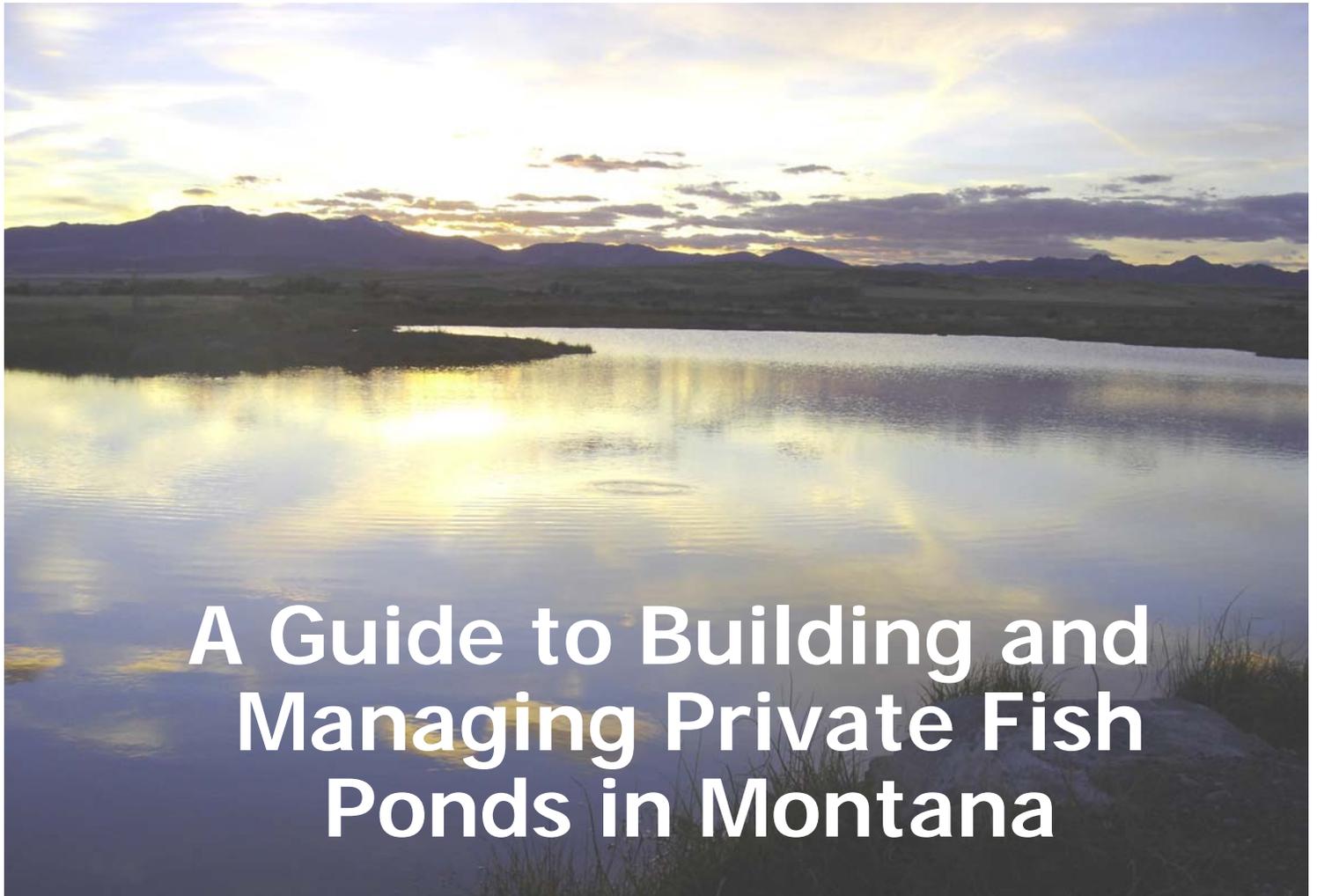




Montana Fish, Wildlife & Parks



A Guide to Building and Managing Private Fish Ponds in Montana

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Fisheries Division

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Introduction

Ponds can be a real asset to a landowner, adding to the beauty and value to property and they can also provide wildlife habitat and support a variety of recreational uses. Many pond owners want fish, whether to raise a few large fish, provide some tasty meals, or have a place to take the grandkids fishing. At the same time, ponds can be expensive to build and maintain. Most require regular maintenance, much like a lawn or garden, to keep the pond healthy and attractive. Improperly managed ponds can be a source of water quality and quantity problems, fish disease, and illegal fish introductions so there are several permit systems in place to try to avoid such problems.

For those considering building a pond, several sources of information are listed in the references at the end of this guide. 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. FWP believes 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 renewed popularity, it is imperative that ponds be properly built and managed. A professional fishery biologist should always be consulted. Private fishery consultants are listed in telephone directories, they can be located on the internet, or a list is available at Montana Fish, Wildlife & Parks (FWP) headquarters. Since most private ponds are not open to the public, State fisheries biologists generally cannot help with private pond planning.

There are many different reasons to have a pond, and it is important to consider all the aspects of building and managing a pond prior to construction. For example, if you want to stock fish in your pond, it must have attributes different from a pond built to enhance wetlands for waterfowl habitat. This handbook will concentrate on developing and managing private fish ponds. You may also wish to read "A Guidebook for Montana Ponds" by Montana Watercourse (406-994-6671; http://www.mtwatercourse.org/Publications/PondsGuidebook_3-11-05.pdf) for suggestions about other types of ponds.

