downstream are deposited in streambeds, floodplains, and other water bodies resulting in a rise in elevation in the bottom of the water body.

1. *Lateral bars* – Sediment bar located on the side of a river channel, usually associated with the inside of slight curves. Also called a side bar.
2. *Coarse materials in riffles embedded* – are boulders, cobble, or rubble surrounded by fine sediments in riffle areas?
3. *Siltation in pools* – Are fine sediments deposited in pools?
4. *Mid-channel bars*- Bar formed in the mid-channel zone, not extending completely across the channel.
5. *Deposition on point bars*- Is material being deposited on the inside of meander bends?
6. *Poor lateral sorting of bed materials* – Typically, larger materials are deposited on bars and banks at lower heights than smaller materials. This results in a 'layering' effect with cobble and rubble being deposited at the toes of depositional features whereas silts and sands are deposited higher up. If these patterns are not discernable, than lateral sorting is poor.
7. *Soft, unconsolidated bed*- Sediment surface materials are loose and easily suspended or movable.
8. *Evidence of deposition in/around structures*- Are sediments being deposited around or in conjunction with larger, more sedentary features such as boulders, culverts, bridge abutments, or instream woody debris?
9. *Deposition in the overbank zone*- Evidence of stream deposited materials above the banks.

Evidence of Degradation – the geologic process by which streambeds and floodplains are lowered in elevation by the removal of materials.

1. *Channel incision into undisturbed overburden / bedrock* – The exposure of an erosion-resistant layer of relatively large materials or bedrock on the surface of the streambed.
2. *Elevated tree roots / root fan above channel bed*- Are the trees near or within the channel being scoured around their root network?
3. *Bank height increases* – Typically, bank heights are relatively uniform through a reach. If the banks of downstream areas are noticeably higher than upstream areas, then bank heights are increasing.
4. *Absence of depositional features* – No bars or other depositional features are present in the reach.

5. *Cut face on bar forms* – Are the toes and lowest portions of bars being actively scoured away?
6. *Head cutting due to knick point migration* - Upstream migration of an abrupt change in slope (cascade or waterfall) of the stream channel resulting in increased current velocities.
7. *Suspended armour layer visible in bank* – The exposure of an erosion-resistant layer of relatively large materials higher up in the stream bank.

Evidence of Widening – the geologic process by which stream channel width increases.

1. *Fallen / leaning trees/ fence posts / etc* – Are nearby stream bank structures falling into the channel?
2. *Occurrence of large organic debris* – Are large trees or collections of debris present in the channel or on bars?
3. *Exposed tree roots* – Are trees on the banks being scoured out with roots exposed?
4. *Basal scour on inside meander bends* – Are point bars being actively eroded away or is the thalweg[a] migrating toward the inside of the meander?
5. *Toe erosion on both sides of channel through riffle* – Are sediments being actively eroded from both sides through higher velocity areas?
6. *Steep bank angles through most of reach* – Are the stream banks steep with evidence of recent slumps or erosion?
7. *Length of bank scour >50% through subject reach* – Is there evidence of active erosion or bank slumping along more than half of the reach?
8. *Fracture lines along top of bank* – Are there cracks or visible lines parallel to the channel in the overbank zone?

Evidence of Planimetric Form Adjustment – the geologic process by which the stream plan form changes.

1. *Formation of chutes* – narrow, confined auxiliary channels for transporting high velocity over flows.
2. *Single thread channel to multiple channel* – single thread main channel anastomosing to a multiple or a braided pattern.
3. *Evolution of pool-riffle form to low bed relief form* – Obvious change from pool/riffle meander pattern to a lower gradient, slower and more uniform flow regime (glides).
4. *Cut-off channels(s)* – A short straight channel auxiliary channel that bypasses a stream bend and is formed by the stream cutting across a land area between two adjacent meander bends.
5. *Formation of islands(s)* – Are islands with maturing vegetation or trees well within the channel?
6. *Thalweg alignment out of phase meander form* – Is the channel thalweg[a] either non-existent or not following a typical meander pattern?
7. *Bar forms poorly formed / reworked / removed* – Are depositional (bars) features in obvious adjustment, not present where expected, or actively eroding?

[a] For a definition of "thalweg", see Figure J-6.

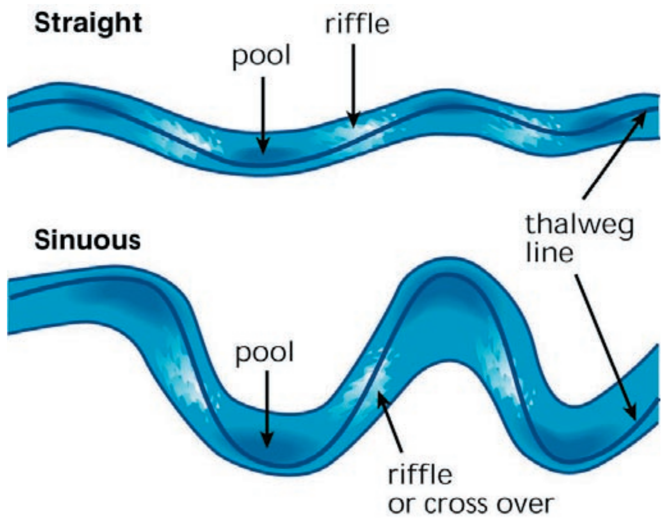


Figure J-6. Normal location of a stream's thalweg – the deepest thread of a channel.

Calculating the Stability Index and assigning geomorphic condition

The STABILITY INDEX is calculated to assess reach stability (*aggradation, degradation, widening,* or *planimetric form adjustment)* by:

STABILITY INDEX (SI) = (AI + DI + WI + PI) / 4

Where: **AI** = # of present aggradation features / 9
DI = # of present degradation features / 7
WI = # of present widening features / 8
PI = # of present planimetric form adjustment features / 7

For **SI** $\leq$ 0.20, CONDITION = in regime[1]
For **SI** 0.21 to 0.40, CONDITION = in transition or stressed[2]
For **SI** $\geq$ 0.41, CONDITION = in adjustment[2]

[1] *In the expected condition.*
[2] *Responding to changes in watershed hydrology or sediment loading.*

In Regime – a stream reach in reference and good condition that:

- Is in dynamic equilibrium which involves localized change to its shape or location while maintaining the fluvial processes and functions of its watershed over time and within the range of natural variability; and
- Provides high quality aquatic and riparian habitat with persistent bed features and channel forms that experience periodic disturbance as a result of erosion, deposition, and woody debris.

In Adjustment – a stream reach in fair condition that:

- Has experienced changes in channel form and fluvial processes outside the expected range of natural variability; may be poised for additional adjustment with future flooding or changes in watershed inputs that would change the stream type; and
- Provides aquatic and riparian habitat that may lack certain bed features and channel forms due to increases or decreases in the rate of erosion and deposition-related processes.

Active Adjustment and Stream Type Departure – a stream reach in poor condition that:

- Is experiencing adjustment outside the expected range of natural variability; is exhibiting a new stream type; is expected to continue to adjust, either evolving back to the historic reference stream type or to a new stream type consistent with watershed inputs; and
- Provides aquatic and riparian habitat that lacks certain bed features and channel forms due to substantial increases or decreases in the rate of erosion and deposition-related processes. Habitat features may be frequently disturbed beyond the range of many species' adaptability.

(From Vermont Agency of Natural Resources [2004])

Completed data sheets should be mailed to one of the addresses below unless your survey is part of a larger-scale survey being coordinated by a group and you have a pre-assigned person who will be collecting data forms:

Maine Dept of Inland Fisheries & Wildlife
Fishery Research Section
650 State Street
Bangor, ME 04401-5654
(207) 941-4381

Maine Department of Environmental Protection
Maine Stream Team Program
312 Canco Road
Portland, ME 04103
(207) 822-6317

Thank you for your assistance!

APPENDIX J-2a: Datasheets: UTM

Reach ID: ___________

STREAM CORRIDOR SURVEY

Level 1

Stream Name: ____

County: ______________________ **Town:** ______________________________

Investigators: ____

Site (description): ____

____

____

GPS Location	**Easting** (ex: 0396812)	**Northing** (ex: 4838054)	**Error** (ex. 16')	**Position in Reach:** (Upstream or Downstream)
			Ft	
Start	0 _ _ _ _ _ _	_ _ _ _ _ _ _	___	____stream
End	0 _ _ _ _ _ _	_ _ _ _ _ _ _	___	____stream

GPS Map Datum (e.g., NAD83, WGS84, etc.): ______________________________

Site or Map Number (if applicable): ______________________________

Date: ______________________ **Time:** ______________________

Weather in past 24 hours:

- ❑ Storm (heavy rain)
- ❑ Rain (steady rain)
- ❑ Showers (intermittent rain)
- ❑ Overcast
- ❑ Clear/ Partly Sunny

Weather now:

- ❑ Storm (heavy rain)
- ❑ Rain (steady rain)
- ❑ Showers (intermittent rain)
- ❑ Overcast
- ❑ Clear/ Partly Sunny

Data sheets last revised: July 2007
UTM Zone 19 VERSION

Photograph Log:

Take pictures of key features within your survey reach. Include the photo flip chart (with "Reach ID – Photo#) in each picture, if you have one. These photos are often very helpful in interpreting information, as well as accurate site referencing. Continue to log pictures in the "Comments" section of these datasheets if additional space is needed.

Suggested photos	**Photo #** (Reach ID—Photo#)	**Description**	**GPS Easting**	**GPS Northing**	**Error (ft)**
<u>Start of reach</u>: Facing direction of survey reach	_____-_____		0 _ _ _ _ _ _ _	_ _ _ _ _ _ _ _	
<u>Problems / Land Uses</u>: Pollution, erosion, sedimentation, riparian buffers or culverts in poor condition, dams, trail crossings, livestock in stream, etc.	_____-_____		0 _ _ _ _ _ _ _	_ _ _ _ _ _ _ _	
	_____-_____		0 _ _ _ _ _ _ _	_ _ _ _ _ _ _ _	
	_____-_____		0 _ _ _ _ _ _ _	_ _ _ _ _ _ _ _	
	_____-_____		0 _ _ _ _ _ _ _	_ _ _ _ _ _ _ _	
	_____-_____		0 _ _ _ _ _ _ _	_ _ _ _ _ _ _ _	
	_____-_____		0 _ _ _ _ _ _ _	_ _ _ _ _ _ _ _	
	_____-_____		0 _ _ _ _ _ _ _	_ _ _ _ _ _ _ _	
	_____-_____		0 _ _ _ _ _ _ _	_ _ _ _ _ _ _ _	
	_____-_____		0 _ _ _ _ _ _ _	_ _ _ _ _ _ _ _	
	_____-_____		0 _ _ _ _ _ _ _	_ _ _ _ _ _ _ _	
	_____-_____		0 _ _ _ _ _ _ _	_ _ _ _ _ _ _ _	
	_____-_____		0 _ _ _ _ _ _ _	_ _ _ _ _ _ _ _	
	_____-_____		0 _ _ _ _ _ _ _	_ _ _ _ _ _ _ _	
<u>Good things</u>: Healthy buffers, wildlife, cold water seeps/springs, good habitat, etc.	_____-_____		0 _ _ _ _ _ _ _	_ _ _ _ _ _ _ _	
	_____-_____		0 _ _ _ _ _ _ _	_ _ _ _ _ _ _ _	
	_____-_____		0 _ _ _ _ _ _ _	_ _ _ _ _ _ _ _	
	_____-_____		0 _ _ _ _ _ _ _	_ _ _ _ _ _ _ _	
	_____-_____		0 _ _ _ _ _ _ _	_ _ _ _ _ _ _ _	
<u>End of reach</u>: facing towards survey reach	_____-_____		0 _ _ _ _ _ _ _	_ _ _ _ _ _ _ _	

PHYSICAL CHARACTERIZATION

In-Stream Characteristics

1. Check which stream habitats are present:
(You can check more than 1 habitat)

❑ Pool(s) ❑ Riffle(s) ❑ Run(s) ❑ Cascade(s)
❑ Rapid(s) ❑ Deadwater(s) ❑ Other _______________

2. Nature of particles in the stream bottom at site

	0%	1-10%	11-49%	>50%
Silt/Clay/Mud (< 0.002" in diam.)	❑	❑	❑	❑
Sand (0.002 – 0.08" in diam.)	❑	❑	❑	❑
Fine or Med [Pea] Gravel (0.08 – 0.6")	❑	❑	❑	❑
Coarse Gravel (0.6 – 2.5" in diam.)	❑	❑	❑	❑
Cobble (2.5 - 10" in diam.)	❑	❑	❑	❑
Rubble (10 – 20" in diam.)	❑	❑	❑	❑
Boulder (over 20" in diam.)	❑	❑	❑	❑
Bedrock (solid)	❑	❑	❑	❑

3. Pick the category that best describes the extent to which gravel, cobbles, rubble, and boulders on the stream bottom are embedded (covered by) in sand, silt, or mud. (Check "not embedded" if stream bottom is all bedrock, sand, or silt [i.e., it lacks any gravel, cobbles, rubble, or boulders].)

❑ Not embedded (0-5%) ❑ Somewhat (5-25%) ❑ Halfway (50%)
❑ Mostly embedded (75%) ❑ Completely (100%)

4. Presence of logs or large woody debris in stream

❑ None ❑ Few ❑ Many ❑ Plentiful

5. Presence of naturally-occurring organic material (i.e., leaves and twigs, etc.) in stream:

❑ None ❑ Occasional ❑ Plentiful

6. Water appearance:

❑ Clear ❑ Light brown ❑ Orange
❑ Milky ❑ Dark brown / tea ❑ Greenish
❑ Foamy ❑ Oily sheen ❑ Turbid
❑ Other ___________________________________

7. Water odor:

❑ Sewage ❑ Fishy ❑ None
❑ Chlorine ❑ Rotten eggs ❑ Other________________

8. Water temperature: _________ °C *or* _________ °F

Streambank and Channel Characteristics

9. (a) Average depth of run(s):
❑ < 1 ft ❑ 1-2 ft ❑ > 2 ft
(b) Average depth of pool(s):
❑ < 1 ft ❑ 1-2 ft ❑ > 2 ft
(c) Number of pool(s) >2 ft deep: _______
(d) Avg. distance between pools: _______ ft

10. Average width of stream channel:

_________ feet ❑ measured ❑ estimated

11. Stream velocity: _________ ft/sec. (optional)

12. Pick the description that best fits the shape of the stream banks and the channel.

(a) Stream bank:
- Vertical/undercut ❑
- Steeply sloping (> 30°) ❑
- Gradual/no slope (< 30°) ❑

(b) Extent of artificial bank modifications:
- Bank 0-25% covered ❑
- Bank 25-50% covered ❑
- Bank 50-75% covered ❑
- Bank 75-100% covered ❑

(c) Shape of the channel:

❑ Narrow, deep ❑ Wide, deep
❑ Narrow, shallow ❑ Wide, shallow

13. Describe the streamside cover. Check "0" if absent, "1" if present, "2" if common

(a) Along water's edge and stream bank only:

	0	1	2
Logs, large woody debris	❑	❑	❑
Rootwads	❑	❑	❑
Overhanging vegetation	❑	❑	❑
Small woody debris	❑	❑	❑
Boulders/rocks	❑	❑	❑
Undercut banks	❑	❑	❑
Anthropogenic (manmade) structures	❑	❑	❑
Deep water, turbulence or foam	❑	❑	❑
Lawn	❑	❑	❑
Bare soil	❑	❑	❑

(b) From the top of the streambanks out to 25 yards.

