A GUIDE FOR BUILDING AND MANAGING PRIVATE FISH PONDS IN MONTANA

Montana Department of Fish, Wildlife & Parks

FISHERIES DIVISION

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INTRODUCTION

Montana places a high value on its stream fisheries. Nearly all of stream fisheries are maintained by wild fish, i.e., without artificial stocking. Consequently, Montana sportsmen and women are sensitive to water withdrawals from streams, whether large or small, that contain wild fish. Many Montana streams already suffer from dewatering by existing consumptive water uses which have been occurring in Montana for over 100 years. Additional water withdrawals compound an already serious problem in trying to maintain adequate fish habitat for these wild fisheries. It is important that the pond builder be aware of and sensitive to the fact that a water withdrawal to supply a new fish pond could impact the stream's fishery. Keep in mind that fish ponds all consume some water. Every effort should be made to eliminate or severely restrict the use of stream surface water for a new fish pond.

The purpose of this handbook is to provide the prospective pond builder with an overview of the process of planning, permitting, constructing and managing a successful private fish pond. We hope the handbook will allow the reader to be informed enough to seek appropriate assistance and ask the right questions. This is not a "do-it-yourself" manual. It is our belief that the risks to both the pond builder and the public fisheries are too great for this task to be undertaken without professional advice. The history of faulty private fish ponds in Montana is still with us and, in this era of their renewed popularity, it is imperative that ponds be properly built and managed.

Several publications on fish pond construction and management have been published over the years. However, new technical information as well as changes in legal requirements suggest the need to update the literature on pond construction and management. We hope this handbook accomplishes this task.

SUMMARY

PLANNING A NEW POND begins with an understanding of all of the legal ramifications of private pond construction and ownership. This will include securing a right for a sufficient amount of water and obtaining the other permits that are necessary. Concurrent with this task is a thorough and comprehensive analysis of the proposed pond location. This analysis should include a study of the water supply in terms of volume, quality and availability, a survey of the watershed to determine soil and vegetation quality and density, erosion potential and flooding characteristics and an inspection of the subsoil strata in the proposed pond site to determine it's compactibility. All of this information will help determine the physical and economic feasibility of pond construction.

DESIGN AND CONSTRUCTION of a new pond begins with a concept based on the needs and desires of the pond builder. From this concept, one will then draw the plan, determine the scope of the project, calculate the cost, "trouble-shoot" for potential problems and schedule the sequence of the work. Physical features of particular importance to the design are: depth and surface area, (depth being more important for fish habitat); water exchange needed to balance the oxygen and nutrient levels in the pond; and the condition of the surrounding land areas. Following construction, an immediate and thorough revegetation of all disturbed areas should occur, which may include providing specific plants for wetlands, ground cover, shading and wildlife habitat.

FISH STOCKING should be undertaken only after a Fish Pond Permit has been issued by the Montana Department of Fish, Wildlife and Parks. In most instances the permit will recommend specific fish species appropriate for the area. Coldwater ponds will usually be best stocked with rainbow trout and warmwater ponds with largemouth bass. In some locations, native species will be recommended. Stocking rates will vary with individual pond conditions and should be postponed until a year after completing revegetation to allow the pond's food base to develop.

POND MANAGEMENT is a lifetime commitment to maintaining the quality of the habitat and diversity of species living in and around the pond. Potential problems include introduction of unwanted fish and overly prolific wetland plants and possible invasion by noxious weeds. Maintenance work should be routine and consistent to prevent little problems from becoming big ones.

LEGAL REQUIREMENTS are found in the appendices which also contain a table of all permits which may be required, citations from Montana state laws, a directory of permitting agencies and licensed Montana commercial fish hatcheries. Some suggested reading materials are also listed.

I. PLANNING A NEW POND

Planning is the key to realizing the fish pond of your dreams. Before you move one shovel full of dirt, you need to become familiar with a broad range of biological and hydrological information. In most cases, it is necessary to provide to the permitting agencies adequate technical data to satisfy legal requirements. The layman may have difficulty obtaining this information, so the Montana Department of Fish, Wildlife and Parks (DFWP) strongly urges that a person interested in building a private pond seek technical assistance. Most DFWP Regional Offices, listed in Appendix C, maintain current listings of public agencies and private consultants who can provide assistance. Local Soil Conservation Service (SCS) offices offer free written materials, technical advice and, in some special cases, financial assistance for pond development.

Legal Requirements

The prospective private pond builder should know the legal requirements for building a pond, including necessary state and federal permits. Before developing a pond, one must obtain some or all of the permits listed in Appendix A. Which of these permits is required will vary among individual cases, but all pond owners must obtain a private Fish Pond License if fish are to be stocked.

The legal description of a "private pond" is found in Montana law MCA 87-4-603 (see Appendix B). A private pond is <u>not</u> "a natural pond or body of water created by natural means or any portion of the {bed} of a natural ... body of water." Natural waters are public waters in Montana and the private pond owner may not restrict the public use of them. Further, the law is meant to prevent the damming of natural streams on private property which destroys stream habitat, interferes with fish migrations and results in ponds ultimately ruined by unmanageable sedimentation. Private ponds are, therefore, "only bodies of water created by artificial means or diversion of water which do not exceed 500 acres of surface area." This type of pond qualifies for a Fish Pond License, allowing its owner to "stock his fish pond with fry {juvenile fish} procured from any lawful source" and to "take fish from the ... pond in any manner." State fishing regulations do not apply and fishing licenses are not required.

Before a pond can be constructed, a water right must be obtained from DNRC. The applicant must complete a Form 600 "Application for Beneficial Water Use Permit" which is available from DNRC offices or county courthouses. This form requires you to provide information about the source of water for the pond, the point of diversion, the water quantity required, the location and size of the pond and other descriptive information. You will also need to know whether there

is water available for your new permit and whether you will interfere with any water users who already use water from the same source. Some streams may appear to have sufficient water to appropriate, but may not be available due to instream flow rights. Existing water users are "senior" water right holders and will always be able to use water before you can use it, particularly when there is not enough water for everyone. This is known as "first in time, first in right" and is the basis of Montana water law. When sufficient water is not available for all users on a water source, senior users can stop the use of water by a junior permit holder. Because water has been appropriated in Montana for about 130 years, permits will almost always be junior to one or more senior water rights.

If DNRC authorizes you to appropriate water, it will issue a "provisional permit." A permit remains "provisional" until the water court completes the adjudication of pre-1973 water rights in a basin and certifies them to the DNRC. DNRC then determines whether the amount of the appropriation granted in a provisional permit needs to be reduced or modified to protect and guarantee water rights determined in the adjudication. A water right certificate will then either be issued to the permittee or the provisional permit will be terminated.

A water right is only good as long as it is being used "beneficially." Fish and wildlife are beneficial uses under Montana law. However, the water right must actually be put to use to be a valid right and it can only be used in the quantity specified in the permit or right.