Overview

Montana places a high value on its stream fisheries. Nearly all stream fisheries in Montana are maintained by naturally reproducing wild fish, *i.e.*, without hatchery stocking. Consequently, Montana anglers are sensitive to water withdrawals from streams (large or small) that contain wild fish. Many Montana streams already suffer from dewatering by consumptive water uses that have been occurring in Montana for over 100 years. Dewatering also affects wildlife species that live in or along streams and rivers. Additional water withdrawals compound an already serious problem in trying to maintain adequate habitat for fish and wildlife. 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 affect the stream's fish and wildlife. Keep in mind that all ponds consume some water. Every effort should be made to eliminate or severely restrict the use of stream surface water for a new fish pond. Groundwater wells, especially shallow wells near stream channels, can also dewater streams by intercepting groundwater. Pond discharges may contain diseases, increased nutrients, and elevated temperatures that may individually or cumulatively impact downstream waters and fisheries.

PLANNING A NEW POND begins with an understanding of all of the physical and legal ramifications of private pond construction and ownership. This planning will include securing a right for a sufficient amount of water and obtaining necessary permits. 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, impact on instream flows and fisheries, 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 its 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 owner. From this concept, you will draw the plan (it is recommended that a professional be involved), 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 may legally be undertaken only after a Non-Commercial Private Fish Pond License has been issued by FWP. The permit will list specific fish species approved for the pond, and the pond builder may choose from these species. In some locations, native species will be required. Stocking rates will vary with individual pond conditions and your goals for the fishery. Stocking should be postponed until a year after completing revegetation to allow the pond's food web to develop. Not all ponds will be permitted.

AQUATIC NUISANCE SPECIES (ANS) are a threat to ponds throughout Montana. Knowing what is prohibited, how to prevent introduction and dispersal, and where to find information is essential to prevent the spread of these troublesome invaders.

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, invertebrates, and noxious plants (aquatic and terrestrial). Maintenance work should be routine and consistent to prevent little problems from becoming big ones.

APPENDICES include a table of permits that may be required, citations from Montana state laws, and a directory of permitting agencies. A diagram of FWP regions is also included. Some suggested reading materials are also listed.

I. PLANNING A NEW FISH POND

Planning is the key to realizing the fish pond you desire. Before beginning, you need to become familiar with a broad range of biological and hydrological information. This knowledge will allow you to provide necessary technical data to satisfy the legal requirements of various permitting agencies. The nonprofessional may have difficulty obtaining this required information, so Montana Fish, Wildlife & Parks (FWP) strongly urges a person interested in building a private pond to seek technical assistance. Private fishery consultants are listed in telephone directories, they can be located on the internet, or a list is available at FWP headquarters (406-444-2535). Local USDA Department of Natural Resource and Conservation Service (DNRC) offices offer free written materials, grants, and loans for pond development. "A Guidebook for Montana Ponds," a booklet written by Montana Watercourse, provides assistance and advice for the potential pond-builder (available online at: http://www.mtwatercourse.org/Publications/PondsGuidebook_3-11-05.pdf).

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, you must obtain some or all of the permits listed in Appendix A. Which of these permits is required will vary with individual circumstances. A joint application for permits 310, 318, 404 and floodplain permits has been developed to save time and paperwork. A Non-Commercial Private Fish Pond License must be obtained from FWP before fish are stocked into a private pond. The Non-Commercial Private Fish Pond License is discussed further in Section III—Stocking the Right Fish.

The legal description of a "private pond" is found in Montana law MCA 87-4-603 (see Appendix B). A private pond is, "a body of water created by artificial means or by a diversion of water that does not exceed 500 acres of surface area." A private pond "does **not** include all other natural ponds or bodies of water, including streams or rivers and impoundments or reservoirs of or on a natural stream, river, lake, or pond." 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 that destroys stream habitat, interferes with fish migrations, and results in ponds ultimately ruined by unmanageable sedimentation. If a pond meets the requirements, the owner of the pond qualifies for a Non-Commercial Private Fish Pond License. This conditional license allows the pond owner to "stock the fish pond with" approved fish species "procured from any lawful source" and to "take fish from the lake or pond in any manner." State fishing regulations do not apply, and fishing licenses are not required to take fish from the pond.

Obtaining the proper water rights for the new pond is necessary under Montana law. For ponds appropriating any surface water or appropriating ground water at a rate greater than 35 gallons per minute or a volume greater than 10 acre-feet per year, (including evaporation) a pond builder must obtain a Beneficial Water Use Permit from DNRC **prior** to construction of any of the appropriation works. For ponds with ground-water appropriations less than 35 gallons per minute and not exceeding 10 acre-feet per year, a Notice of Completion of Groundwater Development Certificate must be filed with the DNRC within 60 days of water being put to use. Another means for obtaining a water right for a new pond is to change the purpose and place of use of an existing water right to accommodate the new pond by filing an Application to Change a Water Right with the DNRC.