	0	1	2
Trees, woodland	❑	❑	❑
Bushes, shrubs	❑	❑	❑
Tall grasses, ferns, etc.	❑	❑	❑
Lawn	❑	❑	❑
Boulders/rocks	❑	❑	❑
Gravel/sand	❑	❑	❑
Bare soil	❑	❑	❑
Pavement, structures	❑	❑	❑
Agricultural land	❑	❑	❑

14. Pick the category that best describes the extent to which vegetation shades the stream at your site.

❑ 0% ❑ 25% ❑ 50% ❑ 75% ❑ 100%

15. Note general conditions. Check "0" if absent, "1" if present, "2" if problem is clearly severe.

Stream Banks	**0**	**1**	**2**
Natural streamside plant cover degraded	❑	❑	❑
Banks collapsed/eroded	❑	❑	❑
Garbage/junk adjacent to the stream	❑	❑	❑
Foam or sheen on bank	❑	❑	❑

Stream	**0**	**1**	**2**
Mud, silt, or sand in or entering the stream	❑	❑	❑
Garbage/junk in the stream	❑	❑	❑

Other	**0**	**1**	**2**
Yard waste on bank (grass, clippings, etc.)	❑	❑	❑
Livestock in or with unrestricted access to stream	❑	❑	❑
Actively discharging pipe(s)	❑	❑	❑
Other pipe(s) entering the stream	❑	❑	❑
Ditches entering the stream	❑	❑	❑

Local Watershed Characteristics

(within about 1/4 mile of the site; adjacent and upstream)

16. Land uses in the local watershed can potentially have an impact on a stream. Check "0" if absent, "1" if present, "2" if clearly having an impact on the stream.

0	**1**	**2**	**Residential**
❑	❑	❑	Single-family housing
❑	❑	❑	Multifamily housing
❑	❑	❑	Lawns
❑	❑	❑	Commercial/institutional

0	**1**	**2**	**Roads, etc**.
❑	❑	❑	Paved roads or bridges
❑	❑	❑	Unpaved roads

0	**1**	**2**	**Construction underway on:**
❑	❑	❑	Housing development
❑	❑	❑	Commercial development
❑	❑	❑	Road bridge construction/repair

0	**1**	**2**	**Agricultural**
❑	❑	❑	Grazing land
❑	❑	❑	Feeding lots or animal holding areas
❑	❑	❑	Cropland
❑	❑	❑	Inactive agricultural land/fields

0	**1**	**2**	**Recreation**
❑	❑	❑	Power boating
❑	❑	❑	Golfing
❑	❑	❑	Camping
❑	❑	❑	Swimming/fishing/canoeing
❑	❑	❑	Hiking/paths

0	**1**	**2**	**Other**
❑	❑	❑	Mining or gravel pits
❑	❑	❑	Logging / industrial forest
❑	❑	❑	Industry
❑	❑	❑	Oil and gas drilling
❑	❑	❑	Trash dump
❑	❑	❑	Landfills
❑	❑		Natural woodland (natural woodlands usually don't have an impact on streams)

BIOLOGICAL CHARACTERIZATION

VISUAL BIOLOGICAL SURVEY

17. Wildlife in or around the stream? (Mark all that apply)

❑ Amphibians ❑ Waterfowl ❑ Reptiles ❑ Mammals

❑ Other wildlife / notes: ____

18. Fish in the stream? (Mark all that apply)

❑ No ❑ Yes, but rare ❑ Yes, abundant

❑ Small (1-2 in.) ❑ Medium (3-6 in.) ❑ Large (7 in. and above)

Are there any potential barriers to fish movement?

❑ Beaver dams ❑ Waterfalls > 1' ❑ None

❑ Dams ❑ Road barriers / culverts ❑ Other _______________

19. Aquatic plants in the stream. (Mark all that apply)

❑ None ❑ Occasional ❑ Plentiful

❑ Attached ❑ Free-floating

❑ Stream margin ❑ Pools ❑ Near riffle

20. Extent of algae in the stream. (Mark all that apply)

(a) Are the submerged stones, twigs, or other material in the stream coated with a layer of algal “slime”?

❑ None ❑ Occasional ❑ Plentiful

❑ Light coating ❑ Heavy coating

❑ Brownish ❑ Greenish ❑ Other _______________

(b) **Are there any filamentous (string-like) algae?**

❑ None ❑ Occasional ❑ Plentiful

❑ Brownish ❑ Greenish ❑ Other _______________

(c) **Are any detached “clumps” or “mats” of algae floating on the water’s surface?**

❑ None ❑ Occasional ❑ Plentiful

❑ Brownish ❑ Greenish ❑ Other _______________

MACROINVERTEBRATE SURVEY

21. If macroinvertebrates were collected from the stream bottom, which type of method/habitat was selected?

❑ Rock-rubbing method: From cobbles and large stones selected from riffles.

❑ Stick-picking method: From woody objects in streams with sandy, silty bottoms.

❑ Leaf-pack sorting method: From submerged leaves in streams with either a rocky or sandy, silty bottom.

22. Are macroinvertebrates present?

❑ No ❑ Yes, but rare ❑ Yes, abundant

23. If present, describe the types of macroinvertebrates found.

(Mark all that apply)

Wormlike	❑ Occasional	❑ Plentiful
Snails/clamlike	❑ Occasional	❑ Plentiful
Insects	❑ Occasional	❑ Plentiful
Crayfish	❑ Occasional	❑ Plentiful

Notes:

24. What is the approximate slope of your stream reach?

❑ Valley / flat (0 – 2 %) ❑ Hill / medium (3 – 4 %)

❑ Ridge / high (5 – 9 %) ❑ Mountain / very high (10 – 13 %)

❑ Waterfall / very steep (> 14 %) [don’t work in these reaches]

COMMENTS: *(Note changes or potential problems such as spills, construction, type of discharging pipes)*

Map/Sketch of Site

Please attach USGS 7.5” topo map of your site (photocopy is OK).
Please note the start and stop points of your stream habitat survey and any features you encountered that require further illustration or clarification.
Also, please draw a sketch of your reach, and any important features, in the space provided below.

Rapid Geomorphic Assessment (RGA)

(Part of the Stream Corridor Survey [Level 1])

Date: **Site/Reach ID:** **Recorder:**
Location: **Crew:**

Form / Process	Geomorphic Indicator		Present		Score
	Num	Description	No	Yes	
Evidence of Aggradation (AI)	1	Lateral bars			
	2	Coarse materials in riffles embedded			
	3	Siltation in pools			
	4	Mid-channel bars			
	5	Deposition on point bars			
	6	Poor lateral sorting of bed materials			
	7	Soft, unconsolidated bed			
	8	Evidence of deposition in / around bank structures			
	9	Deposition in the overbank zone			
		Sum of Indices:			

Evidence of Degradation (DI)	1	Channel incision into undisturbed overburden / bedrock			
	2	Elevated tree roots / root fan above channel bed			
	3	Bank height increases			
	4	Absence of depositional features (no bars)			
	5	Cut face on bar forms			
	6	Head cutting due to knick point migration			
	7	Suspended armor layer visible in bank			
		Sum of Indices:			

Evidence of Widening (WI)	1	Fallen / leaning trees / fence posts / etc.			
	2	Occurrence of large organic debris			
	3	Exposed tree roots			
	4	Basal scour on inside meander bends			
	5	Toe erosion on both sides of channel through riffle			
	6	Steep bank angles through most of subject reach			
	7	Length of bank scour >50% through subject reach			
	8	Fracture lines along top of bank			
		Sum of Indices:			

Evidence of Planimetric Form Adjustment (PI)	1	Formation of chutes			
	2	Single thread to multiple channel			
	3	Evolution of pool-riffle form to low bed relief form			
	4	Cut-off channel(s)			
	5	Formation of island(s)			
	6	Thalweg alignment out of phase meander form			
	7	Bar forms poorly formed / reworked / removed			
		Sum of Indices:			

Stability Index:

Condition:

APPENDIX J-2b: Datasheets Longitude/Latitude

Reach ID: ___________

STREAM CORRIDOR SURVEY

Level 1

Stream Name: ____

County: ______________________ **Town:** ______________________________

Investigators: ____

Site (description): ____

____

____

GPS Location	**Latitude** (ex: 70° 16' 49.3")			**Longitude** (ex: 70° 23' 32.7")			**Error** (ex. 16')	**Position in Reach:** (Upstream or Downstream)
	Degree	Min	Sec	Deg	Min	Sec	Ft	
Start	____°	____'	_____"	____°	____'	_____"	____	____stream
End	____°	____'	_____"	____°	____'	_____"	____	____stream

GPS Map Datum (e.g., NAD83, WGS84, etc.): ______________________________

Site or Map Number (if applicable): ____________________________________

Date: ________________________ **Time:** ______________________________

Weather in past 24 hours:

- ❑ Storm (heavy rain)
- ❑ Rain (steady rain)
- ❑ Showers (intermittent rain)
- ❑ Overcast
- ❑ Clear/ Partly Sunny

Weather now:

- ❑ Storm (heavy rain)
- ❑ Rain (steady rain)
- ❑ Showers (intermittent rain)
- ❑ Overcast
- ❑ Clear/ Partly Sunny

Data sheets last revised: July 2007
LATITUDE/LONGITUDE VERSION

Photograph Log:

Take pictures of key features within your survey reach. Include the photo flip chart (with "Reach ID – Photo#) in each picture, if you have one. These photos are often very helpful in interpreting information, as well as accurate site referencing. Continue to log pictures in the "Comments" section of these datasheets if additional space is needed.

Suggested photos	Photo # (Reach ID—Photo#)	Description	GPS Latitude	GPS Longitude	Error (ft)
Start of reach: Facing direction of survey reach	_____-_____		____° ____’ _____”	____° ____’ _____”	
Problems / Land Uses: Pollution, erosion, sedimentation, riparian buffers or culverts in poor condition, dams, trail crossings, livestock in stream, etc.	_____-_____		____° ____’ _____”	____° ____’ _____”	
	_____-_____		____° ____’ _____”	____° ____’ _____”	
	_____-_____		____° ____’ _____”	____° ____’ _____”	
	_____-_____		____° ____’ _____”	____° ____’ _____”	
	_____-_____		____° ____’ _____”	____° ____’ _____”	
	_____-_____		____° ____’ _____”	____° ____’ _____”	
	_____-_____		____° ____’ _____”	____° ____’ _____”	
	_____-_____		____° ____’ _____”	____° ____’ _____”	
	_____-_____		____° ____’ _____”	____° ____’ _____”	
	_____-_____		____° ____’ _____”	____° ____’ _____”	
	_____-_____		____° ____’ _____”	____° ____’ _____”	
	_____-_____		____° ____’ _____”	____° ____’ _____”	
	_____-_____		____° ____’ _____”	____° ____’ _____”	
Good things: Healthy buffers, wildlife, cold water seeps/springs, good habitat, etc.	_____-_____		____° ____’ _____”	____° ____’ _____”	
	_____-_____		____° ____’ _____”	____° ____’ _____”	
	_____-_____		____° ____’ _____”	____° ____’ _____”	
	_____-_____		____° ____’ _____”	____° ____’ _____”	
	_____-_____		____° ____’ _____”	____° ____’ _____”	
End of reach: facing towards survey reach	_____-_____		____° ____’ _____”	____° ____’ _____”	

PHYSICAL CHARACTERIZATION

In-Stream Characteristics

1. Check which stream habitats are present:
(You can check more than 1 habitat)

❑ Pool(s) ❑ Riffle(s) ❑ Run(s) ❑ Cascade(s)
❑ Rapid(s) ❑ Deadwater(s) ❑ Other _______________

2. Nature of particles in the stream bottom at site

	0%	**1-10%**	**11-49%**	**≥50%**
Silt/Clay/Mud (< 0.002" in diam.)	❑	❑	❑	❑
Sand (0.002 – 0.08" in diam.)	❑	❑	❑	❑
Fine or Med [Pea] Gravel (0.08 – 0.6")	❑	❑	❑	❑
Coarse Gravel (0.6 – 2.5" in diam.)	❑	❑	❑	❑
Cobble (2.5 - 10" in diam.)	❑	❑	❑	❑
Rubble (10 – 20" in diam.)	❑	❑	❑	❑
Boulder (over 20" in diam.)	❑	❑	❑	❑
Bedrock (solid)	❑	❑	❑	❑

3. Pick the category that best describes the extent to which gravel, cobbles, rubble, and boulders on the stream bottom are embedded (covered by) in sand, silt, or mud. (Check "not embedded" if stream bottom is all bedrock, sand, or silt [i.e., it lacks any gravel, cobbles, rubble, or boulders].)

❑ Not embedded (0-5%) ❑ Somewhat (5-25%) ❑ Halfway (50%)
❑ Mostly embedded (75%) ❑ Completely (100%)

4. Presence of logs or large woody debris in stream

❑ None ❑ Few ❑ Many ❑ Plentiful

5. Presence of naturally-occurring organic material (i.e., leaves and twigs, etc.) in stream:

❑ None ❑ Occasional ❑ Plentiful

6. Water appearance:

❑ Clear ❑ Light brown ❑ Orange
❑ Milky ❑ Dark brown / tea ❑ Greenish
❑ Foamy ❑ Oily sheen ❑ Turbid
❑ Other _______________________________________

7. Water odor:

❑ Sewage ❑ Fishy ❑ None
❑ Chlorine ❑ Rotten eggs ❑ Other________________

8. Water temperature: _________ °C *or* _________ °F

Streambank and Channel Characteristics

9. (a) Average depth of run(s):
❑ < 1 ft ❑ 1-2 ft ❑ > 2 ft

(b) Average depth of pool(s):
❑ < 1 ft ❑ 1-2 ft ❑ > 2 ft

(c) Number of pool(s) >2 ft deep: _______

(d) Avg. distance between pools: _______ ft

10. Average width of stream channel:

_________ feet ❑ measured ❑ estimated

11. Stream velocity: _________ ft/sec. (optional)

12. Pick the description that best fits the shape of the stream banks and the channel.

(a) Stream bank:

Vertical/undercut	❑
Steeply sloping (> 30°)	❑
Gradual/no slope (< 30°)	❑

(b) Extent of artificial bank modifications:

Bank 0-25% covered	❑
Bank 25-50% covered	❑
Bank 50-75% covered	❑
Bank 75-100% covered	❑

(c) Shape of the channel:

❑ Narrow, deep ❑ Wide, deep
❑ Narrow, shallow ❑ Wide, shallow

13. Describe the streamside cover. Check "0" if absent, "1" if present, "2" if common

(a) Along water's edge and stream bank only:

	0	**1**	**2**
Logs, large woody debris	❑	❑	❑
Rootwads	❑	❑	❑
Overhanging vegetation	❑	❑	❑
Small woody debris	❑	❑	❑
Boulders/rocks	❑	❑	❑
Undercut banks	❑	❑	❑
Anthropogenic (manmade) structures	❑	❑	❑
Deep water, turbulence or foam	❑	❑	❑
Lawn	❑	❑	❑
Bare soil	❑	❑	❑

(b) From the top of the streambanks out to 25 yards.

	0	1	2
Trees, woodland	❑	❑	❑
Bushes, shrubs	❑	❑	❑
Tall grasses, ferns, etc.	❑	❑	❑
Lawn	❑	❑	❑
Boulders/rocks	❑	❑	❑
Gravel/sand	❑	❑	❑
Bare soil	❑	❑	❑
Pavement, structures	❑	❑	❑
Agricultural land	❑	❑	❑

14. Pick the category that best describes the extent to which vegetation shades the stream at your site.

❑ 0% ❑ 25% ❑ 50% ❑ 75% ❑ 100%

15. Note general conditions. Check “0” if absent, “1” if present, “2” if problem is clearly severe.

Stream Banks	**0**	**1**	**2**
Natural streamside plant cover degraded	❑	❑	❑
Banks collapsed/eroded	❑	❑	❑
Garbage/junk adjacent to the stream	❑	❑	❑
Foam or sheen on bank	❑	❑	❑

Stream	**0**	**1**	**2**
Mud, silt, or sand in or entering the stream	❑	❑	❑
Garbage/junk in the stream	❑	❑	❑

Other	**0**	**1**	**2**
Yard waste on bank (grass, clippings, etc.)	❑	❑	❑
Livestock in or with unrestricted access to stream	❑	❑	❑
Actively discharging pipe(s)	❑	❑	❑
Other pipe(s) entering the stream	❑	❑	❑
Ditches entering the stream	❑	❑	❑

Local Watershed Characteristics

(within about 1/4 mile of the site; adjacent and upstream)

16. Land uses in the local watershed can potentially have an impact on a stream. Check “0” if absent, “1” if present, “2” if clearly having an impact on the stream.