The prospective pond owner should be aware that some water will be consumed by pond evaporation (water vapor released due to heat), transpiration (water utilized by vegetation) and percolation (water seepage into the soil). Since all of these factors will vary between sites due to differences in climatic conditions, it can be difficult to determine how much water will be needed to maintain the pond. This determination is, in large part, the purpose of pond planning, which will be discussed next.

Water Quantity and Quality

The type and volume of water available will somewhat determine the size and quality of the pond fishery that can be developed in a given location. For instance, if the site chosen has groundwater near the surface, such as springs or other surface expressions of groundwater, the pond builder may want to excavate a pond into the groundwater and augment the supply with a diversion from a spring. The latter may be necessary because groundwater levels often fluctuate seasonally and this fluctuation could have a negative impact on the pond's fish habitat. In this case, the size of the pond would be limited by the amount of surface water available to keep it full. There are also legal requirements involved in

spring water developments which must be dealt with by the DNRC on a case-by-case basis.

If a stream is flowing near the proposed site, one might excavate a dry pond basin, compact it to prevent seepage and fill it with water diverted from the stream. Here, the size of the pond might be primarily limited by topography because the pond site must be located safely away from the stream to prevent the stream from "capturing" the pond. Also the same amount of water as was diverted must flow back into the stream in the shortest distance possible to minimize dewatering of the stream.

It is a natural tendency to look for pond sites in low, wet areas, oxbows and abandoned channels. This should be avoided because the stream may re-enter these areas during high water. This type of pond might also be limited in size by the amount of water available at the point of diversion and the influences of evaporation and transpiration water losses.

Two of the most critical elements of water quality are dissolved oxygen and nutrient content (primarily phosphorous and nitrogen). These two factors play dynamic, interactive roles in the suitability of pond habitat for fish. For instance, if the oxygen content is low, as is often the case with groundwater ponds, the fish will be more susceptible to winter-kill. However, if oxygen and nutrients are plentiful, as is common to stream-fed ponds, overabundant aquatic plant growth may result. While aquatic plants are vital oxygen producers in the pond environment, too many may actually deplete the available oxygen while decaying or respiring ("breathing" in oxygen and giving off carbon dioxide at night) and adversely affects the fishery. The nutrient enrichment and decay of plants is part of the process called eutrophication.

Presiding over the interaction of oxygen and nutrients is temperature. For example, water is most dense and holds the most dissolved oxygen at 39°F (4°C). With the same nutrient levels as cooler water, excessive amounts of algae can become a problem in water above about 75°F (24°C), while at the highest water temperatures, blue-green algae thrive and often develop into heavy blooms. There is a general increase in the metabolic rates of pond organisms at higher temperatures (trout are most active and grow best in 50°-61°F (10-16°C) water), which requires more oxygen and thus more rapidly depletes the already reduced oxygen supply. Temperature and eutrophication can also be controlled to a great degree by pond depth. This is discussed under pond design phase in Chapter II.

Watershed Analysis

The watershed (the total land area draining into a given waterway) should be thoroughly evaluated in terms of its nutrient contribution to the water supply. Surface runoff from pastures, barnyards and fertilized lawns will contribute large amounts of nutrients to nearby waterways. The pond should be situated to avoid, as much as possible, runoff from these areas. If this is not possible, plan to construct a diversion terrace to direct runoff away from the pond.

Soils should be assessed with regard to their susceptibility to erosion. Sediment is soil material eroded by water and subsequently deposited in water. It is essentially another problem of surface runoff. Sedimentation contributes to turbidity, or muddiness, which inhibits light penetration and retards the growth of oxygen-producing aquatic plants as well as filling the pond and shortening its life. Overgrazing and trampling by livestock are frequently major contributors to sediment problems. A dirt road in the watershed may be another source of sediment. Fortunately, sedimentation can be controlled by increasing the amount of vegetation in key areas of the watershed. Washes, gullies, road edges and other physical features which concentrate runoff are good places to start and often the best approach is simply to plant more of the native plant varieties which are already present. Plan to deal with this before construction because soil disturbance during excavation will only compound the problem.

Another important consideration of the watershed is its flood potential. Areas given to flash flooding during sudden storms will require runoff diversion structures such as terraces, dikes and berms. These measures may add considerably to the cost of the pond, but these costs pale in comparison to the potential damage of a flash flood. While much more predictable and less damaging than flash floods, snow runoff must also be taken into account since it contributes to sedimentation. Records of average precipitation are available through local offices of the National Weather Service and, coupled with an analysis of soil and vegetation, can provide a long-term view of the runoff characteristics of a watershed.

Soil Analysis

This investigation is necessary to determine the permeability and compactibility of the substrate. Permeability is the amount of seepage a soil type will allow and compactibility refers to how well the soil can be made to resist seepage. Plan to make a thorough analysis of the proposed pond site because of the possibility of different water-holding capabilities in different areas of the site.

This is usually accomplished by digging several test pits with a backhoe to the approximate desired depth of the pond. At least 35% of the soil should be clay and silt-sized particles, the remaining soil being sand and gravel. If there does not appear to be enough clay and silt in the sample, soil sealing agents will be necessary. These range from locally available heavy clays to bentonite to plastic liners, with the costs increasing successively. The water-holding ability of the pond basin is best determined before construction because repairing a leaking pond can be a major financial cost.

At this point, the feasibility, surface area and site of the pond will have been determined. Water supply, water quality, surface and subsurface land features have all been evaluated. Further, the pond builder now has a good idea of the scope of work involved and can begin to design with this in mind. If you will be using stream water, plan the construction schedule to avoid completing the pond during the peak runoff period. If you can complete the pond before the peak runoff, you could be in a good position to utilize this water flow. If not, you should wait until after the ground dries to avoid all of the problems associated with mud.

II. DESIGN AND CONSTRUCTION

By addressing key problem areas of pond maintenance in the design phase, it is possible to create a pond that will provide much more enjoyment than it will take in upkeep. The advice of knowledgeable experts can help minimize costly errors and hassles. Furthermore, as the most expensive mistakes are invariably made during construction, it is recommended that a professional contractor with pond-building experience be sought to do the digging.

Contour, Depth and Water Exchange

Contour and depth of a pond are the primary elements of the design. They should be diagramed first on paper and then marked on the site using stakes or flags. When the equipment is running, it is not a good time to be wondering what will happen next.

Natural depressions or land forms that suggest water barriers may help define the surface contour. This shape should be aesthetically pleasing, with the gentle curves and shoreline variations seen in natural lakes and ponds. Of greater importance to the fishery are the subsurface contours and overall depth because these features will influence the temperature, aquatic vegetation zones and other habitat qualities of the pond.