Information on water right permitting and forms is available from DNRC Water Resources Regional offices or on the internet: http://dnrc.mt.gov/wrd/water_rts/wr_general_info/wrforms/wr_forms.asp). DNRC requires extensive information to obtain a Beneficial Water Use Permit or an Authorization to Change a Water Right. A complete understanding of the information required is essential in making a successful water right application. The issuance of a Beneficial Water Use Permit or an Authorization to Change a Water Right by DNRC is not guaranteed and is subject to objection by other water users. New Beneficial Water Use Permits for consumptive uses of water are not available in some areas of the state because the basin is closed to new water rights. DNRC provides information on basin closure restrictions.

Water rights in Montana are guided by the Prior Appropriation Doctrine (first in time, first in right). This means the first person to use water from a source has the first right or the “senior” water right. The second person to establish rights is a junior water right holder to the first person, and so on. When sufficient water is not available for all users on a water source, senior users can stop the use of water by junior permit holders. Because water appropriation has occurred in Montana for about 130 years, new permits will usually be junior to one or more senior water right holders.

A water right is only good as long as it is being used “beneficially”. Fish and wildlife are beneficial uses under Montana law. 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 claim or right.

Many streams in Montana suffer from de-watering by consumptive uses. Additional water withdrawals can compound an already serious problem for wildlife, wild fish and their habitat. Pond builders should be aware of and be sensitive to the fact that water withdrawals for new fish ponds may negatively impact downstream public resources including wildlife and wild fish. All private fish ponds consume some water. Every effort should be made to eliminate the use of stream surface water or alluvial groundwater for ponds.

The prospective pond owner should be aware that some water would be consumed by pond evaporation (water vapor released due to heat), transpiration (water utilized by vegetation), and percolation (water seepage into the soil). Because all of these factors will vary among 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.

Water Quantity

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. Water sources include streams, springs, irrigation ditches, wells, surface runoff, and ground water. A few examples of utilizing different water sources will be discussed in this section. Knowing what water sources are present and legally available at the location is an important step in building a pond.

If a site is chosen to use topography and a dam to impound surface runoff, the pond builder should evaluate the size of the watershed to determine its potential to fill and maintain water in a pond. Water level fluctuations can have negative impacts on the fishery resource in a pond. In this example, the location and size of the pond may be limited by topography and precipitation patterns. Permits are required when building a dam; please refer to Appendices A and B for more information, or contact your DNRC regional office listed in Appendix C, #1. “Small Earthen Dam Construction,” a manual written by DNRC, can provide guidance for planning and constructing

small earthen dams (Appendix E). Dam safety is a major concern and cost.

If the site chosen has groundwater near the surface, (*e.g.*, 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 that must be approved by the DNRC on a case-by-case basis.

In the past, many ponds were built using streams as water sources. If a stream was flowing near the proposed pond site, you might obtain a legal water right, excavate a dry pond basin, compact it to prevent seepage and fill it with water diverted from the stream. For these ponds, it is desirable and may be required that the same amount of diverted water must flow back into the stream in the shortest distance possible to minimize dewatering of the stream. Flow back to the stream may cause escapement of fish species or aquatic nuisance species from the pond, increased stream temperature because of pond discharge, or increase nutrients in the stream. Today, these types of ponds are usually discouraged or disallowed, because the individual and cumulative effects on the stream are usually too high to be ignored.

Water Quality

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 in 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 (due to dying over winter) or respiring ("breathing" in oxygen and giving off carbon dioxide at night) and adversely affect the fishery. The nutrient enrichment and decay of plants is part of the process called eutrophication.

Temperature strongly affects the interaction of oxygen and nutrients in a pond. For example, water is most dense and holds the most dissolved oxygen at 39°F (4°C). A pond can sustain high nutrient levels with few algal problems at lower temperatures; however, given the same amount of nutrients, excessive amounts of algae can become a problem in water as it warms. At the highest water temperatures, toxic 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, which requires more oxygen and thus more rapidly depletes the already reduced oxygen supply. Temperature and eutrophication can be controlled to a great degree by pond depth. This is discussed in Section II—Design and Construction: Contour, Depth, and Water Exchange.

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 located to avoid runoff from these areas. If the nutrient contribution in surface runoff is too high, a diversion terrace may be constructed to direct runoff away from the pond.

Soils in the watershed should be assessed with regard to their susceptibility to erosion. Sediment is eroded soil material that is subsequently deposited in water. Sedimentation increases turbidity (muddiness), inhibits light penetration, lowers the productive capability of the pond, and fills the pond. Overgrazing and trampling by livestock are frequently major contributors to sediment problems. Fencing can be used to control livestock use of the pond. An unimproved or unpaved road in the watershed may be another source of sediment. Fortunately, sedimentation can be controlled by increasing the amount of vegetative ground cover in key areas of the watershed. Washes, gullies, road edges, and other physical features that concentrate runoff should be revegetated with native plant varieties before pond construction. Soil disturbance during excavation will only compound sedimentation problems.

Another important consideration of the watershed is its flood potential. Areas prone to flash flooding during sudden storms may require runoff diversion structures such as terraces, dikes, and berms and dams may need emergency spillways. 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 to your property and to your neighbors' downstream. While more predictable and less damaging than flash floods, snow runoff must also be taken into account because it contributes to sedimentation. The county floodplain coordinator or the DNRC can help you determine if you are in a historical floodplain. Records of average precipitation are available through local offices of the National Weather Service. These data, coupled with an analysis of soil and vegetation, can provide a long-term view of the runoff characteristics of a watershed.