0	**1**	**2**	**Residential**
❑	❑	❑	Single-family housing
❑	❑	❑	Multifamily housing
❑	❑	❑	Lawns
❑	❑	❑	Commercial/institutional

0	**1**	**2**	**Roads, etc**.
❑	❑	❑	Paved roads or bridges
❑	❑	❑	Unpaved roads

0	**1**	**2**	**Construction underway on:**
❑	❑	❑	Housing development
❑	❑	❑	Commercial development
❑	❑	❑	Road bridge construction/repair

0	**1**	**2**	**Agricultural**
❑	❑	❑	Grazing land
❑	❑	❑	Feeding lots or animal holding areas
❑	❑	❑	Cropland
❑	❑	❑	Inactive agricultural land/fields

0	**1**	**2**	**Recreation**
❑	❑	❑	Power boating
❑	❑	❑	Golfing
❑	❑	❑	Camping
❑	❑	❑	Swimming/fishing/canoeing
❑	❑	❑	Hiking/paths

0	**1**	**2**	**Other**
❑	❑	❑	Mining or gravel pits
❑	❑	❑	Logging / industrial forest
❑	❑	❑	Industry
❑	❑	❑	Oil and gas drilling
❑	❑	❑	Trash dump
❑	❑	❑	Landfills
❑	❑		Natural woodland (natural woodlands usually don’t have an impact on streams)

BIOLOGICAL CHARACTERIZATION

VISUAL BIOLOGICAL SURVEY

17. Wildlife in or around the stream? (Mark all that apply)

❑ Amphibians ❑ Waterfowl ❑ Reptiles ❑ Mammals

❑ Other wildlife / notes: ____

18. Fish in the stream? (Mark all that apply)

❑ No ❑ Yes, but rare ❑ Yes, abundant

❑ Small (1-2 in.) ❑ Medium (3-6 in.) ❑ Large (7 in. and above)

Are there any potential barriers to fish movement?

❑ Beaver dams ❑ Waterfalls > 1' ❑ None

❑ Dams ❑ Road barriers / culverts ❑ Other _______________

19. Aquatic plants in the stream. (Mark all that apply)

❑ None ❑ Occasional ❑ Plentiful

❑ Attached ❑ Free-floating

❑ Stream margin ❑ Pools ❑ Near riffle

20. Extent of algae in the stream. (Mark all that apply)

(a) Are the submerged stones, twigs, or other material in the stream coated with a layer of algal “slime”?

❑ None ❑ Occasional ❑ Plentiful

❑ Light coating ❑ Heavy coating

❑ Brownish ❑ Greenish ❑ Other _______________

(b) **Are there any filamentous (string-like) algae?**

❑ None ❑ Occasional ❑ Plentiful

❑ Brownish ❑ Greenish ❑ Other _______________

(c) **Are any detached “clumps” or “mats” of algae floating on the water’s surface?**

❑ None ❑ Occasional ❑ Plentiful

❑ Brownish ❑ Greenish ❑ Other _______________

MACROINVERTEBRATE SURVEY

21. If macroinvertebrates were collected from the stream bottom, which type of method/habitat was selected?

❑ Rock-rubbing method: From cobbles and large stones selected from riffles.

❑ Stick-picking method: From woody objects in streams with sandy, silty bottoms.

❑ Leaf-pack sorting method: From submerged leaves in streams with either a rocky or sandy, silty bottom.

22. Are macroinvertebrates present?

❑ No ❑ Yes, but rare ❑ Yes, abundant

23. If present, describe the types of macroinvertebrates found.

(Mark all that apply)

Wormlike	❑ Occasional	❑ Plentiful
Snails/clamlike	❑ Occasional	❑ Plentiful
Insects	❑ Occasional	❑ Plentiful
Crayfish	❑ Occasional	❑ Plentiful

Notes:

24. What is the approximate slope of your stream reach?

❑ Valley / flat (0 – 2 %) ❑ Hill / medium (3 – 4 %)

❑ Ridge / high (5 – 9 %) ❑ Mountain / very high (10 – 13 %)

❑ Waterfall / very steep (> 14 %) [don’t work in these reaches]

COMMENTS: *(Note changes or potential problems such as spills, construction, type of discharging pipes)*

Map/Sketch of Site

Please attach USGS 7.5” topo map of your site (photocopy is OK).

Please note the start and stop points of your stream habitat survey and any features you encountered that require further illustration or clarification.

Also, please draw a sketch of your reach, and any important features, in the space provided below.

Rapid Geomorphic Assessment (RGA)

(Part of the Level 1 Stream Corridor Survey)

Date: **Site/Reach ID:** **Recorder:**
Location: **Crew:**

Form / Process	Geomorphic Indicator		Present		Score
	Num	Description	No	Yes	
Evidence of Aggradation (AI)	1	Lateral bars			
	2	Coarse materials in riffles embedded			
	3	Siltation in pools			
	4	Mid-channel bars			
	5	Deposition on point bars			
	6	Poor lateral sorting of bed materials			
	7	Soft, unconsolidated bed			
	8	Evidence of deposition in / around bank structures			
	9	Deposition in the overbank zone			
		Sum of Indices:			

Evidence of Degradation (DI)	1	Channel incision into undisturbed overburden / bedrock			
	2	Elevated tree roots / root fan above channel bed			
	3	Bank height increases			
	4	Absence of depositional features (no bars)			
	5	Cut face on bar forms			
	6	Head cutting due to knick point migration			
	7	Suspended armor layer visible in bank			
		Sum of Indices:			

Evidence of Widening (WI)	1	Fallen / leaning trees / fence posts / etc.			
	2	Occurrence of large organic debris			
	3	Exposed tree roots			
	4	Basal scour on inside meander bends			
	5	Toe erosion on both sides of channel through riffle			
	6	Steep bank angles through most of subject reach			
	7	Length of bank scour >50% through subject reach			
	8	Fracture lines along top of bank			
		Sum of Indices:			

Evidence of Planimetric Form Adjustment (PI)	1	Formation of chutes			
	2	Single thread to multiple channel			
	3	Evolution of pool-riffle form to low bed relief form			
	4	Cut-off channel(s)			
	5	Formation of island(s)			
	6	Thalweg alignment out of phase meander form			
	7	Bar forms poorly formed / reworked / removed			
		Sum of Indices:			

Stability Index:

Condition:

Appendix J-3:

Rapid Geomorphic Assessment Picture Key

Last updated November 30, 2007

Table of Contents

Acknowledgements

This picture key is intended to compliment the Rapid Geomorphic Assessment (RGA) technique. We thankfully acknowledge the following source for the RGA technique currently being promoted by the Maine Stream Team Program (Maine Department of Environmental Protection) and Fisheries Research Section (Maine Department of Inland Fisheries & Wildlife):

Parish Geomorphic Ltd. (Georgetown, Ontario, Canada). 2003. Rapid Geomorphic Assessment (RGA). *Adapted from the RGA method described in*:

Ontario (Canada) Ministry of the Environment. 2003. Stormwater Management Planning and Design Manual. Document # 4329e. Queen's Printer for Ontario; Ontario, Canada.

Section heading text was adapted from parts of *The Streamside Sentinel* (1999) and the *Vermont Stream Geomorphic Assessment Protocols* (2004), publications of the Vermont Agency of Natural Resources — < http://www.anr.state.vt.us/dec/waterq/rivers/htm/rv_geoassess.htm >.

We also would like to thank John Field (Field Geology Services, Farmington, Maine) for assistance in editing this picture key.

Tips for Use

This picture key is meant to accompany the rapid geomorphic assessment (RGA) portion of the datasheets and instructions in Appendix J (Stream Corridor Survey [Level 1] Field Sheets) of the MDEP/MDIFW guidance document entitled “Stream Survey Manual (Volume 1): A Citizen’s Guide to Basic Watershed, Habitat, and Geomorphology Surveys in Stream & River Watersheds” (2008). It is designed to help translate the scientific jargon in the RGA into practical information that you can apply in the field.

This document should in no means be considered a replacement for training, and is not intended to produce the same caliber of results you would obtain from a professional fluvial geomorphologist. It should, however, help you to gain a basic understanding of the underlying water– and sediment-transport issues affecting your stream of interest, and help you identify stream reaches that may be abnormally unstable.

You can share this information with stream specialists to determine whether your stream may have significant instability issues. Information gleaned from these stream corridor surveys, including the RGA component, can help identify possible good or poor fisheries habitats as well as where simple best management practices (BMPs) such as riparian (shoreland) tree plantings, or ATV or cattle exclusion projects, ought to be focused. This information may also help you prioritize regions of the stream watershed where soil erosion BMPs ought to be focused to reduce impacts on the stream. <u>More complex problems, especially those associated with actual streambank or channel features, require the guidance of stream specialists (e.g., geomorphologists, biologists, natural resource engineers, etc.), more intensive studies and, possibly, engineering designs and appropriate DEP permits.</u>

If you are interested in more information about the Rapid Geomorphic Assessment (Level I), or other volunteer stream surveying techniques within the State of Maine, please contact the Maine Department of Inland Fisheries and Wildlife, Fishery Research Station, 650 State Street; Bangor, ME 04401; or the Maine Department of Environmental Protection, c/o Maine Stream Team Program, 312 Canco Rd., Portland, ME 04103 or by emailing < mstp@maine.gov >.

If you are interested in more comprehensive geomorphic assessment techniques, we suggest checking out the geomorphology protocol guidance documents and other materials produced by the Vermont Agency of Natural resources at < http://www.vtwaterquality.org/rivers/htm/rv_geoassess.htm >.

Photograph/Image Credits

Each photograph has a copyright symbol (©) followed by a number. This refers to the picture credits and copyright information listed below.

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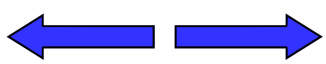
9. Photo © Richard Harwood, Black Hawk College
10. Image obtained from Maine Office of Geographic Information Systems (GIS).
11. Image supplied by Field Geology Services (Farmington, ME).

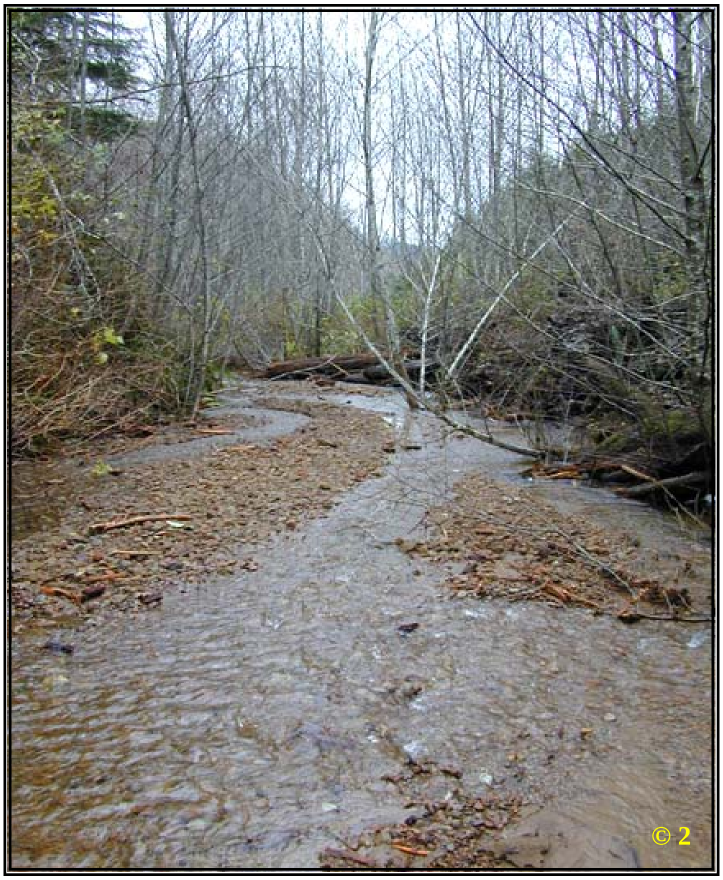
Photographs and Direction of Water Flow

Many of the principles described in this picture key are demonstrated with photographs and diagrams. For the sake of consistency, all **blue** arrows represent direction of water flow within a river or stream channel. Arrows of any other color will have an associated text box describing the feature of interest.

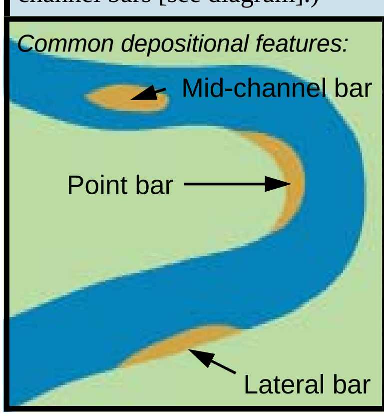


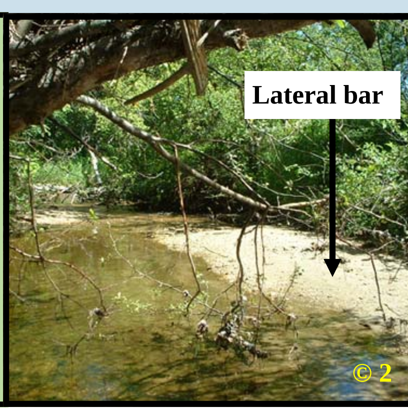
SECTION 1:
EVIDENCE OF AGGRADATION

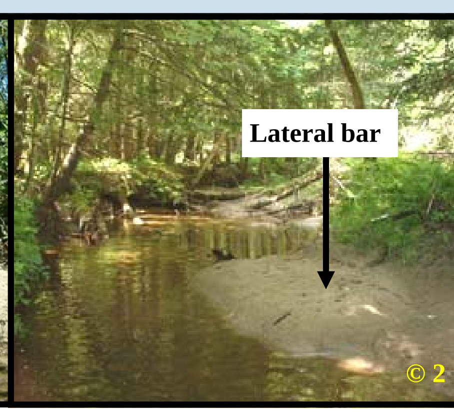
Sediment loads pile up in the river. This happens when the sediment load to the river increases (due to natural processes or human activities) and it lacks the capacity to transport it. Piles of sediment in a river can re-direct flow against the banks, causing yet more erosion.



1. Lateral bars—Sediment bars located on the side of a river channel. (Do not confuse lateral bars with point bars or mid-channel bars [see diagram].)





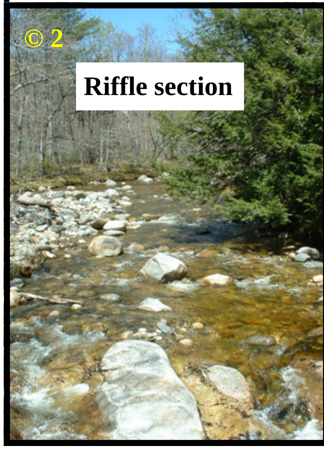


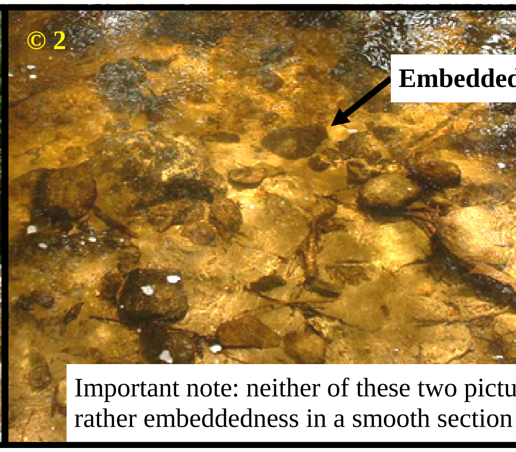
SECTION 1: EVIDENCE OF AGGRADATION

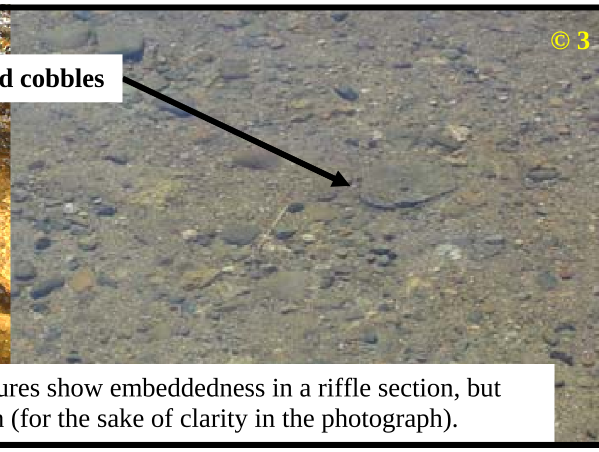
2. Coarse materials in riffles embedded—

Are rocks (fist-sized and bigger) partially or entirely buried by fine sediments (sands, silts, muds) in riffles? If you pick up a cobble, is there a hollow left in the sediment? Is it difficult to pry cobbles out of the sediments?