The aquatic vegetation zones will occupy the first contour below water surface. These shallow water wetlands should extend from the shoreline to a depth of about three feet and amount to anywhere from 10-25% of the pond surface area depending on the oxygen and nutrient qualities of the site. They should be situated adjacent to inflow and outflow streams, or wherever seems appropriate to the topography. In stream-fed ponds, these shallow wetland areas will quickly be colonized by zooplankton (microscopic animals), crustaceans, insects and amphibians; in other words, fish food. They will also attract waterfowl and other wildlife, making the pond more enjoyable even when you aren't fishing.

Below the vegetation contour, the pond bottom should slope fairly steeply down to a depth of at least six feet to prevent growth of aquatic plants. This steep slope will also provide a prime feeding area for fish. Terraces in the 6 to 8 feet contours are good places for piles of big rocks or woody debris, which fish will use as cover. Overall, depths of 12 to 15 feet over at least 15% of the pond bottom will provide an adequate cool water zone to store dissolved oxygen and provide fish with livable habitat during the temperature extremes of both summer and winter.

If either the inflowing or outflowing water will move in an open channel (as opposed to a pipeline), the pond owner is obligated to prevent the pond fish from escaping or wild fish from entering. While this is generally acknowledged to be difficult, it is critical to prevent contamination of and reduce the loss of fish from the stream. Instream fish barriers such as fixed screens, rotating screens, or louvers are available for this purpose. These devices must be installed in both the inflowing and outflowing streams.

At this point, the pond designer has a clear mental picture of the finished pond and it is almost time to dig. Even when building a small pond, a mountain of material will be removed and it can be a major disposal problem. In compliance with the Federal Clean Water Act (404 permit), the pond owner has certified that the spoils will not be disposed of in water or wetlands and a suitable disposal site has been chosen. It will also be the responsibility of the pond owner to reclaim the disposal site after construction.

Excavation

This type of work is typically done with an excavator. It is highly efficient and has relatively low impact above the pond basin. In the hands of a skilled operator, this machine can be surprisingly agile and precise.

With careful manipulation of sequence, much of the excavated material may be put to good use within the pond system. If any sod is to be removed, it should be stripped off at a depth of at least 6 inches and stockpiled (grass side up) nearby. Sod is very useful as an erosion barrier around the finished pond edge and in reclaiming areas damaged during excavation. Next, any remaining topsoil should be removed and stockpiled separately. This soil can be used on the shallow wetland contour and as part of the revegetation process. Topsoil will also be useful when reclaiming the disposal site.

Elevations are measured as the design takes shape. The slope of the shallow wetlands, the depth of the holes and the breadth of the deeper terraces are all graded and measured according to plan. In a dry pond basin, the bottom is left uneven to maximize its surface area and compacted to minimize seepage.

When at last the heavy equipment work is complete, the more delicate work of restoring disturbed areas and establishing new vegetation above and below the water line begins.

Revegetation

Most of the revegetation process is best conducted once the pond begins to fill, either very early in spring or late in fall while they are still dormant. One of the objectives here is to enable the new vegetation to establish itself quickly to serve as a method of erosion control. Another is to help ensure the plants' survival. As with the watershed, the simplest and most ecologically balanced approach is to revegetate using native species planted in their natural environments.

Water's edge is typically a densely foliated zone due to the moisture content of the soil. The sod which was stockpiled earlier is utilized for this narrow zone because it provides an established sediment/erosion barrier in a vulnerable area. The topsoil from the excavation can be used to set the sod into the slope of the shoreline and to smooth the joints between sod chunks. Expanding upon this base, common shore grasses such as fescues, wheatgrasses and bromes may be planted. Among the usual shrubs found in this area are several varieties of willow, some better adapted to lower elevations, others to higher regions. Another popular shrub is alder. This plant grows well in unconsolidated soils, is an excellent soil builder and withstands both flooding and drought. Dogwood also complements the low-lying shoreline and, like willow, is an excellent bank stabilizer.

The upper banks are often home to woods rose and snowberry. Both establish themselves quickly through shallow, rapidly spreading lateral root systems. Chokecherry, which produces edible fruit and is very hardy, might also be planted. Vegetation on the upper banks should be planted in context with the surrounding area to create a more natural setting for visiting wildlife.

Wetland communities commonly host varieties of sedges, which colonize aggressively, as well as reeds and rushes. While cattail is commonly found in wetlands, it is highly prolific and care should be taken if it is to be introduced. One precaution is to plant cattail on the downwind edge of the pond, so that most of its seeds will drift out of the pond and onto dry land where they will not germinate. It is also not uncommon to find both willow and dogwood below water line.

Almost all species of wild flora are commercially available. Some, such as willow and dogwood, can be transplanted from stem cuttings or mature plants. Seedlings should be planted as early in spring as possible before high runoff. Seeds are best planted immediately following high water. If this is not feasible, then late fall is the next best opportunity. The reasons for these considerations are to help ensure root establishment prior to spring runoff or after summer heat and to maximize moisture conditions. Any mature plants or rapidly emerging grasses planted before runoff will help to control erosion. When planting after runoff or in the fall, straw mulch can be added to aid in erosion control.

Besides vegetation, there are other erosion control methods available for high-impact areas such as steep banks or wave impacted shores. In the former case, construction fabrics woven of biodegradable fibers can be stapled to the bank after seeding. The seedlings sprout through the fabric, which serves as mulch while it is breaking down. Fabrics may also be used to control wave erosion, or a rock belt placed in the impact area will serve as well. The latter technique is called "riprapping," and it should be well-integrated with shoreline vegetation for maximum effectiveness.

III. STOCKING THE RIGHT FISH

With 85 species of fish in Montana it would seem difficult to choose the right combination for a new pond. However, there are really very few reasonable choices. Start with rainbow trout, cutthroat trout (if available) or largemouth bass, depending on whether the pond is cold or warm water and you should be pleased with the result. Only when special considerations are taken into account should planning of these tried and proven species be deviated from. A new pond is a major investment and the wrong fish can limit your enjoyment of the living resource you have created. When in doubt, consult a professional fisheries biologist. Never make an illegal or unplanned introduction. The consequences could include contamination of an existing wild stream fishery as well as creating problems in your own pond which could be hard to correct.

Legal Requirements

All of the laws, rules and regulations pertaining to the development and use of private fish ponds are contained in Appendix B, which include:

- it is illegal to import live fish into Montana without an import permit issued by the Department of Fish, Wildlife and Parks;
- it is required that the fish be obtained from a lawful source (a list of sources is provided in Appendix D);
- DFWP may condition the Fish Pond Permit regarding which fish species may be planted;
- DFWP may condition the permit regarding fish barriers if they are deemed necessary. There is no fee for the permit, but it must be obtained before fish can be procured and stocked.