Soil Analysis

Soil analysis 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 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 sealants range from locally available heavy clays, to bentonites, 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. The local Soil and Water Conservation District office can help determine your soil characteristics (Appendix C, #4).

Overview

At this point, the feasibility, surface area, and site of the pond will have been determined. Water supply, water quality, surface land features, 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. Be mindful of the potential problems associated with pond construction in the different seasons. Factors such as high water, wet and muddy conditions, etc. may make construction difficult.

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 enjoyment with the least maintenance. The advice of knowledgeable

experts with pond-building experience can reduce costly errors and hassles, as the most expensive mistakes are invariably made during design and construction. Finally, having the ability to drain a pond allows a manager flexibility to solve problems (*e.g.*, removal of aquatic nuisance species, removal of undesirable fish species, altering the design of the pond to prevent erosion, or controlling excessive plant growth).

Contour, Depth, and Water Exchange

Contour and depth of a pond are the primary elements of the design. They should be diagrammed first on paper and then marked on the site using stakes or flags. Using a professional contractor will help prevent mistakes or time lost due to inadequate preparation of the site prior to digging.

Natural depressions or landforms that suggest water barriers may help define the shoreline contours. 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. 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 are not fishing. Near-shore areas should have a gentle slope for safety for humans and animals.

Below the vegetation contour, the pond bottom should slope steeply down to a depth of at least ten feet to prevent growth of aquatic plants. This steep slope will also provide prime feeding area for fish. Terraces in the 6- to 8-foot contours are good places for piles of big rocks or woody debris, which fish will use as cover. Maximum depth of the pond is variable. In general, depths of 12 to 15 feet over at least 25% 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. In some areas, 12 feet over at least 50% of the pond or 15 feet over 30% of the pond may be necessary to prevent winterkill. Winterkill is death of fish in a pond caused by oxygen depletion (anoxic conditions) due to bacterial decomposition of decaying aquatic plants and lack of photosynthesis. It occurs in the winter when there is prolonged ice and snow cover and aquatic plants die off and are consumed by bacteria.

Maximum depths for preventing vegetation growth and necessary depths to prevent anoxic conditions (or winterkill) vary around the state. Conditions in eastern Montana require a maximum depth of at least 10 feet to prevent vegetative growth. In addition, a pond 12 feet deep may need half its area at that depth, while one 15 feet deep may need only one-third its area at this depth to prevent anoxic conditions. This variation in conditions around the state illustrates the importance of talking to a professional contractor familiar with the area for design and construction of the site. Aeration and recirculation are additional methods to prevent anoxic conditions. These types of devices may be expensive and will add to the total cost of the pond construction.

If either the inflowing or the 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 as 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.

Excavation

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, an excavator must remove a mountain of material, which can be a major disposal problem. In compliance with the Federal Clean Water Act (404 permit; see Appendix A and Appendix C, #7), 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.

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 sod is to be removed, it should be stripped off at a depth of at least 6 inches, stockpiled (grass side up) nearby and kept watered. 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 in reclaiming the disposal site. Large rocks can also be sorted for later placement as shoreline stabilization or used to create underwater habitat features.

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 as planned. In a dry basin, the bottom is left uneven to maximize its surface area and is 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 plants are still dormant. One of the objectives here is to enable the new vegetation to establish itself quickly 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. The county extension agent can be contacted for recommended native plant species in an area.

The water's edge is typically a densely vegetated zone due to the moisture content of the soil. The sod that 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 sections. Expanding upon this base, common shore grasses such as fescues, wheat grasses, 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. Large-rooted trees should be avoided on dams, as their roots may compromise the integrity of the dam.

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

Wetland communities commonly host varieties of sedges, which colonize aggressively. Reeds, rushes, willow, and dogwood are often found below water line. While cattail is commonly found in wetlands, it will colonize eventually and should not be introduced intentionally. Aquatic nuisance species should be avoided and are discussed in Section IV—Aquatic Nuisance Species.

Almost all species of common native plants are commercially available. Some, such as willow and dogwood, can be transplanted from stem cuttings of mature plants. Seedlings should be planted as early in spring as possible before runoff. Seeds are best planted immediately following high water. If spring is not feasible, then late fall is the next best opportunity. These considerations will help to 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, you can add straw mulch to aid in erosion control and hold moisture while young plants establish roots.

Avoid planting exotic species that may be readily available at nurseries. Though these are often common, beautiful, and hardy, they are not native to Montana and tend to choke out native species through dense growth or excessive water use. Plants such as lily pads can be a nuisance. Exotic plants are difficult to control and can harm aquatic and terrestrial resources in the surrounding area. Your county extension agent can provide native species information and sources for vegetation.

Besides vegetation, there are other erosion control methods available for high-impact areas like steep banks or wave-affected 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 "rip rapping", and it should be properly 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. A professional fishery biologist should always be consulted (contact FWP headquarters at 406-444-2449 for a list of private fisheries consultants). A Non-Commercial Private Fish Pond License is required before obtaining and stocking fish. Based on state law first passed in 1945, FWP administers private fish pond licensing. Regulations are intended to allow stocking of private fish ponds while ensuring that public resources are not adversely affected by unwanted fish or fish diseases, aquatic nuisance species are not introduced into ponds (where they can escape or be introduced into state waters), and habitat of wild fish is not harmed. Most of Montana's streams

support wild fish without artificial stocking, and the introduction of unwanted fish species or the diversion of water for artificial ponds could potentially affect the natural ecological balance. Through the licensing process, FWP will identify the fish species allowed to be planted based on fisheries management objectives for the watershed.