Riffle: *n. Shallow, turbulent area in stream where water flows swiftly over gravel and rocks.*





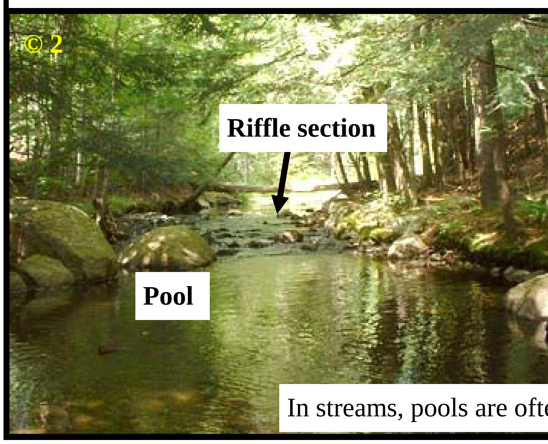


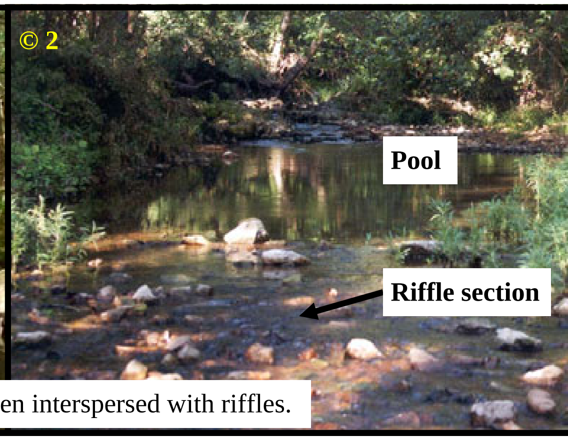
Important note: neither of these two pictures show embeddedness in a riffle section, but rather embeddedness in a smooth section (for the sake of clarity in the photograph).

3. Siltation in pools—

Are fine sediments being deposited in pools?

Pool: *n. Deeper portion of stream where water flows more slowly.*





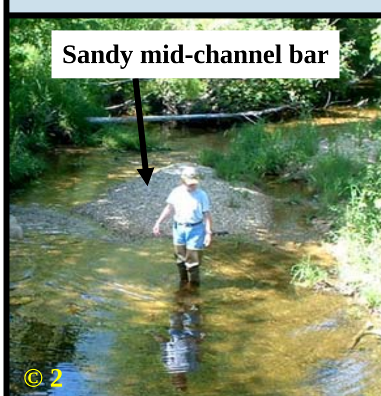
In streams, pools are often interspersed with riffles.

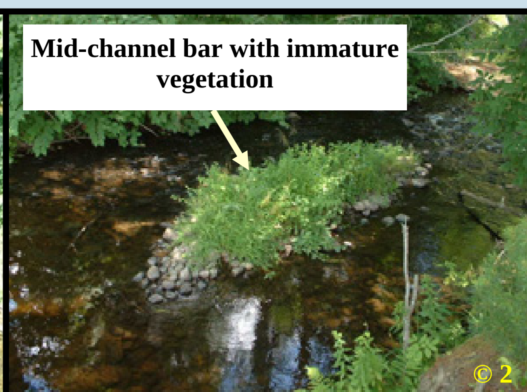
IMPORTANT NOTE:
You are looking for evidence of fresh deposition of fine sediments that will have buried any organic material (leaves/etc.)

LONG-TERM TIP:
If you were to drop a large white stone into the pool and return to the pool after the next storm, would the stone be covered?

4. Mid-channel bars—

Bars formed in the mid-channel zone, not extending completely across the channel, and lacking mature vegetation (trees, etc.).

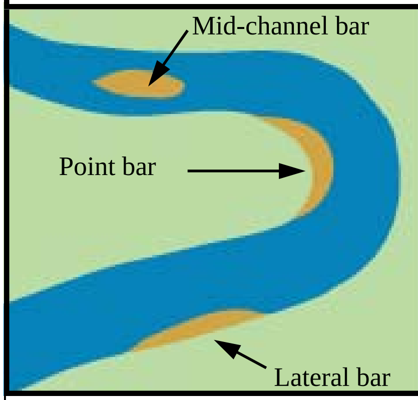


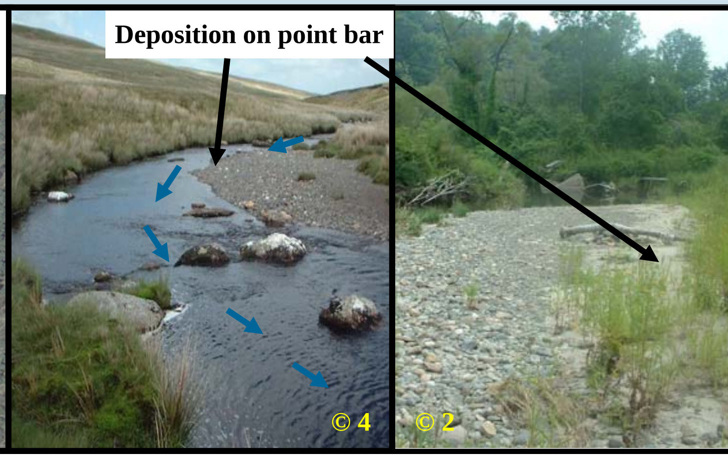


SECTION 1: EVIDENCE OF AGGRADATION

5. Deposition on point bars—Is new, fresh material being deposited on the inside of meander bends?

Common depositional features:

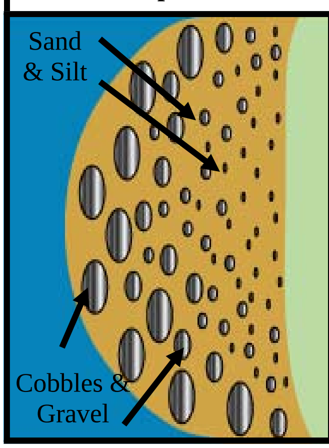




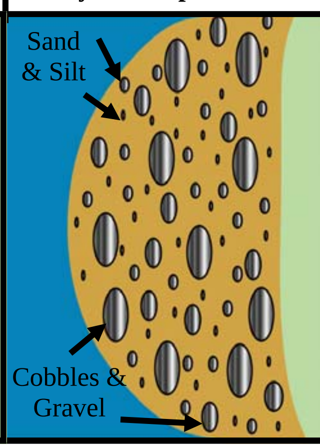
CAUTION: Point bars are natural features. You are not looking for the existence of point bars, but rather, evidence of fresh deposition on the point bar. This will appear as fine- to coarse- grained sediment, and is often unconsolidated (it has not had time to compact).

6. Poor lateral sorting of bed materials—Typically, larger materials are deposited on bars and banks at lower heights than smaller materials. This results in a "layering" effect with cobble and rubble being deposited at the toes of depositional features whereas silts and sands are deposited higher up (see drawing). If these patterns are not discernable, then longitudinal sorting is poor.

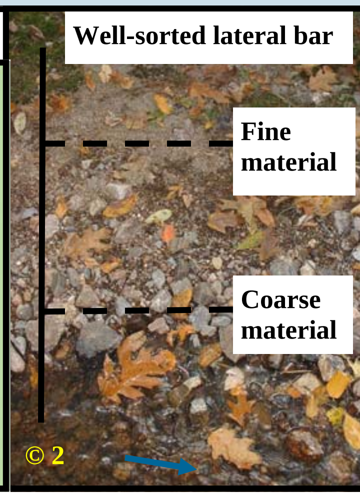
Well-sorted point bar



Poorly-sorted point bar



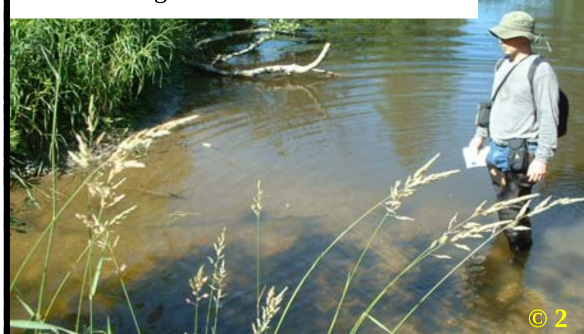
Well-sorted lateral bar



Poorly-sorted lateral bar: no sorting evident along transect

7. Soft, unconsolidated bed—Sediment surface materials are loose and easily suspended or moveable. "Mucky" sediments can be considered soft and unconsolidated.

Boots often stir up clouds of muck as you walk in fine-grained unconsolidated beds.

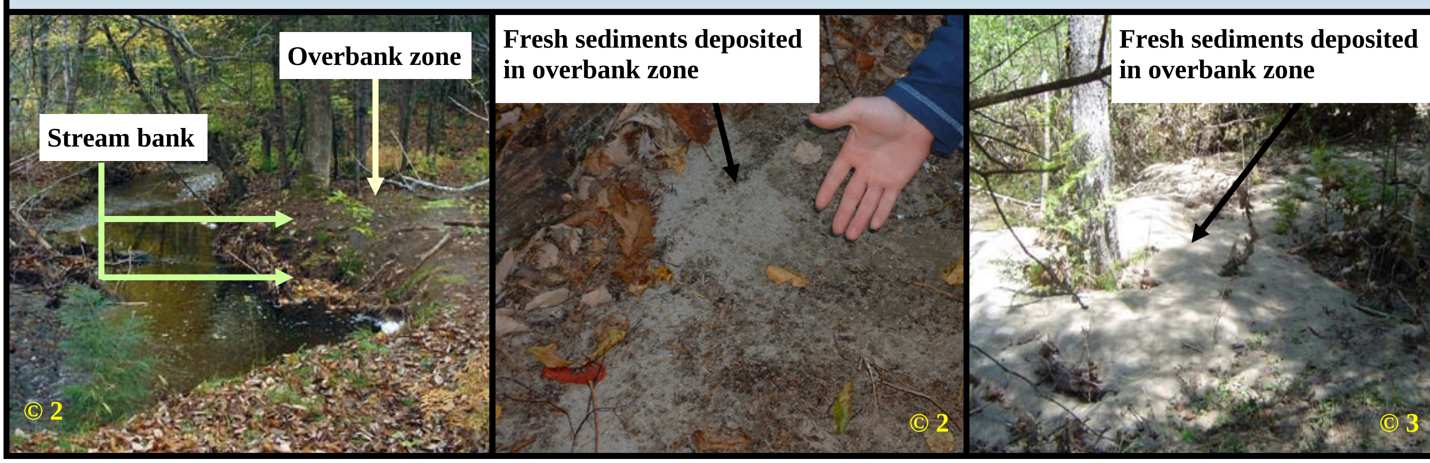


QUICK TIP:
The best way to test for unconsolidated beds is to walk the channel. If you sink in, the bed is unconsolidated.

SECTION 1: EVIDENCE OF AGGRADATION

8. Evidence of deposition in/around structures—Are sediments being deposited around or in conjunction with larger, more sedentary features such as boulders, culverts, bridge abutments, or in-stream woody debris?

9. Deposition in the overbank zone—Evidence of stream deposited materials above the banks (i.e. on the flood-plain, where the permanent vegetation starts).

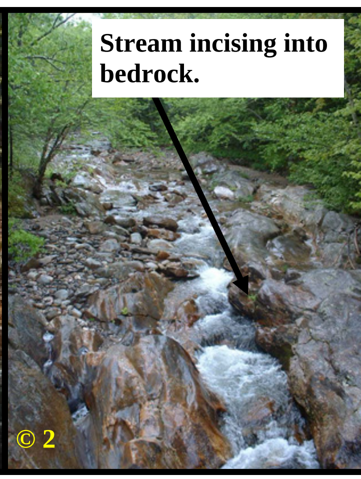


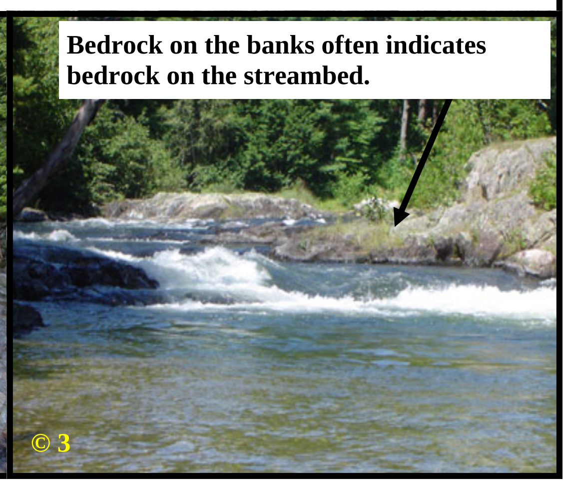
SECTION 2:
EVIDENCE OF DEGRADATION

The river cuts deeper into the land. One result is that bridge footings are undermined and exposed. Degradation can sometimes be caused by straightening and shortening a channel, which increases the slope of the river. The water flows faster down this steeper slope and has extra energy to move sediment, causing the river channel to cut deeper or degrade. Other causes of degradation include increases in peak flows and frequency due to activities such as poorly-planned urbanization, agriculture, and forest practices.

1. Channel incision into undisturbed overburden/bedrock—The exposure of an erosion-resistant layer of relatively large materials or bedrock on the surface of the streambed.

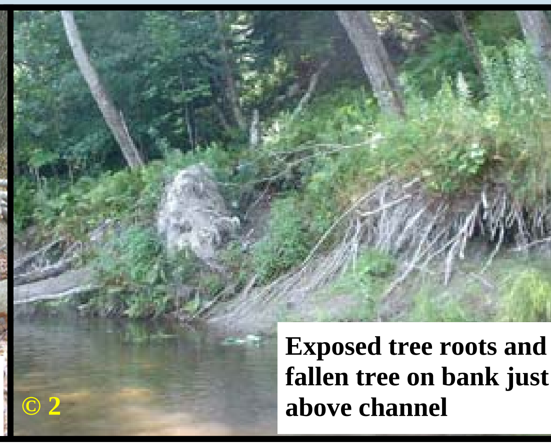
Incision: *n. The process in which a river cuts downward, lowering its base elevation.*



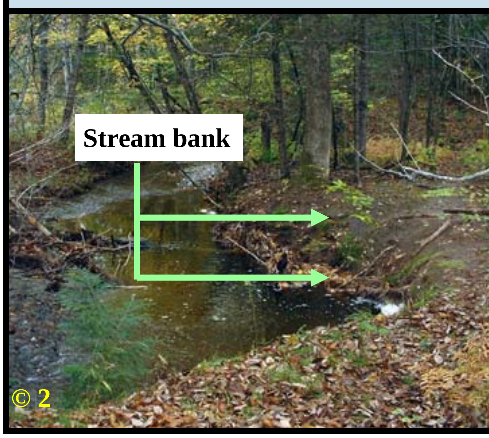


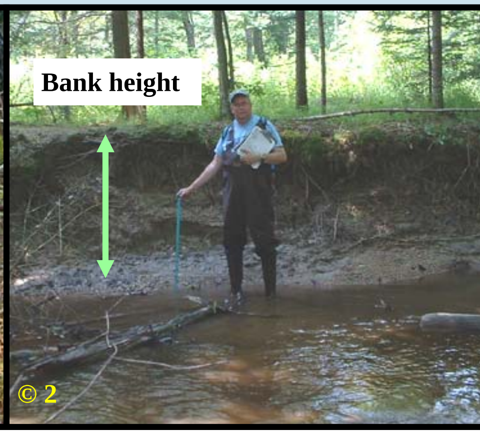
SECTION 2: EVIDENCE OF DEGRADATION

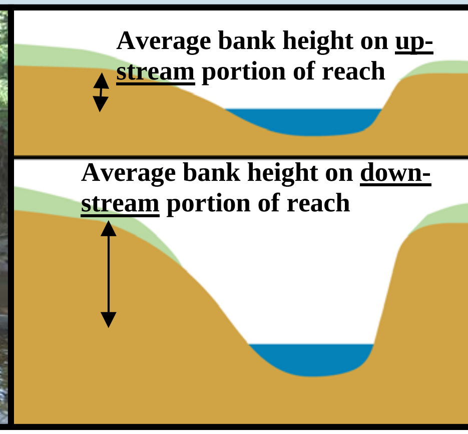
2. Elevated tree roots/root fan above channel bed—Are the trees within the channel or just above on the adjacent bank being scoured around their root network?