Recommended Species

There are two types of fish ponds in Montana, warmwater ponds and coldwater ponds. The type of fishery that can be successfully established is largely dependent on summer water temperatures. In general, ponds with summer maximum water temperatures that exceed 75°F (24°C) will be marginal for trout. Temperatures exceeding 80°F (27°C) will normally kill trout. Conversely, true

warmwater species like largemouth bass do best in low elevation ponds where long summer days and warm nights produce a longer growing season. In mountainous western Montana, there are very few small ponds that should be stocked with species other than trout.

Warmwater Ponds

In addition to largemouth and smallmouth bass, six other species of the sunfish family are found in Montana waters; none of them are native. Fish classified as sunfishes include white and black crappie, rock bass, green sunfish, pumpkinseed and bluegill. There are very few ponds in Montana that provide any type of quality fishing for these species. While anglers transplanted to Montana from the midwest or the south are often tempted by their past experiences to introduce these species, the results are rarely satisfactory. Furthermore, once these fish are introduced they are often very difficult to eradicate. If you want to fish for sunfish, go to one of the many waters across the state that already have a population; don't make the mistake of starting one in your own pond or any other water body. Such introductions often escape and have dire consequences for existing fisheries.

In Montana, the species list of sunfish which do well in warmwater ponds pretty much starts and ends with largemouth bass. For many years, fisheries managers promoted mixed-stock fisheries of largemouth bass supported by a forage fish such as bluegill, crappie, or a minnow species. Although this technique works well in the midwest, the growing season in Montana is too short for these mixed species fisheries to work well. Typically, what starts as a good idea gleaned from a 1960's pond booklet or national sporting magazine ends up with the disappointing result of very few bass and hordes of stunted panfish. These species can provide amusement for children, but they seldom reach an acceptable size for eating and rapidly become a nuisance rather than an asset.

Repeatedly, fisheries managers in eastern Montana are discovering that largemouth bass stocked by themselves provide their own young bass for forage. This yields a nice mix of eager juveniles along with a few wise old tacklebusters. Proper harvest and management strategies can go a long way toward maintaining the right mix of sizes.

Smallmouth bass have been called, pound for pound, the gamest fish that swims, and they may well be. They are really a fish best adapted to large reservoirs and lazy rivers. In a pond, they could provide a novelty fishery but they are unlikely to do as well as their true warmwater cousin, the largemouth.

A second family of fishes which is found across Montana is the Perch Family. It includes the native sauger and Iowa darter, as well as the introduced

yellow perch. A fourth member, the ubiquitous walleye, is not listed as native but populations have been established by introduction.

Yellow perch is probably the biggest nuisance species in the state, with the possible exception of carp. They are hardy enough to be frozen stiff and revived to swim away, and they are frequently reported from new waters in nearly every region of the state. Very few of these illegal introductions ever pay benefits to the angler and *you don't want them in your pond*. Yellow perch are voracious little predators and very few trout or bass fisheries thrive after their introduction. Yellow perch are generally able to provide a quality fishery only in larger lakes and reservoirs where factors such as water level fluctuation or predation, even by anglers, may be sufficient to control numbers and keep the sizes up.

Walleye and sauger are lake and river species, respectively, and neither is suitable for pond fisheries. These species are also voracious predators and seldom do ponds provide the forage base or spawning requirements to establish a self-sustaining population. While the eating qualities of these fish are legendary, the difficulty in managing them successfully is nearly as famous. Walleye introduction is strictly forbidden in western Montana where they could jeopardize existing fisheries.

There are four representatives of the catfish family in Montana, including the diminutive native stonecat and the larger channel catfish. Channel cats are the staple of fisheries throughout the south and they provide some quality sporting opportunities in the larger rivers and reservoirs of eastern Montana. While they may live in smaller ponds, they are unlikely to reproduce there. Channel catfish do exceedingly well in very muddy water where their small eyes are used as a secondary sense to their renowned sense of smell as a means of procuring food. Channel catfish may have some applications in very turbid and warm ponds in eastern Montana. Consult your local biologist if you feel this is an option for you.

The black bullhead and, to a much less extent, the yellow bullhead are widespread as a result of introductions across Montana. In many cases, these populations were established by well-intentioned but ill-advised pond managers who thought they could be used to create dependable kids' fisheries like those found in the midwest. Unfortunately, they have proven to be largely another nuisance, too small to ever create an attractive fishery in Montana.

Finally, we look at the last of the warmwater and coolwater sport species, the pike family. Much of what was said about yellow perch applies to northern pike. Quite possibly the closest thing to a Montana piranha, these fish will rapidly eat themselves out of a food supply. To make matters worse, initial pike introductions often provide spectacular results as they chow down on an overabundant population of other species. However, this chain reaction cannot be

sustained in a small pond, and soon the water will contain only 14-18" "hammerhandles." At that point, further species introductions are pointless as there is no species of fish that will survive stocking in the face of an overabundant population of northerns.

Montana currently has 22 species of minnows and 9 species of suckers. Nearly all are native and many are widespread across the state. In a few locations, combinations of largemouth bass and fathead minnows or golden shiners provide quality bass fishing opportunities. However, for every one of those there are fifty examples where suckers, shiners, or carp were accidentally introduced from a bait bucket and have resulted in a decline in a promising fishery. With 31 species of minnows and suckers in Montana and dozens more outside the state, only a trained ichthyologist can tell whether that bucket full of little minnows will grow into a pond full of bottom-rooting ten-pound carp. Don't gamble on your own or someone else's ability to identify fathead minnows and don't break the law by introducing them in places where live minnows are prohibited.

In the long run, starting a warmwater pond fishery in Montana should be spelled B-A-S-S (largemouth), unless a qualified fisheries biologist has good reason to recommend otherwise. Stay with the basics!

Trout Ponds

There are 15 members of the trout family (Salmonidae) presently found in Montana waters. Nine of them -- westslope and Yellowstone cutthroat trout; redband rainbow trout; bull trout; lake trout; arctic grayling; and mountain, lake and pygmy whitefish -- are native species in at least one drainage of the state. The other six -- cisco, chinook and kokanee salmon, golden, brown and brook trout -- are all introduced species.

Across the mountainous western half of Montana and in regions of the east where cold springs rise to the surface, spectacular fishing can be provided by some very small trout ponds. As was pointed out earlier in this booklet, proper design and construction of a pond has everything to do with the fishery that results. Montana has a legendary trout resource and fishery managers are constantly working to improve the quality of trout-fishing opportunities. Because they are part of our heritage, we must also be vigilant in protecting the native trout resources that were here when Lewis and Clark visited the area.

It goes without saying that introducing suckers, minnows, or warmwater and coolwater game fish described in the preceding section is a foolish thing to do if a quality trout pond is your ultimate goal. In fact, one of the most frequently asked questions of fisheries managers is, "How do I get those blankety-blank so-

and-so's out of my pond?" That subject is treated later in the management portion of this publication. Here we will deal with the subject matter of trout.