Never make an illegal introduction, as there are biological and legal consequences for these actions. The biological consequences could include contamination of an existing wild stream fishery, introduction of invasive species or diseases, or problems in your own pond that could be difficult and expensive to correct. A new pond is a major investment, and the wrong fish can limit your enjoyment of the living resource you have created.

Legal Requirements

Appendix B contains all of the laws, rules, and regulations pertaining to the development and use of private fish ponds. A brief list of some important fish pond requirements follows:

- It is required that the fish be obtained from a lawful source. A list of sources can be obtained by contacting:

**FWP Fish Health Lab
4801 Giant Springs Road
Great Falls, MT 59405
406-452-6181**

- It is illegal to import live fish into Montana without an Import Permit issued by FWP.
- A Non-Commercial Private Fish Pond License must be obtained from FWP before fish can be procured or stocked:
 - FWP will designate which fish species may be planted;
 - FWP may condition the license regarding fish barriers, if they are deemed necessary. There is a \$10 application fee that must be paid to initiate the review process.
- Proof of a water right will be required prior to issuing the Non-Commercial Private Fish Pond License. FWP Policy requires a private fish pond permit applicant must have a water right appropriate for the size and location of the pond.
 - For existing ponds, the applicant's General Abstract from DNRC must include a "Reservoir Record" that is consistent with the size and location of the pond.
 - For existing ponds that have a valid Reservoir Record and a priority date prior to January 1, 2000 a private pond permit can be issued without a specific "fishery" or "fish and wildlife" purpose for the water body included in the water right.
 - For ponds with a water right priority date of January 1, 2000 or later, the water right must include a "fishery" or "fish and wildlife" purpose to obtain a fish pond permit.
 - Any impoundment created via the "stockwater exemption" in the Water Use Act (85-2-306(3), MCA) must obtain a new water right for fishery purposes if the stockwater exception was issued January 1, 2000 or later.

Prohibited Species

Species not allowed for stocking in traditional private ponds include grass carp, channel catfish, sauger, walleye, smallmouth bass, northern pike, bullheads (yellow and black), green sunfish, pumpkinseed, shiners, chinook salmon, kokanee salmon, lake trout, grayling, whitefish, channel catfish, goldfish and koi (carp). Other species may be added to this list of prohibited species as

they are requested and evaluated. Koi and goldfish may be held in ornamental backyard ponds; contact FWP for more information about ornamental backyard ponds.

Sterile Fish

Technology for producing sterile fish is advancing at a rapid rate. When FWP is confident in the process for producing sterile fish, it is likely that some ponds will be approved only if they are stocked with sterile fish. FWP is currently working with commercial hatcheries in the state to ensure that potential sources of sterile fish will be available before requiring their use.

One time stocking permits

One time stocking permits may be issued to pond owners who do not fit the requirements for a private fish pond permit. These permits are issued sparingly and only for circumstances where there is no conflict with state fishery resources; typically natural ponds on private land with no inlets or outlets, i.e. prairie pothole ponds.

Species of Fish Generally Allowed for Stocking

The determination of what fish species are appropriate for stocking in private ponds in various regions of Montana is complex and extremely important. There are about 85 different fish species in Montana, and 56 of these species are native to the state. The distribution of native fish in Montana is not uniform, because of ancient geologic and climatic events. These events allowed certain fish species to colonize some river drainages, but not others. Therefore, some species like bull trout are native in the Columbia River drainage in western Montana, but not in the Missouri River drainage in eastern Montana. The reverse is true for species like sauger and paddlefish. Some introduced species are compatible with native fish, and some are not. This compatibility varies by river drainage, depending on which native and non-native species are present or are being considered for introduction.

Unfortunately, many of our native fish species are in trouble, for various reasons. One-half of Montana's native fish species are listed by the Montana Natural Heritage Program as "species of concern" or "potential species of concern" due to declining populations. Several native fish species (white sturgeon, pallid sturgeon, and bull trout) have federal designation as "threatened or endangered", and others are being considered for federal listing. One of the major factors affecting native species is the introduction of new fish species that compete, hybridize, and/or prey directly on the natives.

Native fish are not the only species vulnerable to the introduction of new fish species. The introduction of new fish, or even the expansion of existing species can have major effects on established fishery resources in a given area. For instance, there are many examples where the establishment of yellow perch, black bullheads, walleyes, sunfish, and other species have seriously degraded popular high-quality fisheries for stocked non-native rainbow trout or other species in lakes, ponds and reservoirs. In some cases, the existing fishery was depleted by direct predation, and in other cases the introduced species overpopulated and depleted food supplies. Some species, like walleye, can have dramatic adverse effects on other species such as perch and trout, but the walleye themselves usually provide limited fishing opportunity in small ponds.

The phenomenon of adverse fish-species interaction is not limited to public waters. There are examples where upstream private pond owners have adversely affected others by stocking inappropriate species that drifted downstream and colonized neighbors' ponds. In some cases,

establishment of undesirable species in private ponds simply establishes more “source populations” for illegal introduction to other waters. Illegal fish introduction is a chronic problem. More than 500 illegal introductions involving 50 different fish species have been documented in Montana.