3. Bank height increases—Typically, bank heights are relatively uniform through a reach. If, on average, the banks of downstream areas are noticeably higher than upstream areas, then bank heights are increasing.

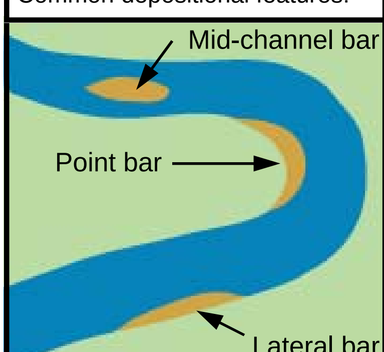


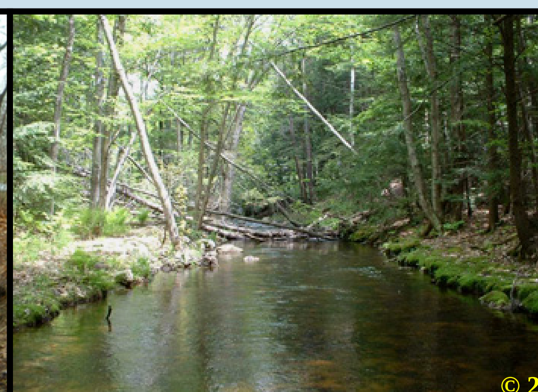




4. Absence of depositional features—No bars or other depositional features are present (particularly where you would expect to see depositional features). Should be a reach-wide condition.

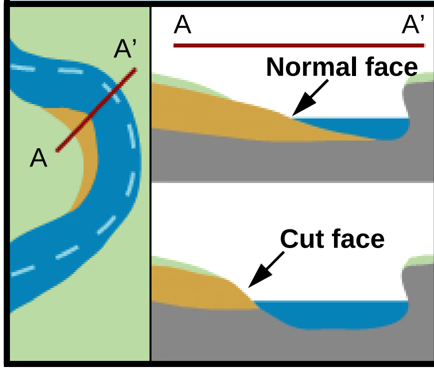
Common depositional features:





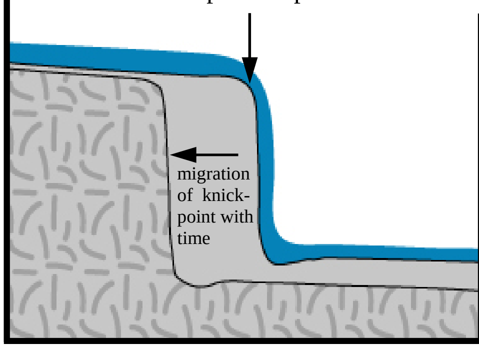
SECTION 2: EVIDENCE OF DEGRADATION

5. Cut face on bar forms—Are the toes (lowest portions) of bars being actively scoured away?

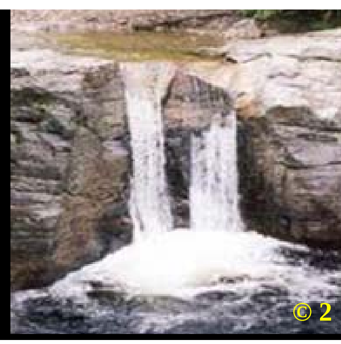


Scour: *v. to remove with high flows of sediment-bearing water*

6. Head cutting due to knick point migration—Upstream migration of an abrupt change in slope (cascade or waterfall) of the stream channel resulting in increased current velocities



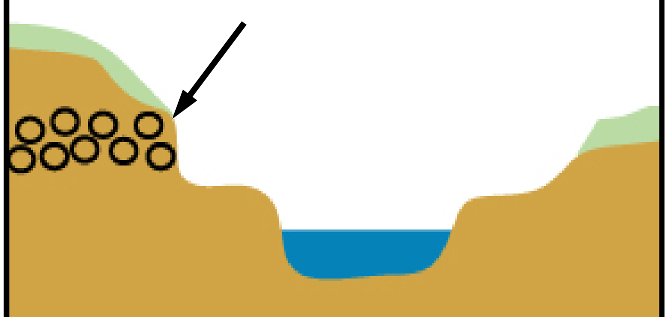
Knick point migration in bedrock



Knick point migration in unconsolidated sediments.

7. Suspended armor layer visible in bank—The exposure of an erosion-resistant layer of relatively large materials higher up in the stream bank.

Erosion-resistant layer of cobbles indicates old stream channel bottom elevation.

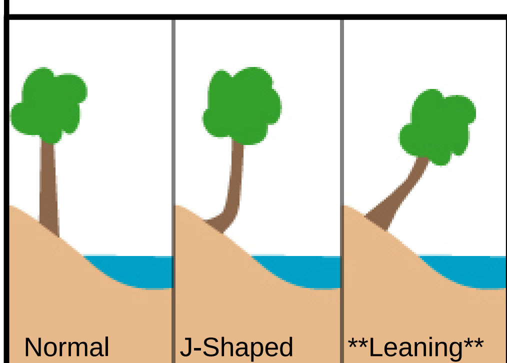


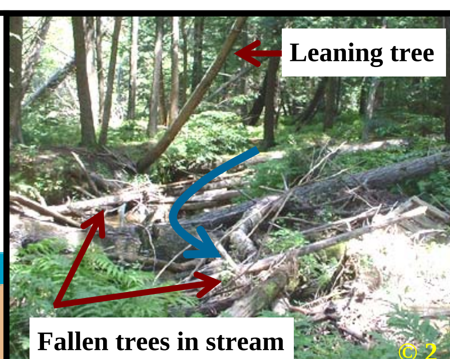
SECTION 3:
EVIDENCE OF WIDENING

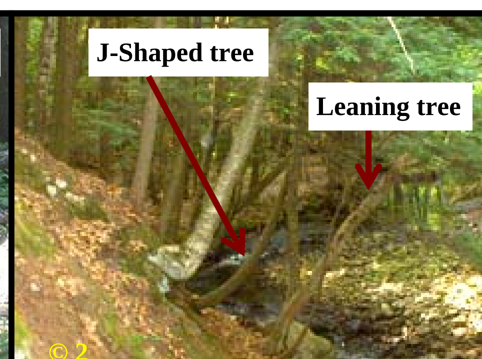
Banks collapse, and the river becomes wider and shallower. A wider, shallower river does not have the same capacity to transport sediment, so sediment can build up in the channel. ~ ~ ~ Widening is a process that typically follows aggradation or degradation geomorphic phases. Widening occurs because the stream bottom materials eventually become more resistant to erosion (harder to move) by the flowing waters than the materials in the streambanks.

1. Fallen or leaning trees, fence posts, etc.—Are nearby stream bank structures falling into the channel?

QUICK TIP: Take a careful look at the shape of tree trunks on the stream banks. Trees growing on a stable slope will have a straight, vertical trunk. Trees growing on a slowly slumping (but mostly stable) slope will have a J-shaped curve in their trunk, but the top of the tree will be oriented close to vertically. Trees growing on an unstable slope may have a curve to their trunk, but will not be oriented vertically; they **lean** towards the channel. See the drawing below.





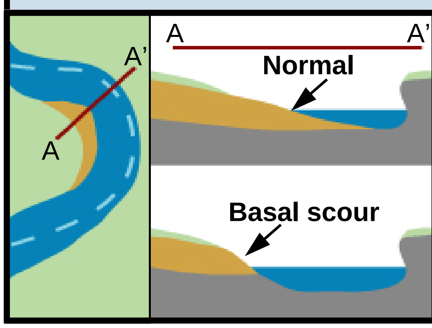


SECTION 3: EVIDENCE OF WIDENING

2. Occurrence of large organic debris—Are trees or collections of woody debris present in the channel/on bars?

3. Exposed tree roots—Are trees on the banks being scoured out with roots exposed?

4. Basal scour on inside meander bends—Are point bars being actively eroded away, or is the thalweg migrating toward the inside of the meander?



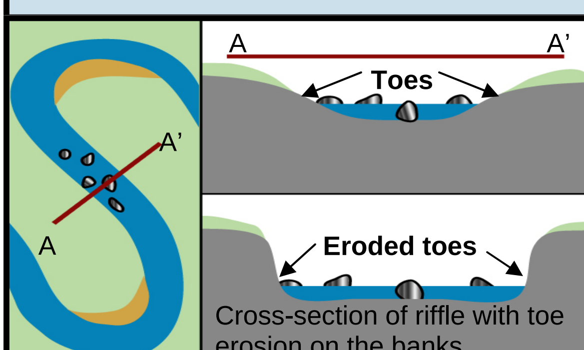
Meander bend: n. Broad, semi-circular curve in a stream that develops as a stream erodes the outer bank and deposits sediment on the inner bank.

Thalweg: n. The deepest part (often fastest moving) portion of the channel. For a stable stream, the thalweg is on the outside edge of a meander bend (see pale-blue dashed line on the figure).

IMPORTANT NOTE:

The point bar may be partially-scoured or may be missing altogether.

5. Toe erosion on both sides of channel through riffle—Are sediments being actively eroded from both sides through higher velocity areas?



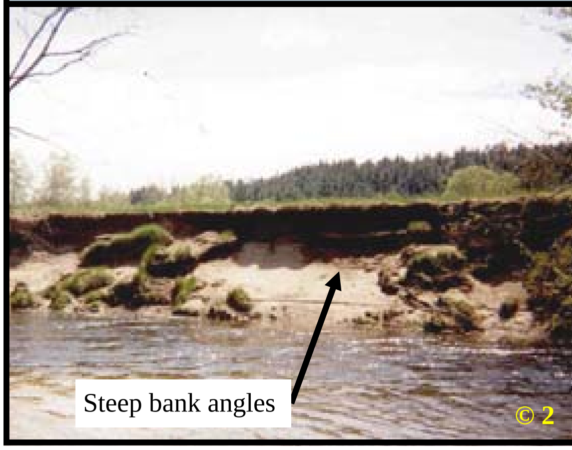
Cross-section of riffle with toe erosion on the banks.

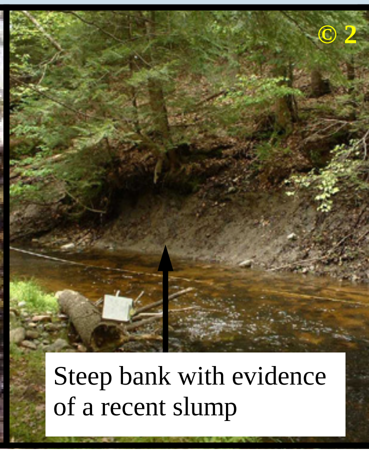
Toe: n. Base of a bank or bar

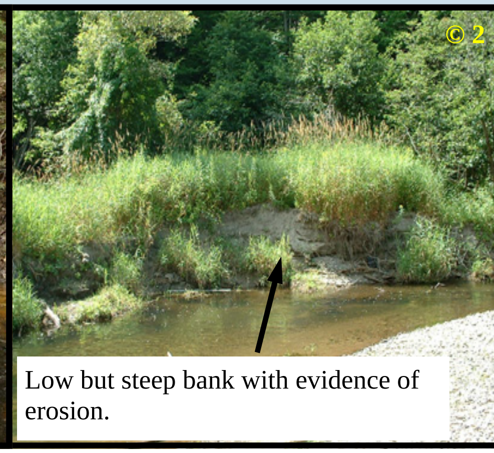
Riffle: n. Shallow, turbulent area in stream where water flows swiftly over rocks.

SECTION 3: EVIDENCE OF WIDENING

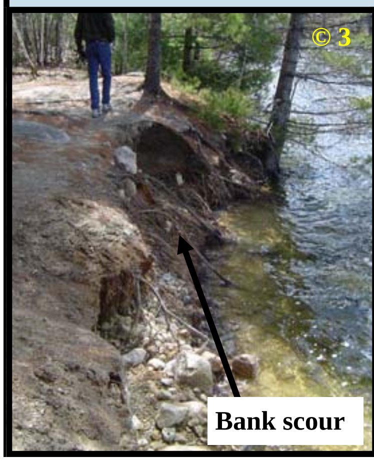
6. Steep bank angles through most of reach—Are the stream banks on both sides steep with evidence of recent slumps or erosion? Focus more on straight segments of the stream, where slumping would be less expected. (Banks may be steep due to natural processes, but for this question you're looking for banks steepened by slumping and erosion from river processes.)

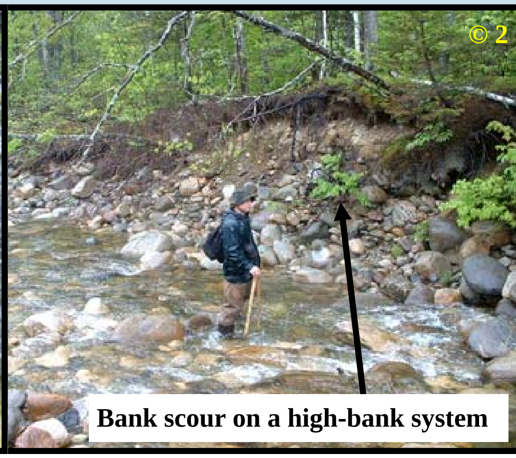


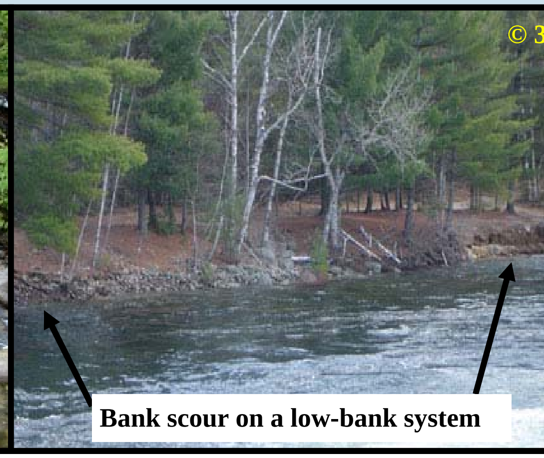




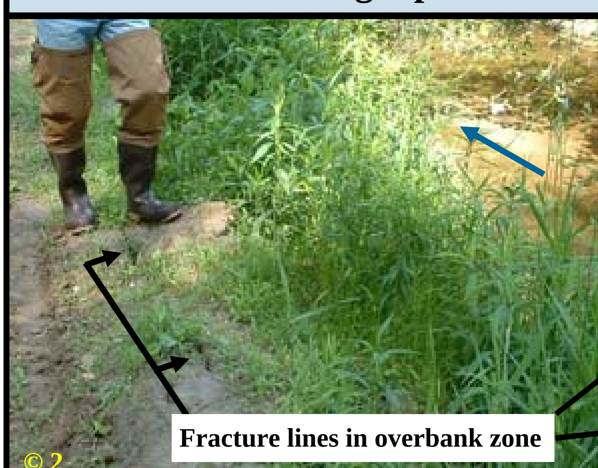
7. Length of bank scour >50% through subject reach—Is there evidence of active erosion or bank slumping along more than half of the reach?