Rainbow trout are the number one game fish species in Montana. Recently, scientists have concluded that the redband form of rainbow, found in the very northwest corner of Montana in the Kootenai drainage, is a native species. All the others were introduced here, beginning in 1889. The last 100 years of rainbow trout management have been a success story and rainbow trout are without a doubt the number one choice of trout pond managers across the state.

Several strains of rainbow trout are used by managers to accomplish varying purposes, just as we use different breeds of cattle for different purposes. When you hear the names, Kamloops, Arlee, DeSmet, and Eagle Lake, you are hearing about different strains of rainbow trout. Some strains have a more diverse genetic makeup, are more variable in size and behavioral tendencies, longer-lived, and are more difficult to catch on hook and line. Other strains are just the opposite: very uniform in size, predictably easy to catch, tend to grow very rapidly and very large, and are unlikely to reproduce. Again, get some advice from a fishery biologist.

While rainbow trout are the "bread and butter" fish of Montana trout ponds, there are situations where another species may be a better choice. In particular, this occurs when the pond is situated in an area where the last stocks of native cutthroat trout are present. Fisheries managers in the upper Yellowstone river basin and in the upper Flathead river basin may limit trout pond stocking to Yellowstone cutthroat trout or westslope cutthroat trout, respectively.

In a pond situation, the two native subspecies of cutthroat trout will behave very much like wild strains of rainbow trout. Yellowstone cutthroat have the potential to grow to very large sizes under fertile pond conditions. Westslope cutthroat will not grow as large. However both are exceptionally beautiful fish, easy to catch, and are valued parts of our natural heritage. Great care is being taken by managers to keep the two subspecies from hybridizing, so Yellowstone cutthroat won't be allowed in westslope cutthroat range and vice versa. Native cutthroat trout stocks that are genetically pure are in limited supply. Check with the local management biologists to make sure you are getting the proper fish.

Brook trout, an introduced species from the eastern U.S., were first stocked in Montana in 1889. They have been, in truth, a mixed blessing in the West. Many an angler in Montana and elsewhere cut his teeth on brookies. They are easy and fun to catch and tasty to eat. However, because they do exceedingly well in small, spring-fed streams and ponds, they can quickly overpopulate and their growth is stunted. Unlike rainbow and cutthroat trout, brook trout can usually spawn successfully in a spring source, and sometimes even on a windswept shoreline. Recently, managers have become aware of the potential for

brook trout to hybridize with native bull trout, producing sterile offspring. *Brook trout should not be introduced into watersheds where they do not already exist, and we do not recommend planting this species in a new pond situation.*

Brown trout are the other introduced trout species that is widespread across Montana, occurring almost everywhere except in the northwest corner of the state. They were introduced from Europe into North America in 1883 and to Montana in 1889. Brown trout are hardy competitors. They will generally tolerate environmental disturbances better than our native species. They also are quite piscivorous (fish eaters), and, like the brook trout, they spawn in the fall, and they require spawning conditions similar to those needed by rainbows and cutthroats. A major drawback to brown trout is their general low catchability in standing water environments. Many of our larger reservoirs have ample supplies of brown trout that are seldom caught. They are less widely available than rainbow trout for private pond stocking and they really do not offer any advantages over rainbow. With their inherent low catchability, they are not generally regarded as a good pond fish.

The remaining native salmonids, the whitefish, lake trout, bull trout, and arctic grayling are not generally available for private fish pond use. In fact, they would have little practical application in such settings. Likewise, the introduced cisco, chinook salmon, kokanee, or golden trout are impractical choices. None of these species are widely available and for the most part they are more adapted to large reservoirs or mountain lakes.

Rainbow trout should be the trout pond manager's first choice, with cutthroat or brook trout considered for special applications.

IV. POND MANAGEMENT

Having taken steps to minimize pond maintenance during the design and construction phases, it will now be necessary only to observe some general principles of fishery management. Although these will vary widely among individual pond sites and owners, there are some basic principles which will be useful to understand and will be dealt with in this chapter.

Water Management

As you will recall, the first step to take in controlling water quality is to address the problem of sedimentation. Having done this effectively, it will now be necessary to monitor the turbidity of the water in the inflow stream and in the pond to "troubleshoot" any problem areas. If any should arise, they can be dealt with using any of the appropriate means discussed earlier. Simply planting seeds may not suffice at this late stage, but a combination of seeds and fabric or transplanted vegetation and fabric will surely do the job of controlling any bank erosion unforeseen in the construction process. Heavy rains early in the growing season may initiate some sudden, short-term erosion. It is wise to deal with this type of problem immediately by promptly repairing the damaged areas, as they are very vulnerable to further deterioration.

Often the pond inflow stream is controlled by a headgate at the source which allows the pond owner to control the amount of water flowing into the pond. Having such control is particularly important during high flow periods when sediment volumes are likely to be high.

Management of Aquatic and Upland Vegetation

Although some aquatic vegetation is an essential part of a healthy pond, its overabundance can lead to aesthetic and water quality problems. The primary method of controlling vegetation is through the proper planning of the depth of the pond. Encroachment of vegetation is a natural process and the degree to which it must be controlled depends somewhat on the preference of the pond owner. For instance, long before floating algae becomes a problem in terms of nutrient supply, its odor, color, or texture may become distasteful to the pond owner. While the pond owner is encouraged to accept the presence of some algae for the sake of the fishery, it is a relatively simple task to rake some of the algae onto the shore and dispose of it. One of the redeeming qualities of the raked out material is its usefulness as a fertilizer in the garden.

Bottom-rooted wetland plants are very vigorous competitors and periodically require a human referee to maintain fair play. Hand-thinning the dominating types by pulling them up from the root is usually all that is necessary if this is done regularly. If the situation gets out of hand, however, more drastic measures will eventually be called for. These include opaque plastic sheets laid over problem areas to kill all of the invading plants, mechanical mowers for cutting down large areas of dense vegetation, or lowering the water level to dry out wetland areas. In any case, dead foliage should be removed from the pond immediately, as the bacteria which feeds on it also consumes dissolved oxygen.

Herbicides and algicide can be used in the control of aquatic vegetation. These must be applied by a licensed professional and the Department of Health and Environmental Sciences, Water Quality Bureau must be notified. Because these chemicals will kill fish and contribute to oxygen deficiencies, their use is not recommended. For information on their use, contact the Montana Department of Agriculture, Environmental Management Division.

Wildlife browsing on newly planted nursery stock is another potential problem. The young plants will be regarded as irresistible forage by any herbivores with a palate for them. The remedy is a repugnant potion, commercially available under different brand names, which is sprayed on the leaves and stalks of the new plants. While harmless to both the vegetation and the browsers, the latter are most unpleasantly surprised by the foul taste of the treated greens and carefully avoid them thereafter.