Another major and growing concern is the risk of accidentally introducing undesirable Aquatic Nuisance Species or fish diseases via the importation of fish for stocking in Montana waters. Whirling disease, which can devastate Montana’s world-class wild trout fisheries, was likely introduced into private ponds in western Montana by the illegal importation of diseased hatchery trout from Idaho. Zebra mussels, and a wide array of other exotic aquatic organisms (fish, aquatic plants, and aquatic invertebrates) from Europe and Asia, have had detrimental effects on popular fisheries and have caused major property damage in Midwestern lakes, but have not appeared yet in Montana. Importation of fish (and transport water) from contaminated areas poses a major risk for introducing these organisms into Montana.

Because of our northern latitude, cold water, and short growing season, many of the popular “southern” fish species like bass, crappie, sunfish and others do not grow and reproduce well, and they fail to provide good recreational fisheries in many parts of Montana. Consequently, they are not often successfully raised in private Montana fish hatcheries and private pond owners who wish to stock these species must usually obtain a permit to import them from private hatcheries located in other states, which poses a risk. State and federal fish hatcheries typically have stringent disease and aquatic-organism monitoring protocols to minimize the risk of accidentally importing ANS or new fish diseases. Private fish hatcheries in Montana are closely monitored, but that is not always the case for private fish hatcheries in other states where rules may vary. There may be instances where there is no choice but to legally import fish from out-of-state, but Montana’s private pond owners are strongly encouraged to stock species that are available from in-state hatcheries.

Fish species authorized for stocking in private ponds in various regions of Montana are listed in Table 1. This list was developed based on careful consideration of the numerous factors described above, including: threat to existing fish populations in public and private waters; threats to native species; effects on threatened and endangered species and species of special concern; availability in Montana hatcheries; likelihood of importing ANS and fish diseases; potential to create more sources for illegal introduction; and the likelihood of providing a suitable and desirable fishery. The species listed in Table 1 are generally considered compatible with other species for the region in question, but each introduction must be considered on a case-by-case basis because fish distribution and risk varies among watersheds, even within a single FWP region.

Pond Stocking Recommendations

The type of fishery that can be successfully established in a pond is largely dependent on location and summer water temperatures. Warmwater fish (*e.g.*, largemouth bass and bluegill) do best in low elevation ponds where summer water temperatures are greater than 74°F, and there is a longer growing season (greater than 150 days). Cold-water fish (*e.g.*, rainbow trout) do well when water temperatures are kept below 65°F. Finally, coolwater species (*e.g.*, yellow perch) prefer summer temperatures to be in the mid range, 65°F to 75°F. Due to the large variation in habitat throughout the state, there are many different regional options for stocking ponds. This booklet will provide you with a general idea for types of fish stocked in Montana ponds, and the Non-Commercial Private

Fish Pond License process will give you a more specific option. Introduction of nonnative species in Montana will only be allowed in areas where their presence is compatible with existing aquatic communities and fisheries management programs. Introduction of aquatic nuisance species is not permitted in Montana and will be discussed further in Section IV—Aquatic Nuisance Species. Nomenclature used to identify fish species is consistent with *A Field Guide to Montana Fishes*; this book is listed in Appendix E.

Each FWP Region (see Appendix D for a FWP Regional Map) has its own rules and recommendations for stocking fish in ponds, as discussed previously and shown in Table 1. A Non-Commercial Private Fish Pond License must be obtained before any fish may be stocked into a private pond.

Warmwater and Coolwater Species

Warmwater and coolwater ponds can be found throughout the state. However, these species are often prolific and predatory, which can pose a threat to other fishery resources in a watershed. Warmwater and coolwater species for private fish pond stocking must usually be imported from out-of-state, since few or no sources typically exist in Montana. Thus, an Import Permit issued by FWP will be necessary prior to stocking all imported warmwater and coolwater fish species. When importing fish from an out-of-state hatchery, it is possible to introduce non-native species or aquatic nuisance species (*e.g.*, zebra mussels, whirling disease, and round goby). To find out if an out-of-state hatchery is permitted to import into Montana, or for a list of acceptable import-hatcheries, contact the FWP Fish Health Lab (Appendix C, #6).

Sunfish

Eight sunfish species have been introduced into Montana waters. These fish include largemouth bass, smallmouth bass, white crappie, black crappie, rock bass, green sunfish, pumpkinseed, and bluegill. These eight species are not present throughout the entire state, thus stocking will be limited to protect native species and to prevent their unwanted spread. Smallmouth bass, green sunfish, and pumpkinseed are not permitted for stocking in traditional private ponds.

Many largemouth bass ponds are located throughout Montana, and largemouth bass are considered a game fish in Montana waters. 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. Bluegill often overpopulate in northern latitudes when stocked with largemouth bass due to slow growth of largemouth bass, high survivability of age-0 bluegill, and earlier age of maturation of bluegill. Growth of largemouth bass is slow in Montana ponds and reservoirs because they usually provide limited fisheries and do not reproduce well in because of the short growing season (100-180 days). It is generally recommended to stock largemouth bass without a forage fish in Montana, as the juveniles will act as the forage fish. Sometimes fathead minnows are recommended as a forage base for largemouth bass.