8. Fracture lines along top of bank—Are there cracks or visible lines parallel to the channel in the overbank zone?

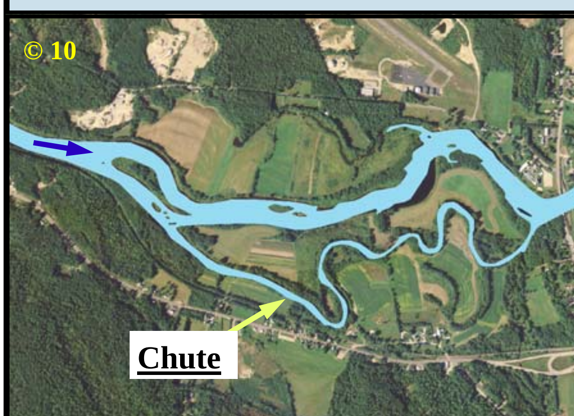


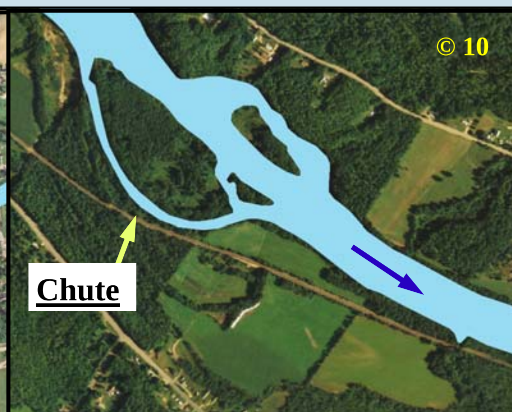
Overbank zone—
n. The floodplain (relatively flat slope) adjacent to the river bank (steeper slope).

SECTION 4:
EVIDENCE OF PLANIMETRIC FORM ADJUSTMENT

These are the changes that can be seen from the air when looking down at the river. The river's pattern has changed. This can happen because of human intervention (such as straightening the bends of the river with heavy equipment). Planform changes also occur during floods. When there is no streambank vegetation, with roots to hold soil in place, rivers cut new channels in the weak part of the bank during high water. ~ ~ ~ When not a result of direct human manipulation, planform adjustments typically are responses to aggradation, degradation, or widening geomorphic phases.

1. Formation of chutes—Newly-formed, narrow, confined auxiliary channels for transporting high velocity overflows.



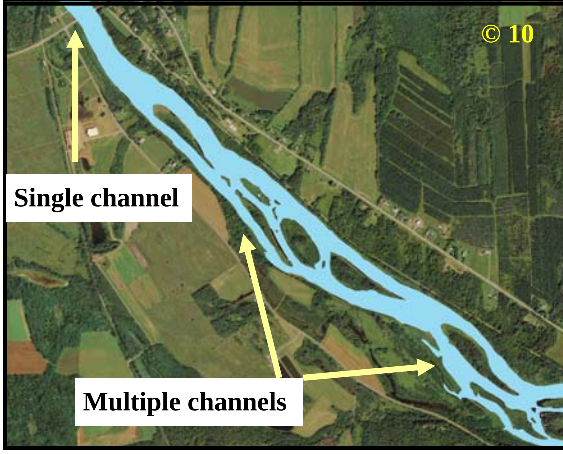


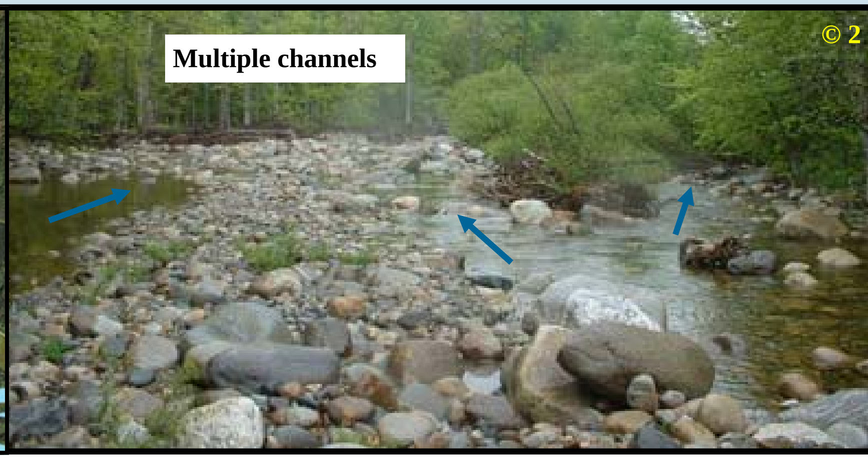
CAUTION:

Be careful distinguishing chutes from cutoff channels (see question 4 in this section). A cutoff channel moves water almost all of the time, and frequently cuts off a meander bend. A chute only moves water intermittently, at high flows and when the river is at flood stage.

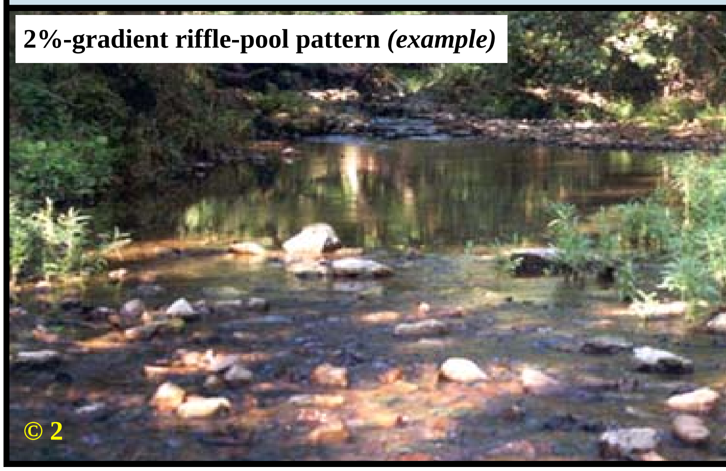
SECTION 4: EVIDENCE OF PLANIMETRIC FORM ADJUSTMENT

2. Single thread channel to multiple channel— Stream with one channel through one portion of reach shifts to many channels (“braided”) through another portion of the reach.



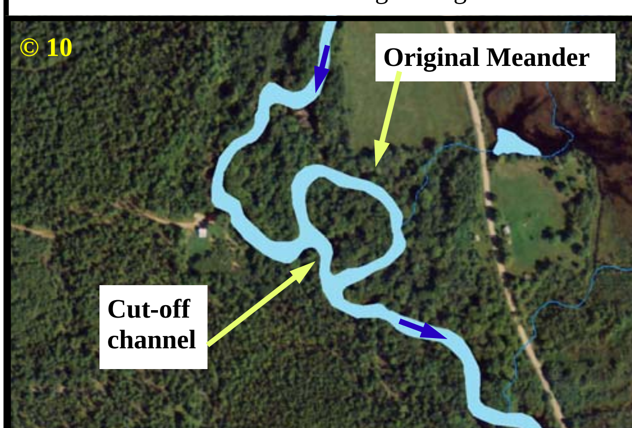


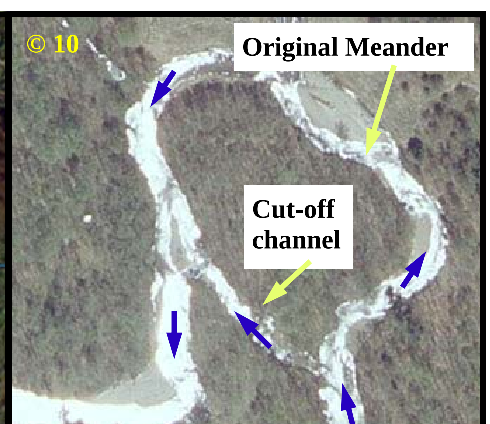
3. Evolution of pool-riffle form to low bed relief form—Obvious change from pool/riffle meander pattern in upstream portion of reach to a lower gradient, slower and more uniform flow regime (glides or runs) in downstream portion.



4. Cut-off channels—A <u>short, straight auxiliary channel that bypasses a stream bend</u> and is formed by the stream cutting across a land area between two adjacent meander bends.

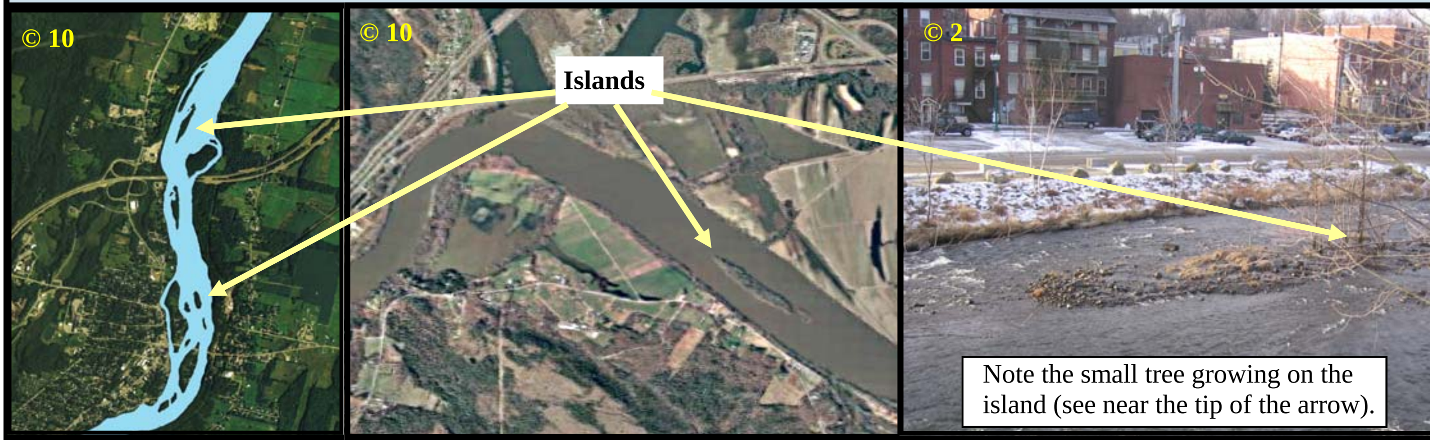
CAUTION: Be careful distinguishing chutes with cutoff-channels (see question 1 in this section).





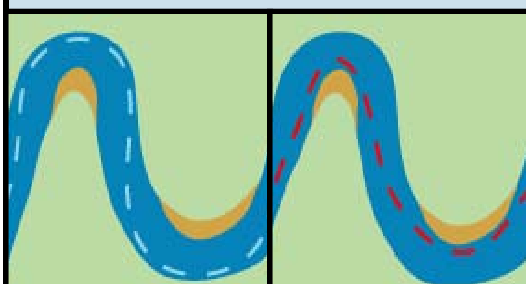
SECTION 4: EVIDENCE OF PLANIMETRIC FORM ADJUSTMENT

5. Formation of islands—Are there stream-sediment (alluvial) islands with maturing vegetation or trees within the channel?



Note the small tree growing on the island (see near the tip of the arrow).

6. Thalweg alignment out of phase meander form—Is the channel thalweg in a naturally meandering stream either non-existent, not obvious, or not following a typical meander pattern?



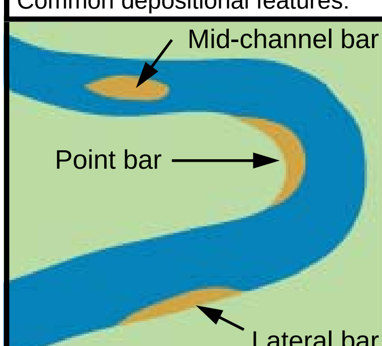
The dashed line in these two drawings represents the thalweg. The first (blue) demonstrates a properly aligned thalweg. The second (red) represents an out-of-phase thalweg.

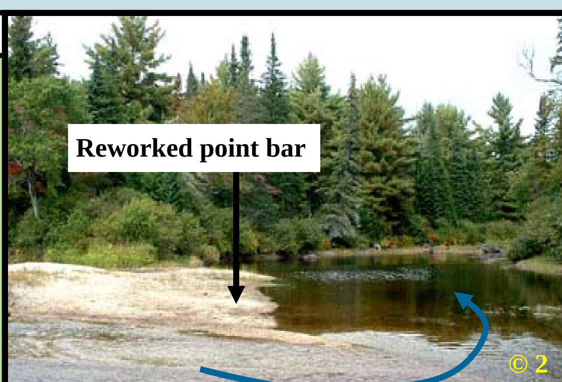
Meander form: n. Broad, semi-circular curve in a stream that develops as a stream erodes the outer bank and deposits sediment on the inner bank (point bar).

Thalweg: n. The deepest (and often fastest moving) portion of the channel. For a stable stream, the thalweg is on the outside edge of a meander bend (see pale-blue dashed line on the figure).

7. Bar forms poorly formed / reworked / removed—Are depositional features (bars) in obvious adjustment, not present where expected, or actively eroding?

Common depositional features:



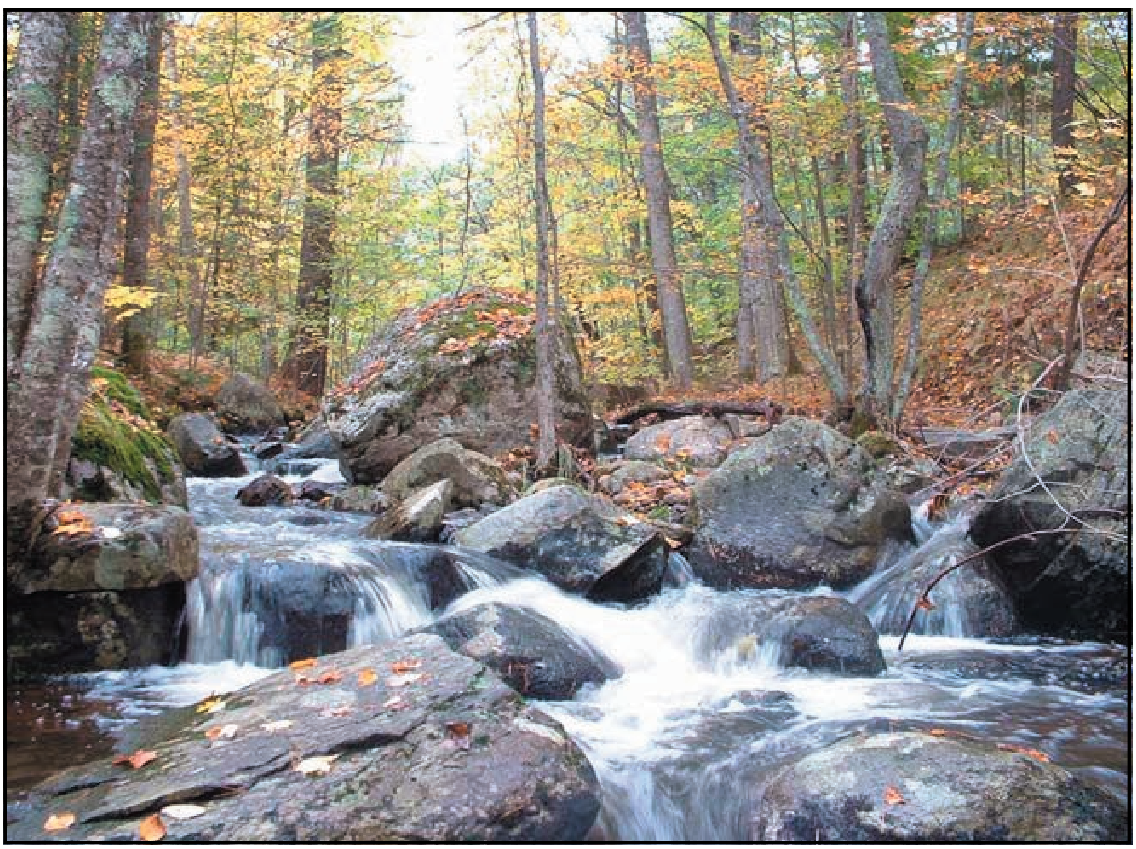


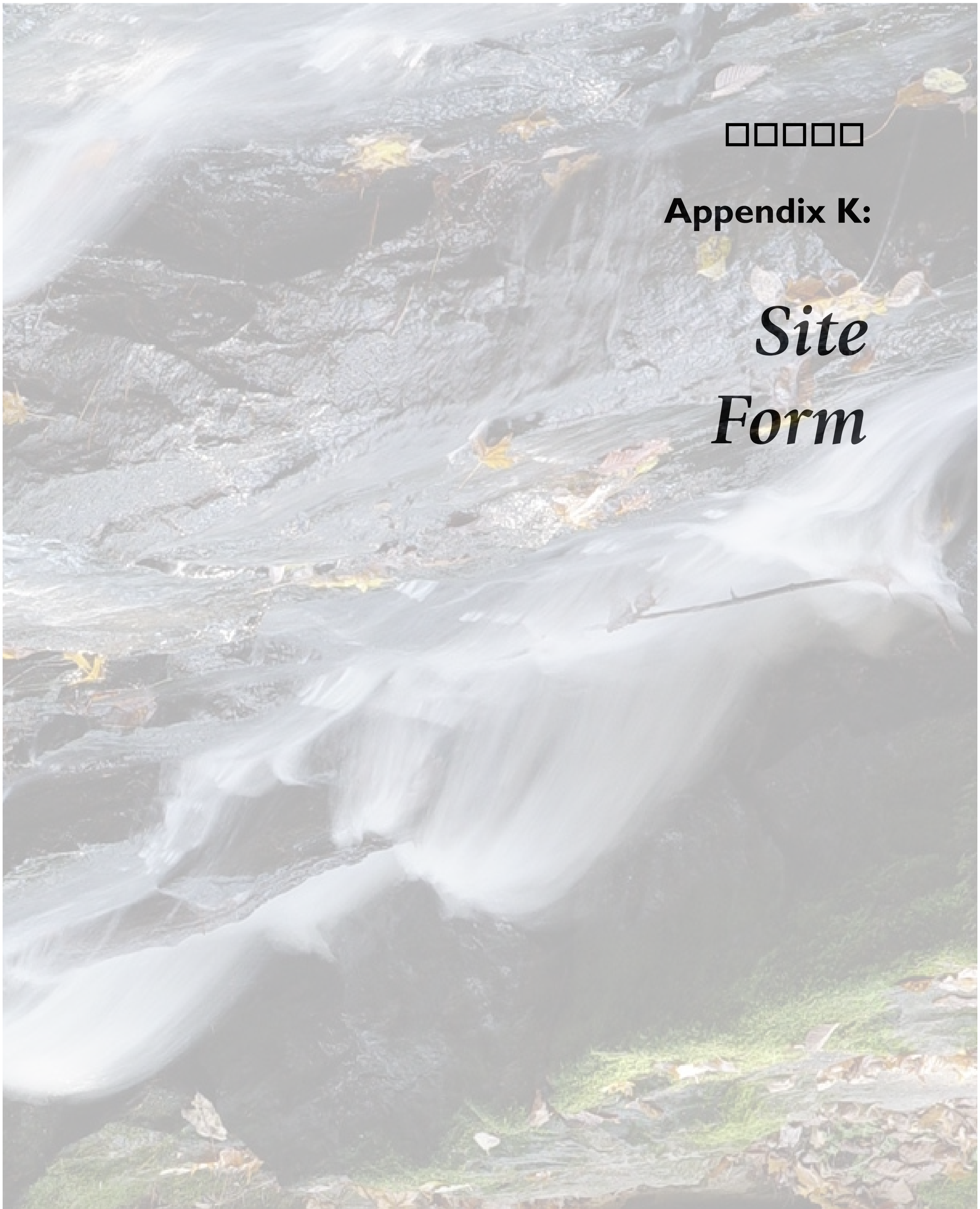
QUICK TIP:

Are bars in your segment oddly shaped (e.g. not rounded)?

Do they have evidence of fresh sediment deposition?

Are they missing altogether?





□□□□□

Appendix K:

Site Form

Site Form*

Sector # or Reach #________ Affected waterbody ____________________

Site #: ___________	Date _________	Surveyor Initials _____________	Landowner Contacted? Y N	# Photos Taken__________

Location

Describe:	____ *(house #, road name,* **# of nearest telephone pole**, *etc.)*			
GPS: **(UTM)** **(Zone 19)**	0 _ _ _ _ _ _ _ (Easting)	_ _ _ _ _ _ _ _ (Northing)	____ft (Error)	___________ (Waypoint #)
Area affected:	____ ft x ___ ft (Length x width)	_________ ft^2 (Area)	__________________ ft (Distance from stream or tributary)	

Land Use: (circle one)

Industrial	Commercial	Residential
Recreational	Municipal	Logging
Agriculture	Construction site	Gravel pit / mining
Undist. forest	Stream channel	Trail or path
State road	Town road	Private road
Other____		

Issues: (circle all that apply)

Soil Erosion/Sediment
- Bare soil / fields
- Stockpiled soil
- Unstable construction site
- Road surface erosion
- Road shoulder / ditch erosion
- Unstable culvert inlet / outlet
- Livestock trampling of streambank

Bacteria
- Pet waste
- Livestock; poor manure storage
- Waterfowl / wildlife gathering area
- Septic system problem
- Sewer line problem

Nutrients
- Livestock / improper manure storage
- Fertilizer flags / very green lawn
- Pet waste
- Algae mats in stream
- Lawn clippings piled next to stream

Toxics
- Staining around storm drain / spills
- Pesticide flags / manicured lawns
- Drainage from high-use parking lot
- Exposed indust. / comm. activities
- Heavy vehicle traffic
- Dumpster runoff / "juice"

Temperature
- Lack of stream shading
- Riprap on streambanks
- Drainage from large paved area
- Drainage from pond/dammed area

Other Buffer Issues
- Buffer not wide enough
- Poor / degraded buffer
- Concentrated flow path of stormwater through buffer
- Invasive species abundant

Other Issues: _________________

____

Stream Channel
- Channel straightened
- Bank/channel downcutting/incision
- Severe streambank erosion/failure
- Storm drains directly to channel
- Excessive trash
- Excessive build up of sediment
- Floodplain filled in for development
- Remains of old log-drive dam

Culvert / Crossing
- Culvert misaligned
- Hanging culvert (no fish passage)
- Beaver dam blockage of culvert
- Slip-lined culvert

* PURPOSE: For documenting either pollution / habitat problem sites or stream regions with excellent coldwater habitat during stream watershed surveys or stream corridor surveys.

Recommendations: (circle all that apply)

Soil Erosion/Sediment/Culverts

Clean out culvert
Enlarge culvert
Install plunge pool
Replace culvert
Lengthen culvert
Stabilize inlet and/or outlet
Armor ditch with stone or grass
Install ditch
Install turnout
Reshape ditch
Stabilize banks
Install erosion controls (silt fence, etc.)
Fence out livestock from stream

Soil Erosion/Sediment (cont.)

Build up road / add surface mat'l
Remove grader berms
Remove winter sand
Reshape / veg. Shoulder
Reshape or crown road
Pave
Install runoff diverter
Plant / improve buffer

Toxics

Improve stormwater controls
Stencil storm drain
Low impact turf care
Clean up garbage/dumpster-area

Nutrients/Bacteria

Ag waste management
Fence out livestock from stream
Low impact fertilizing
Remove pet waste
Put in signage / bags for pet owners
Wildlife management
Upgrade septic system
Repair sewer line
Stencil storm drains

Stream Channel / Culverts

Re-align, repair, or upgrade culvert
Bank stabilization
Restore channel

Temperature

Establish buffer
Extend / improve buffer
Plant trees & shrubs
Seed and mulch
Stormwater controls
Bioretention cells

Other Buffer Recommendations

Install level-lip spreader to prevent concentrated flow path

Other

____

____

Impact – circle one item from each column and add totals to determine rating

Size / Amount	Pollutants Involved	Transport to Stream	Total Score
Small =1 Medium = 2 Large = 3	Single = 1 Multiple = 2	Limited = 1 Direct flow = 2	

Rating

High	6-7 points
Medium	5 points
Low	3-4 points

Cost

High	Greater than $2,500
Medium	$500-$2,500
Low	Less than $500

Good habitat features (coldwater seeps, springs, clean spawning gravels, very deep pools, lots of large woody debris, etc.)

____

____

Additional comments:

____

____

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____

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- Install ditch
- Install turnout
- Reshape ditch
- Stabilize banks
- Install erosion controls (silt fence, etc.)
- Fence out livestock from stream

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- Remove grader berms
- Remove winter sand
- Reshape / veg. Shoulder
- Reshape or crown road
- Pave
- Install runoff diverter
- Plant / improve buffer

Toxics
- Improve stormwater controls
- Stencil storm drain
- Low impact turf care
- Clean up garbage/dumpster-area

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- Ag waste management
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- Restore channel

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Other

____

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____

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Additional comments:

____

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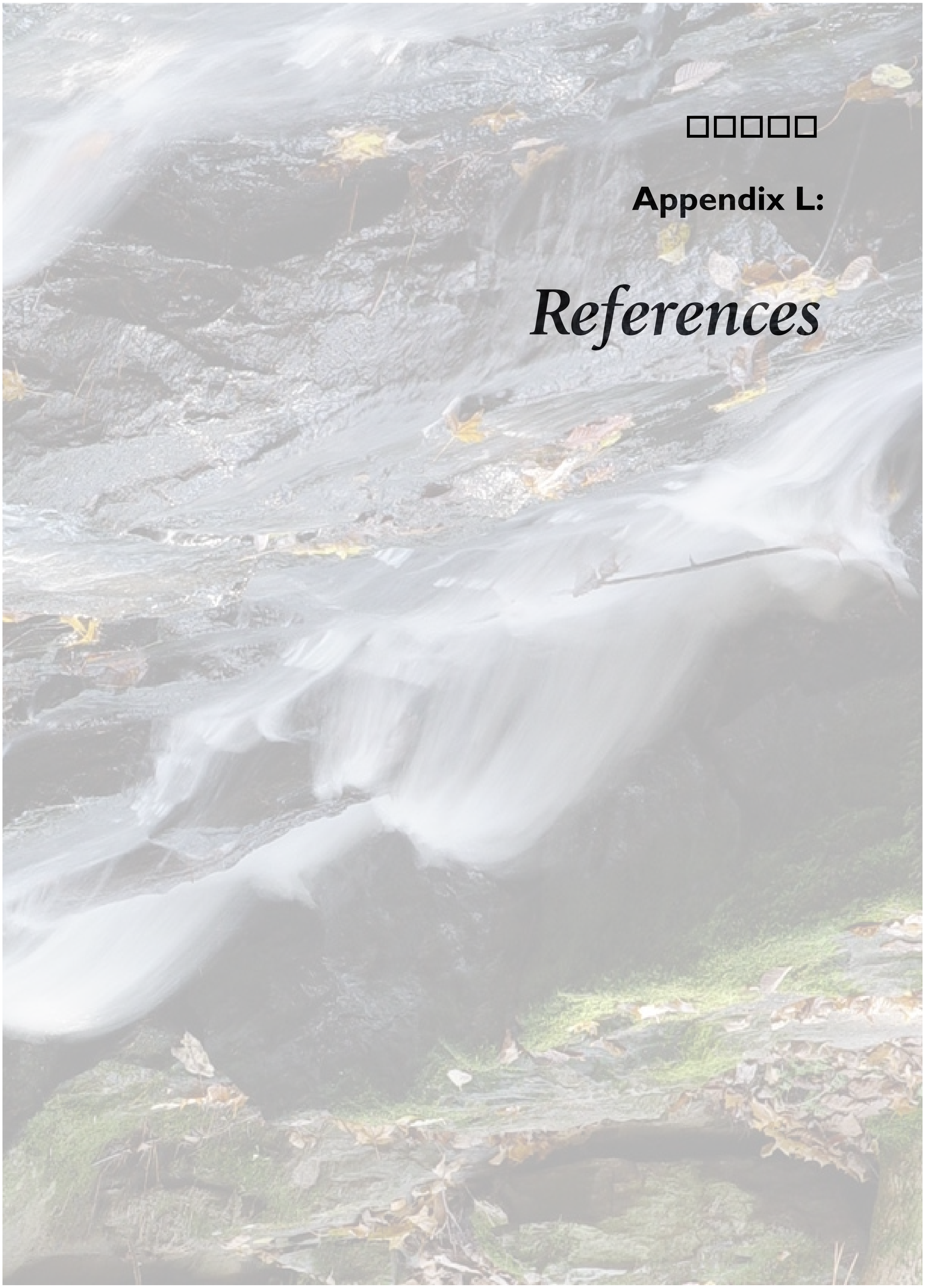
* PURPOSE: For documenting either pollution / habitat problem sites or stream regions with excellent coldwater habitat during stream watershed surveys or stream corridor surveys.

Appendix L:

References



APPENDIX L

References

Rating System for References and Resources

(located at the end of each reference and resource):

\# — beginner level; recommended for grades K - 8 and adults

\# # — intermediate level; provides some introduction and good for beginners in many cases, but also more details about various topics; recommended for grades 9-12 and adults; some material may also be helpful to K-8 and college students

\# # # — advanced level; written for college-level readers, researchers, and adults

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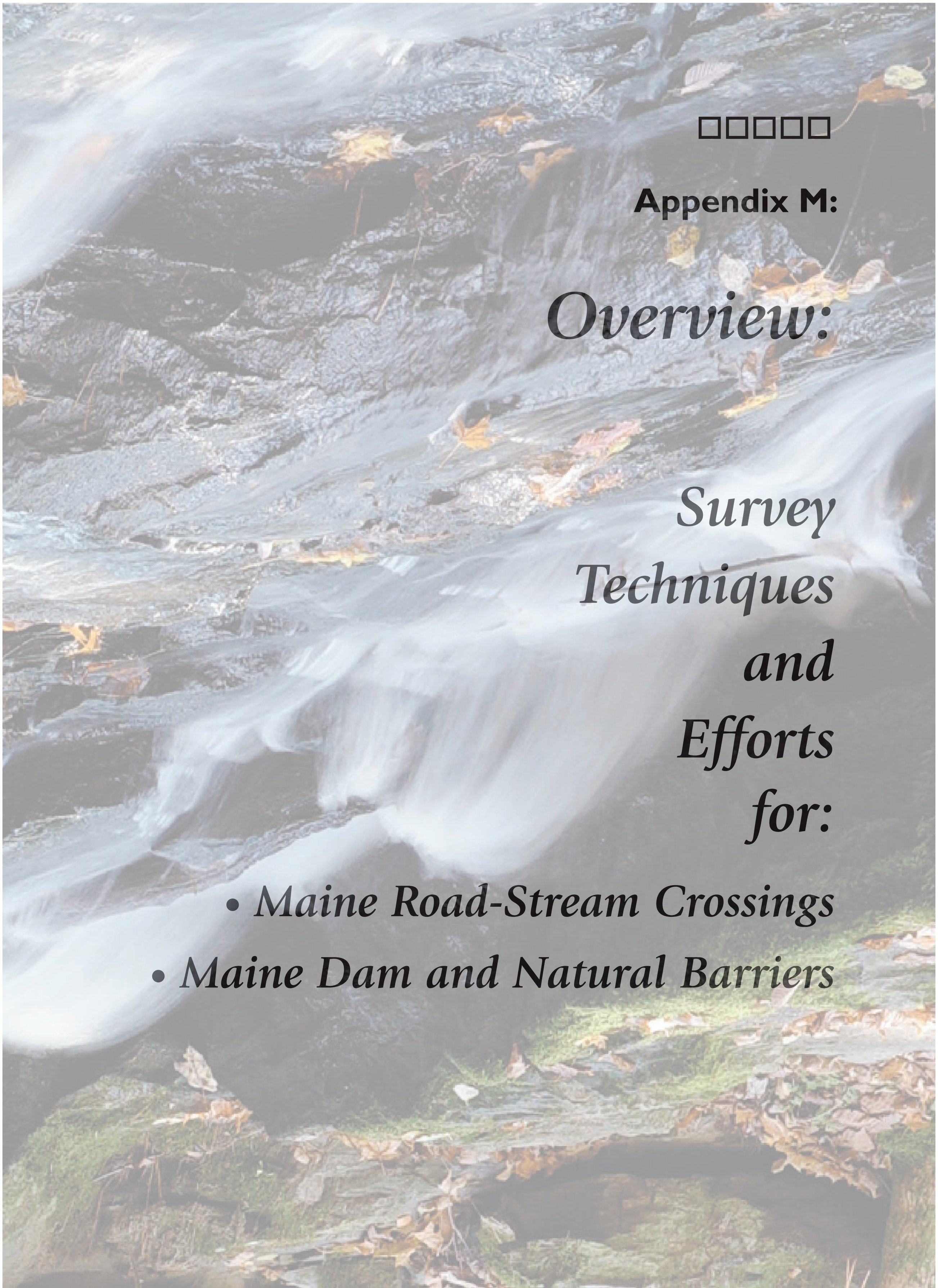


Appendix M:

Overview:

Survey Techniques and Efforts for:

- ***Maine Road-Stream Crossings***
- ***Maine Dam and Natural Barriers***

APPENDIX M

Overview of the Objectives and Training Opportunities for:

- **Maine Road-Stream Crossing Survey and**
- **Maine Dam and Natural Barrier Survey Techniques (USFWS-GOMP)***

*(**NOTE:** These protocols are a 2007 product of a multi-agency and organization collaboration led by the U.S. Fish & Wildlife Service's Gulf of Maine Program.)