It should be noted in this discussion that several of the plants listed as noxious weeds in Montana will often show up in areas disturbed by construction, and they are adapted to the saturated zone. Burdock, tansy, leafy spurge, knapweed, poison hemlock, and several thistles are among them. Landowners should familiarize themselves with noxious weeds and take the necessary steps to eradicate any weeds found on their property. Before pond owners use herbicides for weed and vegetation control, however, they should consider the possible negative impact on the fish and the rest of the pond ecosystem. They should also inform themselves of the legal restrictions applicable to herbicides and read the label. Check with the Department of Agriculture for the current regulations and guidance in these matters.

Fish Management

As we have already mentioned, the best time to begin fisheries management is during species selection. Having carefully planned the type(s) of fish to plant for the habitat you have to offer, and having installed some device to prevent their escape, it now remains only to plant the proper numbers for the size of pond you

have created, watch them grow, and catch them! It is recommended, however, that the pond be allowed one growing season to establish a food base and a covering foliage.

Each individual pond will sustain an optimum number of fish (carrying capacity) depending on its size and the amount of food it produces. However, fish will grow larger if there are fewer of them to compete for food whereas greater numbers of fish will be of smaller average size.

Bass fingerlings 2 to 3 inches long should be planted at about 300 to 400 per surface acre. This allows for predation losses that will reduce these numbers significantly in the first two years. Bass should not be harvested until they have successfully reproduced, which is usually about two or three years after stocking. Harvest before spawning has occurred will result in a declining population.

Generally, largemouth bass will spawn successfully in a warmwater pond. In early summer, the female will fan a depression or nest in the soft substrate and deposit a mass of eggs. The male will then take over, guarding the nest and its emerging young from any would-be intruder. Once the young are out on their own, however, they become fair game, and even the parents will dine on them given the opportunity. Largemouth bass love cover, and the most successful ponds are usually littered with logs, lily pads or other structures. In a small pond, manmade shelter structures can be provided which will improve the survival of the young fry.

Trout which are 2 to 3 inches in length, should be stocked at a rate of 750 to 1,000 per surface acre. Juveniles, 5 to 7 inches long, should be stocked about 400 to 600 per surface acre. Stocking is best done in the spring to allow the fish to adapt to the pond. Both spring fingerlings and fall juveniles should reach catchable size (10 inches and larger) the following summer. Catchables can be stocked alone at a rate of 300 to 400 per surface acre. One may also choose to plant a combination of fingerlings and catchables.

Rainbow trout will spawn, (given the opportunity) in the spring of their third year. Hatchlings will stay in the gravel of the inflow stream for the first few weeks until they have consumed their yolk sacs. They will emerge from the gravel and move down to the pond edge in early summer. Because the metabolism of coldwater fish is regulated by the water temperature, the entire reproductive process varies widely in timing and duration from stream to stream. In most of Montana, rainbows will spawn in March or April. The eggs will hatch in about 30 days and the fry will move downstream in a couple of weeks. These estimates are based on an average spring water temperature of about 50°F.

Depending on water temperature and food sources, the young trout will grow 4 to 6 inches the first year. By the second year, they will have reached 10 to 12 inches. Mature three-year-olds will be 14 to 17 inches long. Most hatchery-reared fish currently available will live at least three to four years and will seldom spawn in a wild situation. Consequently, the pond owner should expect to restock every two to four years, depending on fishing quality.

The pond food base, as mentioned earlier, is composed of zooplankton, insects, freshwater crustaceans, snails and worms. Many of these organisms will colonize a new pond quickly on their own. Largemouth bass will forage heavily on their own young. Rainbow trout are diverse and opportunistic feeders. They will eat whatever is most available, including zooplankton, aquatic and terrestrial insects and small fish. A healthy pond ecosystem will provide plenty of natural food for adequate growth without supplemental feeding, if it is not overstocked.

Keeping out undesirable fish species is crucial to long-term pond management. Occasionally unwelcome strains of fish may invade the pond. Angling is the most sporting method of eradicating them; another is lowering the water level and netting them. Drawing down the water level by pumping or decreasing inflow will help to isolate the invaders, making netting or other means of harvesting much easier. The ill-advised pond owner may be tempted to stock other predator fish varieties to help control undesirable species, but this practice usually just causes more problems.

Chemical treatment can be used to eradicate unwanted fish but depending on the pond construction and location it may not be feasible. Rotenone is a commercially available chemical used to eradicate undesirable fish. The use of chemicals requires careful planning. Chemical treatment should not be attempted without first contacting the Montana Department of Health and Environmental Sciences, Water Quality Bureau. Improperly applied chemical can damage the pond and affect other waters downstream. The chemical applicator and pond owner assume significant liability when treating a pond.

The final consideration of fish pond management is harvesting. In both warm and cold water ponds, the pond owner should be the greatest predator. Other predators such as birds and mammals (e.g., herons and otters) may prey on the fish in your pond, but they will have little or no adverse effect on fishing quality. In fact they should be considered part of the ecosystem. Trout will die naturally relatively soon after maturing anyway, so there really is no point in releasing all caught fish back into the pond. To maintain a diverse age and size structure, most mature fish should be caught and kept over the course of the summer and fall. If spawning is possible some breeders may be left overwinter to spawn in the spring.

By following the guidelines in this handbook, you should be able to properly plan, design, and manage your new pond for the benefit of either warmwater or coldwater fisheries. Properly developed and managed ponds are also valuable and pleasing wildlife areas which will attract numerous birds and animals. If you implement the suggestions and practice the cautions outlined here, you will provide many years of enjoyment and you will have also helped to protect the valuable fishery resources of Montana's streams, lakes and ponds.

APPENDIX A
TABLE OF PERMITS

NOTE: All permits except the Montana Water Use Act "Certificate of Water Right" require *approval prior to commencing construction*. Plan ahead to avoid confusion and disappointment.

PERMIT	FEES	PERIOD	INFORMATION	AGENCY
Montana Water Use Act (Water Right) • Provisional Permit	$100	About 6 months (if no public objection); file before construction File after completing construction	Grants use of water for specific amount and purpose. Applies to all surface water and ground water greater than 35 gpm and 10 acre-feet per year.	Dept. of Natural Resources and Conservation (DNRC), Water Rights Bureau
• Certificate of Water Right (permit exception)	$25	About 6 months (if no public objection); file before construction	Issued only for groundwater appropriations of 35 gpm or less or not to exceed 10 acre-feet per year.	
• Authorization to Change	$100		Allows appropriator with recognized water right to change place of use or storage, purpose of use, or point of diversion with original priority date.	
Montana Natural Streambed and Land Preservation Act (310 Permit)	No Fee	Approximately 60 days from date of application	Any private work done in or near a stream on public or private land.	Local Conservation District offices; SCS & DFWP field review
Montana Surface Water Quality Standard (3A Permit)	No Fee	14 days (may be waived by DFWP in 310 review)	Any work which may cause short-term violation of water quality standards for turbidity, total dissolved solids or temperature.	Dept. of Health and Environmental Sciences (DHES), Water Quality Bureau
Federal Clean Water Act (404 Permit)	$10 - $100	60-90 days (public review)	Any work which will result in discharge or placement of dredged or fill material into waters or wetlands of the U.S.	Army Corps of Engineers; EPA regulatory review and enforcement
Montana Floodplain and Floodway Management Act (Floodplain Permit)	Fees vary widely within the state	Up to 60 days	Any work proposed within a designated 100-year floodplain (check with the DNRC to find out if 100-year floodplain has been designated for the stream of interest.	Local floodplain coordinator, may be city/ county planner, sanitarian, building inspector, town clerk, or county commissioner