Table 1 - Fish species authorized for stocking in licensed private fish ponds in Montana

Area of Montana		Coldwater Species					Warmwater Species				
		Rainbow Trout	Brook Trout	Brown Trout	Westslope Cutthroat Trout	Yellowstone Cutthroat Trout	Largemouth Bass	Crappie (black and white)	Yellow Perch	Bluegill	Fathead Minnows
Western Montana	Region 1, northwestern Montana	Case-by-case stocking	Case-by-case stocking	Case-by-case stocking	Case-by-case stocking	No stocking permitted	Case-by-case stocking	No stocking permitted	No stocking permitted	No stocking permitted	No stocking permitted
	Region 2, southwest Montana	Case-by-case stocking	Case-by-case stocking	Case-by-case stocking	Case-by-case stocking	No stocking permitted	Case-by-case stocking	No stocking permitted	No stocking permitted	No stocking permitted	No stocking permitted
Central Montana	Region 3, southwest-central Montana	Case-by-case stocking	Case-by-case stocking	Case-by-case stocking	Case-by-case stocking	Case-by-case stocking	No stocking permitted	No stocking permitted	No stocking permitted	No stocking permitted	No stocking permitted
	Region 4, north-central Montana	Case-by-case stocking	Case-by-case stocking	Case-by-case stocking	Case-by-case stocking	No stocking permitted	Case-by-case stocking	Case-by-case stocking	No stocking permitted	No stocking permitted	Case-by-case stocking
Eastern Montana	Region 5, south-central Montana	Case-by-case stocking	Case-by-case stocking	Case-by-case stocking	No stocking permitted	Case-by-case stocking	Case-by-case stocking	Case-by-case stocking	No stocking permitted	No stocking permitted	Case-by-case stocking
	Region 6, northeast Montana	Case-by-case stocking	Case-by-case stocking	Case-by-case stocking	No stocking permitted	Case-by-case stocking	Case-by-case stocking	Case-by-case stocking	Case-by-case stocking	Case-by-case stocking	Case-by-case stocking
	Region 7, southeast Montana	Case-by-case stocking	Case-by-case stocking	Case-by-case stocking	No stocking permitted	Case-by-case stocking	Case-by-case stocking	Case-by-case stocking	Case-by-case stocking	Case-by-case stocking	Case-by-case stocking

In eastern Montana, fathead minnows will reproduce two to three times a year and will not compete with juvenile bass. Depth of the pond is very important in stocking largemouth bass. The pond must be deep enough for the population to survive through the winter. Largemouth bass fingerlings two to three inches long should be planted at about 300 to 400 fish per surface acre. This density 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 usually takes about two or three years after stocking. Harvest before spawning has occurred will result in a declining population. In many areas throughout the state, there is a high likelihood of natural reproduction by largemouth bass, and thus only one stocking may be required. Even in the best conditions, it may take 5-8 years for largemouth bass to reach three pounds. Largemouth bass stocking is allowed on a case-by-case basis in most FWP Regions except Region 3 (Table 1).

Stocking white crappie, black crappie, or bluegill is often discouraged because they sometimes create dense, slow-growing (stunted) populations, or fail to reproduce successfully. Unless fish are harvested frequently from the pond, it is likely that there will be an overpopulation of fish, which will cause low growth rates. Stocking of these species is allowed in some regions on a case-by-case basis (see Table 1).

Perch

A second family of fishes that is found across Montana is the perch family. It includes the native sauger and Iowa darter, as well as the introduced yellow perch and walleye. Walleye and sauger are not permitted for stocking in traditional private ponds because the potential impact to state waters and fisheries resources from an unanticipated release is significant and these species do not generally make a good pond fishery.

Yellow perch are a game fish. They have been illegally introduced throughout much of Montana. Yellow perch are generally able to provide a quality fishery only in larger lakes and reservoirs where factors such as water-level fluctuation, predation, or harvest are sufficient to control numbers and keep the sizes up. Perch tend to overpopulate and “stunt” in smaller ponds and often out compete trout for food, resulting in poor fishing for both species. Perch stocking is allowed on a case-by-case basis in far eastern Montana (see Table 1).

Catfish

There are four representatives of the catfish family in Montana. The stonecat and channel catfish are native to Montana, while black bullhead and yellow bullhead have been introduced. Black bullhead and Yellow bullhead are not permitted for stocking in traditional private ponds in Montana because they typically overpopulate and have stunted growth. They usually provide poor fishing as a result of overpopulation, they are easily spread to other waters, and are often illegally introduced to inappropriate locations.

Channel catfish are a unique and large native game fish in Montana and are the staple of fisheries throughout the southern United States. They also provide some quality sporting opportunities in the rivers and large reservoirs of eastern Montana. They have rarely been stocked by FWP in smaller these environments. There are no legal in-state commercial sources for channel catfish and there are concerns that out-of-state sources could cause genetic contamination of Montana’s native populations. Consequently, channel cats are not permitted for stocking in private ponds in Montana.

Pike

The northern pike is only native to the South Saskatchewan River drainage, which occupies a small portion of the northeastern end of Glacier National Park in Montana. It has been stocked throughout the state and is now widely distributed. The northern pike is a voracious predator that eats mostly other fish. They do not do well in small ponds because they will overpopulate and eat themselves out of a food supply. Illegal introductions of northern pike have impacted fisheries across much of the state. Northern pike are not permitted for stocking in traditional private ponds in Montana.