Overview of the Maine Road-Stream Crossing Survey Techniques and Efforts

MAINE
ROAD-STREAM CROSSING SURVEY
MANUAL

Alex Abbott

Gulf of Maine Coastal Program
U.S. Fish and Wildlife Service
Falmouth, Maine

May 2007

Tens of thousands of miles of streams flow throughout the state of Maine. Most of these streams are crossed by a network of thousands of miles of roads. Structures such as bridges and culverts that occur at every road-stream crossing have the potential to limit the movement of fish and terrestrial species, particularly on smaller streams. In addition, incorrectly sized or poorly placed culverts can have a significant impact on stream processes. In order to reconnect riverine habitats for many species across Maine, efforts are underway [to survey] and improve the condition of road-stream crossings.

It is essential to know the location and condition of structures in our streams in order to improve habitat connectivity in Maine. The Maine Road-Stream Crossing Survey has been designed to collect information to help evaluate the impact of crossing structures on streams. An array of state and federal agencies and nonprofit organizations are helping to survey existing structures in our streams to allow us to make better decisions about possible improvements to restore habitat across the state. The goal is to use volunteers and professionals involved primarily in the protection and restoration of fish habitat to collect data that feeds into a statewide inventory of road-stream crossings. Once we know which of these crossings act as barriers to fish and terrestrial species, we can then use our data to set priorities for habitat restoration. *(Excerpt from the manual)*

Training Opportunities

These protocols require that individuals be trained by designated trainers before they can perform the surveys. This is required so as to insure that the data are collected in a standardized method, resulting in high quality, usable information that can be added into a database covering the entire State. This database will be used by numerous state and federal agencies, nonprofits, and other organizations.

Contact the Maine Stream Team Program to inquire about the latest training opportunities.

Overview of the Maine Dam & Natural Barrier Survey Techniques and Efforts

MAINE
DAM & NATURAL BARRIER SURVEY
MANUAL

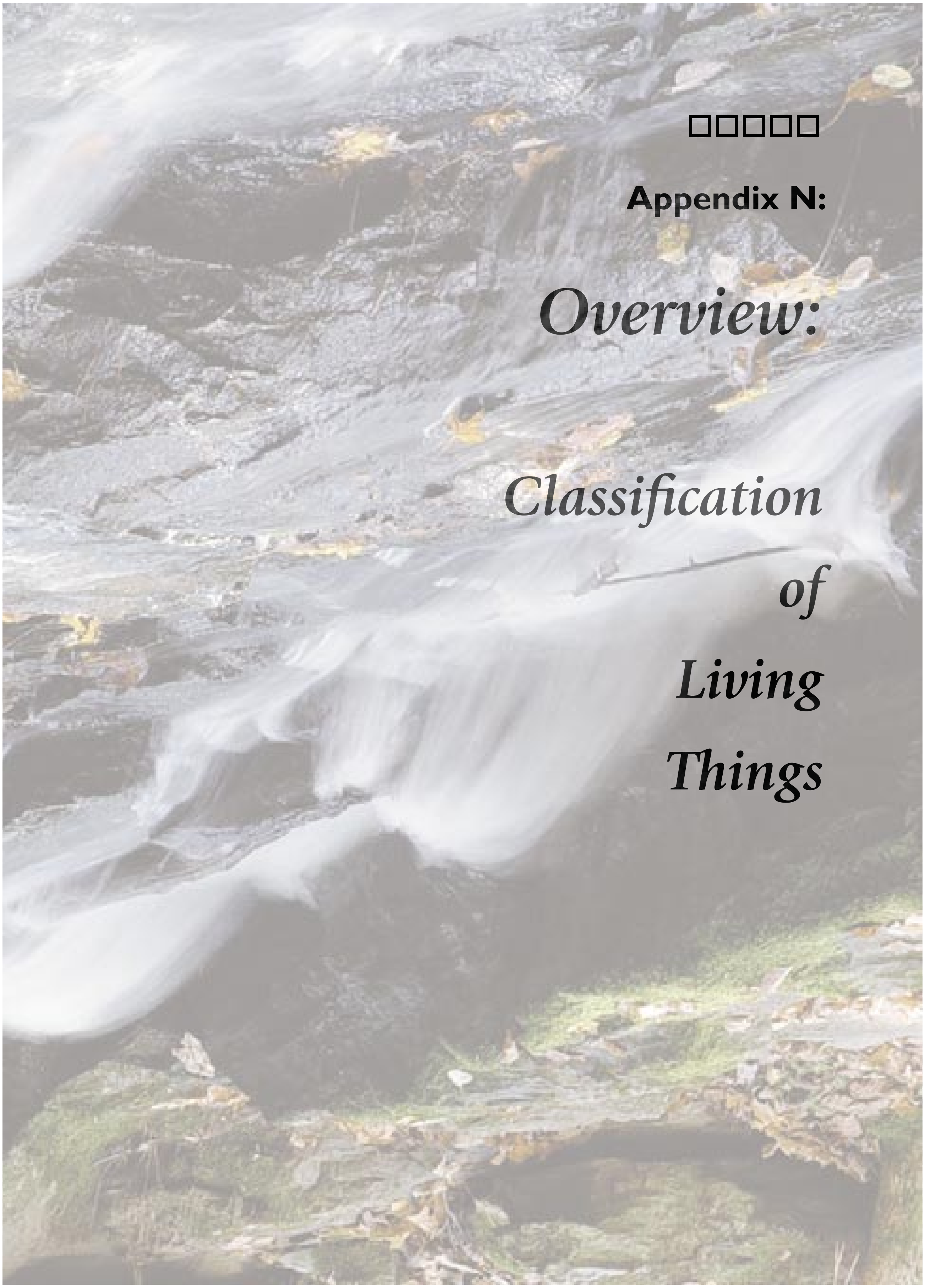
Alex Abbott

Gulf of Maine Coastal Program
U.S. Fish and Wildlife Service
Falmouth, Maine

July 2008

Tens of thousands of miles of streams flow throughout the state of Maine. Many of these streams are blocked by dams and natural obstructions that limit fish movements. We know quite a bit about the over 750 structures currently in Maine's statewide dam database, but we know little or nothing about many hundreds, and perhaps thousands of smaller dams and innumerable natural obstructions throughout the state.

It is essential to know the location and condition of structures in our streams in order to improve habitat connectivity in Maine. The Maine Dam & Natural Barrier Survey has been designed to collect information to help evaluate the impact of barriers on streams. An array of state and federal agencies and nonprofit organizations are helping to survey existing barriers in our streams to allow us to make better decisions about possible improvements to restore habitat across the state. The goal is to use volunteers and professionals involved primarily in the protection and restoration of fish habitat to collect data that feeds into a statewide inventory of barriers. Once we know which of these barriers most limit the movement of fish and terrestrial species, we can then use our data to set priorities for habitat restoration. *(Excerpt from the manual)*



Appendix N:

Overview:

Classification of Living Things

APPENDIX N

CLASSIFICATION OF LIVING THINGS: AN OVERVIEW

Understanding how living things are classified by scientists is helpful when learning about subjects such as stream biology. In order to help the reader of this manual series better understand the "scientific naming of organisms" that is used, we provide a very brief introduction (or review for some readers) to the terms of classification below. For readers who want more details about the history of the classification of living things or how the system works, we provide Internet links at the end of this appendix.

Brief Overview of Biological Classification Terminology

In general, the order oF taxonomic categories moves from most general, largest group **(Kingdom)**, progressively down through smaller and smaller groups **(Phylum > Class > Order ...)**, all the way down to a very specific type of organism **(Species)**.

For illustration purposes, below is a list of the major taxonomic categories for a certain kind of stonefly called the Northeastern Sallfly *(Sweltsa naica)*.

ORDER OF TAXONOMIC CATEGORIES (largest to smallest group)

- Kingdom............................ Animalia
  - Phylum .... Arthropoda
    - Class .... Insecta
      - Order .... Plecoptera (stonefly order)
        - Family..................... Chloroperlidae
          - Genus .... Sweltsa
            - Species .... naica

Genus Naming Conventions

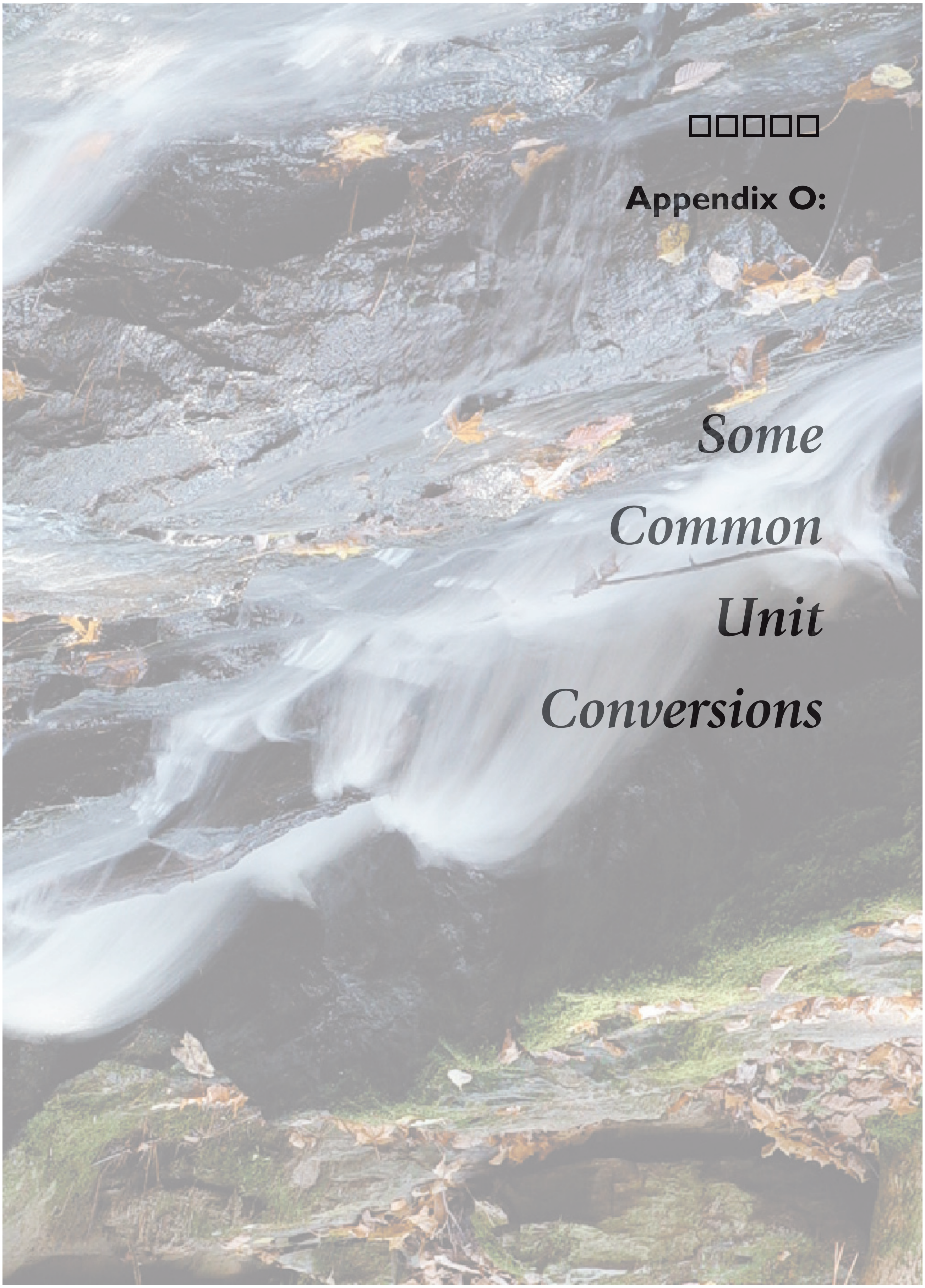
When scientists identify a creature as *Sweltsa* (as an example), they are referring to an organism within the genus *Sweltsa* without identifying which particular species they are talking about. Sometimes this is done because they didn't have the time to identify the creature to the species level (a more time-consuming task). Other times it is done because multiple (or an unknown number of) species of the same genus have been found in a set of samples (or data), and it is more efficient to refer to just the genus as a whole rather than all the species which make up that particular genus found in a given sample.

Examples of other naming conventions could be *Swelsta sp.* or *Sweltsa spp.* When referring to what is either believed or known to exist in a sample of aquatic organisms, the abbreviation *sp.* following the genus indicates a single unidentified species, while *spp.* indicates multiple (or an unknown number of) species within the genus (*Sweltsa* in this example).

(Note: The term *genera* is plural for *genus*.)

Internet Resources for More Information about the Classification of Living Things

http://www.physicalgeography.net/fundamentals/9b.html
http://www.msu.edu/~nixonjos/armadillo/taxonomy.html
http://www.bioedonline.org/presentations/index.cfm#presentation2
http://www.bio200.buffalo.edu/labs/nomenclature.html



Appendix O:

Some Common Unit Conversions

APPENDIX O

Some Common Unit Conversions

Concentration Notes:

- **The symbol " ≈ " means approximately.**

  1 milligram (mg) = 1 x 10^{-3} gram = 0.001 gram
  1 microgram (µg) = 1 x 10^{-6} gram = 0.000001 gram
  1 milliliter (mL) = 1 x 10^{-3} liter = 0.001 liter

- **Concentrations of various water quality parameters are usually measured in:**

  milligrams per liter (mg/L) — or —
  micrograms per liter (µg/L).
  (To convert between the two: 1 mg/L = 1,000 µg/L)

  Also used to measure concentration are the units "parts per million" (ppm) and "parts per billion" (ppb). For general purposes, one can use the following very simple conversions: 1 ppm ≈ 1 mg/L and 1 ppb ≈ 1 µg/L

Length:

1 millimeter (mm) = 1 x 10^{-3} meter = 0.001 meter
1 micrometer (µm) = 1 x 10^{-6} meter = 0.000001 meter

Estimating Total Dissolved Solids from Electrical Conductivity:

To convert total dissolved solids (TDS) to electrical conductivity (a measure of salinity): the TDS concentration in mg/L is approximately 65 percent of the electrical conductivity value in µS/cm.

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