APPENDIX B
SUMMARY OF PERTINENT ENVIRONMENTAL STATUTES, RULES AND REGULATIONS

All private and public fishing waters are subject to certain laws and rules. Individuals involved in building and managing fish ponds should be aware of them and keep abreast of changes.

The following is a summary of pertinent laws and rules administered by the Montana Department of Fish, Wildlife & Parks (DFWP). (MCA = Montana Codes Annotated; ARM = Administrative Rules of Montana.)

1. It is unlawful to introduce fish or fish eggs into waters of the state without authorization of the Montana Fish, Wildlife & Parks Commission (MCA 87-3-105, 85-5-701 to 716; ARM 12.7.701).

2. The Department will not plant fish nor will the Commission authorize fish to be planted if such planting will be harmful to native fishes in the drainage (MCA 85-5-701 to 716; ARM 12.7.601).

3. Salmonid fish (salmon, trout, whitefish and grayling, or their eggs) cannot be imported into Montana without written certification ensuring that these fish or eggs are free of such fish diseases as may be listed by the Department (MCA 87-3-221 to 224; ARM 12.7.501).

The following is a summary of pertinent laws and regulations administered by agencies other than DFWP. More detailed information, can be obtained using addresses and telephone numbers listed in Appendix C.

4. Fish Toxicants. Owners or managers of a private pond do not need a special license to use a rotenone-based fish toxicant to remove unwanted fishes. However, the product must be one that is registered for this use with the Montana Department of Agriculture. Directions on the label must be followed, including the requirement that the DFWP be consulted prior to use.

5. Herbicides. In Montana most aquatic herbicides (weed killers) are classified as restricted-use pesticides which may be applied only by applicators specifically licensed by the Montana Department of Agriculture to use them. An exception is that the owner or manager of a private pond does not need a license to apply copper-based herbicides for algae control; however, directions on the product label must be followed.

6. 3A Permit. Authorization must be obtained from the Montana Department of Health and Environmental Sciences before undertaking any activity that will violate Montana surface water or ground water quality standards. Authorization for a temporary increase in turbidity (3A permit) resulting from installation of a water diversion structure is usually included in the permit for stream bank and bed alteration (310 permit) obtained from the local Soil and Water Conservation District.

7. High Hazard Dam. If a reservoir created by a dam has an impoundment capacity to the crest of the dam of 50 acre-feet or more, the owner must apply to the Department of Natural Resources and Conservation for a hazard classification.

8. 310 Permit. Natural flowing perennial streams or rivers, their bed and immediate banks cannot be altered, including installation of water diversion facilities, without written approval (310 permit) from the Supervisors of the local Soil and Water Conservation District.

9. Navigable stream license or easement. If a stream or river is classified by the state as navigable, a land-use license or easement must be obtained from the Montana Department of State Lands before undertaking any activity that will disturb the stream bed.

10. 404 Permit. Projects that will result in the discharge or placement of dredged or fill materials into the waters of the United States, including wetlands, require a 404 permit from the U.S. Army Corps of Engineers.

11. Water Use Permit. A person may not appropriate water or commence construction of a diversion, impoundment, withdrawal, or distribution works except by applying for and receiving a permit from the Department of Natural Resources and Conservation. The exception is groundwater appropriation of 35 gallons per minute or less, not to exceed 10 acre feet per year.

12. MCA 87-4-603. FISH POND LICENSE FOR ARTIFICIAL LAKE OR POND RECORDS. (1) A person who owns or lawfully controls an artificial lake or pond may apply to the director for a fish pond license. The holder of a private fish pond license may stock his fish pond with fry procured from any lawful source. The department may designate the species of fish which may be released in the pond and otherwise condition the license when there is a possibility of fish escaping form the pond into adjacent streams or lakes. The license holder may take fish from the lake or pond in any manner. Before a license holder may sell fish or eggs or fry from the lake or pond, he shall furnish a corporate surety bond to the state for $500, conditioned to the effect that he will not sell fish or spawn from any of the public waters of this

state or violate the conditions of his license and also conditioned to the effect that he will submit an annual report on transactions to the director.

(2) "Artificial lake or pond" as used in this section does not include a natural pond or body of water created by natural means or any portion of the streambed or lakebed of a natural pond or body of water. It includes only bodies of water created by artificial means or diversion of water which do not exceed 500 acres of surface area.

(3) The Department may condition the license to require the construction, implementation, and maintenance of measures or devices to prevent fish in an artificial lake or pond from escaping into adjacent waters.

(4)(a) Each licensee who sells fish or eggs shall keep accurate records of:
- (i) the species and quantities of fish or eggs sold or purchased;
- (ii) dates of sales or purchase;
- (iii) names of purchasers and sellers; and
- (iv) locations to or from which fish or eggs are transferred.

(b) On or before January 31 of each year, each licensee who sells fish or eggs shall file a report with the department, on forms made available by the department, summarizing the records required under subsection (4)(a).

APPENDIX C
DIRECTORY OF AGENCIES

1. For information on water rights and dam safety requirements, contact Dept. of Natural Resources and Conservation (DNRC), Water Resources Regional Offices.

Billings Field Office
1537 Avenue D, Suite 121
Billings, MT 59102
(406) 657-2105
Counties served: Big Horn, Treasure, Carbon, Yellowstone, Stillwater, Sweetgrass

Bozeman Field Office
111 N. Tracy
Bozeman, MT 59715

(406) 586-3136
(406) 586-3137
Counties served: Gallatin, Madison, Park

Glasgow Field Office
P.O. Box 1269
839 First Ave. South
Glasgow, MT 59230
(406) 228-2561

Counties served: Daniels, Dawson, McCone, Phillips, Richland, Roosevelt, Sheridan

Helena Field Office
1520 E. 6th Avenue
Helena, MT 59620-2301
(406) 444-6695
Counties served: Deer Lodge, Lewis & Clark, Powell, Silver Bow, Broadwater, Jefferson, Beaverhead

Kalispell Field Office

P.O. Box 860 (zip 59903)
3220 Highway 93 South
Kalispell, MT 59901
(406) 752-2288
Counties served: Flathead, Lake, Lincoln, Sanders

Lewistown Field Office
311 West Janeaux
P.O. Box 438
Lewistown, MT 59457
(406) 538-7459
(406) 538-7012
Counties served: Cascade, Fergus, Golden Valley, Judith Basin, Meagher, Musselshell, Petroleum, Wheatland

1. (cont'd.)

Havre Field Office
P.O. Box 1828
1708 West 2nd St.
Havre, MT 59501
(406) 265-5516
(406) 265-2225
Counties served: Blaine, Choteau, Glacier, Hill, Liberty, Pondera, Teton, Toole

Miles City Field Office
P.O. Box 276
5 North Prairie
Miles City, MT 59301
(406) 232-6359

Counties served: Carter, Custer, Fallon, Powder, Prairie, Rosebud, Wibaux

Missoula Field Office
P.O. Box 5004 (zip 59806)
1610 South 3rd St. West, Suite 103
Missoula, MT 59801
(406) 721-4284
Counties served: Granite, Mineral, Missoula, Ravalli

For information on fish toxicants and herbicides that are registered in Montana and rules for their use, contact:

Technical Services Bureau
Montana Department of Agriculture
6th and Roberts St.
Helena, MT 59620
(406) 444-2944

2. For streambank/streambed protection permit (310) required when installing water diversion devices or doing work below the high water line on streams and rivers and for information on state and federal laws and rules involved, contact your local Soil and Water Conservation District.

For the license or easement required before the bed of a stream defined as navigable by the state may be disturbed, contact:

Land Administration Division
Montana Department of State Lands
1625 11th Ave.
Helena, MT 59620
(406) 444-2074

3. For information on Montana's surface or ground water quality standards, contact:

Water Quality Bureau
Dept. of Health and Environmental Sciences
Cogswell Building
Helena, MT 59620
(406) 444-2406

4. For the permit (404) required to do any activity that will result in the discharge of dredged or placement of fill material into waters of the U.S., including adjacent wetlands, contact:

U.S. Army Corps of Engineers
Lee Metcalf Building
1520 East Sixth
Helena, MT 59620
(406) 444-6670

5. For a private fish pond license, additional information on laws and rules or information on fish management, contact any of the following DFWP headquarters:

Helena Headquarters
1420 East Sixth Ave.
Helena, MT 59620
(406) 444-2535

Region 1 - Kalispell
490 Meridian Rd.
Kalispell, MT 59901
(406) 755-5505

Region 2 - Missoula
3201 Spurgin Rd.
Missoula, MT 59801
(406) 721-5508

Region 3 - Bozeman
1400 South 19th
Bozeman, MT 59715
(406) 994-4042

Region 4 - Great Falls
4600 Giant Springs Rd.
Great Falls, MT 59405
(406) 454-3441

Region 5 - Billings
2300 Lake Elmo Dr.
Billings, MT 59105
(406) 252-4654

Region 6 - Glasgow
Rural Route 1-4210
Glasgow, MT 59230
(406) 228-9347

Region 7 - Miles City
P.O. Box 2004
Miles City, MT 59301
(406) 232-4365

Region 8 - Helena
1420 East Sixth Ave.
Helena, MT 59620
(406) 444-2602

APPENDIX D
LICENSED COMMERCIAL FISH HATCHERIES

COMPANY NAME, ADDRESS & PHONE	CONTACT PERSON	FISH REARED
Hamilton Trout Company 951 Ponderosa Dr. Hamilton, MT 59840 (406) 363-1795	Herman Hamilton	Rainbow trout
Harriman Trout Company 9615 Fish Hatchery Rd. St. Ignatius, MT 59865	Alan or Margaret Harriman	Rainbow, brown cutthroat trout
Kinney Trout Ponds Rt. #1 West Laurel, MT 59044 (406) 628-7405	Stan Kinney	Rainbow trout
Nelson's Spring Creek Ranch Rt. 38, Box 2023 Livingston, MT 59047 (406) 222-3922	Roger Nelson	Cutthroat, brown, rainbow, kamloops
Rainbow Springs Hatchery Rt. 85, Box 4101 Livingston, MT 59047 (406) 222-3922	Tom Morgan	Cutthroat trout
Sekokini Springs Trout Farm 5850 Rabe Road Columbia Falls, MT 59912 (406) 387-5547	Cary King	Rainbow trout
Spring Creek Camp & Trout Ranch P.O. Box 328 Big Timber, MT 59011 (406) 932-4387	Bob Bovee	Rainbow trout
Spring Creek Trout Hatchery Rt. 1, Box 1600 Lewiston, MT 59457 (406) 538-3538	Tony Nowak	Rainbow, brown trout, kamloops

APPENDIX E
SUGGESTED READING

Brown, C.J.D. and N. Thoreson. "Ranch Fish Ponds," Montana Agricultural Experiment Station Bulletin 544, Bozeman, 1958, 26 pages. An old but far from outdated manual covering all the basics of fish pond construction and management.

Brown, C.J.D. "Fishes of Montana," Big Sky Books, Montana State Univ., Bozeman, 1971, 207 pages. Information on identification, distribution and life history of Montana fishes, including breeding and feeding habits.

Everhart, W. Harry and Wm. D. Youngs. "Principles of Fishery Science," second edition, Cornell University Press, Ithaca, New York, 1981, 349 pages. A comprehensive scientific text reference covering all aspects of fishery science.

Lacey, John R. and Celestine A. "Controlling Pasture and Range Weeds in Montana," Cooperative Extension Service Bulletin 362, Bozeman, 1985, 34 pages. Identification and eradication of noxious weeds.

Marriage, L.D., A.E. Borell, and P.M. Scheffer. "Trout Ponds for Recreation," U.S. Dept. of Agriculture Farmers Bulletin No. 2249, Washington, 1971, 13 pages. Has sections on planning the pond and trout stocking and management.

Montana Association of Conservation Districts. "A Guide to Stream Permitting in Montana," MACD, Helena, 1990. A complete reference to pertinent permits.

Montana Dept. of Natural Resources and Conservation. "Appropriation of Water in Montana," DNRC, Helena, 1992, 24 pages. Background, current policy, description of process and explanation of terms.

Mullin, Barbara. "Herbicides Registered for Aquatic and Ditchbank Weed Control in Montana," Montana Dept. of Agriculture, Environmental Management Division, Technical Bulletin 86-1, Helena, 1986, 13 pages. List of herbicides registered to be used in and around water in Montana.

Piper, Robert G. et al. "Fish Hatchery Management," U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C., 1982, 517 pages. A comprehensive guide to the planning and management of hatcheries.

Soil Conservation Service. "Ponds -- Planning, Design, Construction," U.S. Dept. of Agriculture, Agriculture Handbook Number 590, Washington, 1982, 51 pages. Deals primarily with the design of ponds.