Minnows and Suckers

Montana currently has 22 species of minnows and 9 species of suckers. Nearly all are native and many are widespread across the state. Introductions of carp (Koi), goldfish, shiners, grass carp, bighead carp, silver carp, and black carp are not permitted in Montana. There are many examples where introduction of white suckers (one of the most common species in Montana) have decimated high quality trout fisheries by overpopulating and out competing trout for food. In a few locations, combinations of largemouth bass and fathead minnows provide quality bass fishing opportunities. Frequently, bait bucket transfers of undesirable species have led to a decline in these largemouth bass-dominated fisheries. Bait-bucket transfers are a great concern with minnow and sucker species. With 31 species of minnows and suckers in Montana and hundreds more outside the state, only a trained ichthyologist can tell whether that bucket full of little minnows will grow into a pond full of carp. Do not gamble on your own or someone else's ability to identify fathead minnows. Do not break the law by stocking them without the proper permits or fishing with them in areas where live minnows are prohibited. With a few exceptions, stocking of minnows and suckers is not allowed in Montana private ponds. Fathead minnows are permitted in some waters of central and eastern Montana on a case-by-case basis (see Table 1).

Coldwater Species

There are 17 members of the trout family (Salmonidae) presently found in Montana waters. Eight or nine of them are native: westslope cutthroat trout, Yellowstone cutthroat trout, redband trout, bull trout, lake trout, Arctic grayling, mountain whitefish, pygmy whitefish and possibly lake whitefish. Rainbow trout, westslope cutthroat trout, Yellowstone cutthroat trout, brook trout, and brown trout are the only species allowed in private ponds (Table 1) and they are commercially available in Montana. Rainbow, brook, and brown trout are non-native and compete directly or hybridize with our native cutthroat trout. Consequently, these species are not allowed for stocking in drainages that contain native trout. Contact the FWP Fish Health Lab (Appendix C, #6) for a list of licensed commercial hatcheries prior to stocking.

Across the mountainous western half of Montana, and in regions of eastern Montana where cold-water springs are found, spectacular fishing can be provided in some very small trout ponds. Proper design and construction of a pond will dictate fishery quality. With its generally cool climate and productive water chemistry, Montana has a legendary trout resource, and fishery managers are constantly working to improve the quality of trout-fishing opportunities. Managers are also vigilant about protecting the native trout resources. For most trout ponds throughout Montana, stocking permits will be drainage specific. Only stock the fish species listed on your Non-Commercial Private Fish Pond License.

Do not introduce suckers, minnows, or warmwater and coolwater game fish described in the preceding section if a quality trout pond is your ultimate goal. The best trout ponds contain only trout, with density and growth rate controlled by stocking. Stocking minnows and other species into

good trout ponds is illegal and usually has a detrimental effect via increased competition for food. In fact, one of the most frequently asked questions of fisheries managers is, "How do I get those out of my pond?" That subject is addressed later in Section V—Pond Management. Here we will discuss legal and intentional trout introductions.

Rainbow Trout

Scientists have concluded that the redband form of rainbow trout, found in the very northwest corner of Montana in the Kootenai drainage, is the only native rainbow trout subspecies. All other rainbow trout strains were introduced into Montana beginning in 1889.

Rainbow trout, like cutthroat trout, are often stocked in ponds because they typically thrive in our climate and usually produce excellent pond fisheries with low risks that are easy to manage. Stocking of rainbow trout is only permitted if the new pond population will not pose a hybridization threat to native cutthroat trout or native redband trout. Rainbow trout survive and grow well in ponds, but spawning rarely occurs unless there is a good quality gravel-bottom inlet stream. Rainbow trout stocking is allowed on a case-by-case basis in all FWP regions (see Table 1). To determine if rainbow trout will be allowed in your private pond, contact your local FWP office.

Rainbow trout stocking densities will vary by location across the state. Stocking rates will also vary dependant on intended harvest rates, predation, species mix, etc. It is usually recommended that pond owners start small and work up. Stocking is often done in spring to give the fish ample time to adapt to the pond. Productive ponds can be stocked in the fall, and this strategy can be attempted to reduce predation by cormorants and other predatory birds. Both spring fingerlings and fall juveniles should reach catchable size (ten inches and larger) the following summer in a reasonably productive pond with good water quality and no competing fish species. You may also choose to plant a combination of fingerlings and catchables. Rainbow trout generally cannot reproduce in a pond environment, so they will need to be restocked periodically. This inability to reproduce can actually be beneficial because it allows a pond owner to regulate fish densities, which in turn affects growth rates and catch rates.

Cutthroat Trout

In a pond situation, the two native subspecies of cutthroat trout will behave very much like rainbow trout. Cutthroat trout may not survive in warm ponds of far eastern Montana because of thermal intolerance. Yellowstone cutthroat trout are native only in the Yellowstone River drainage and have the potential to grow to very large sizes under fertile pond conditions. Westslope cutthroat trout are native to the Missouri River drainage and to rivers and streams west of the Continental Divide in Montana but will not grow as large. Both are exceptionally beautiful fish, easy to catch, and are valued parts of our natural heritage. Fishery managers are taking great care to keep the two subspecies from hybridizing. As a result, Yellowstone cutthroat trout will not be allowed in westslope cutthroat trout range, and vice versa (see Table 1). In-state commercial supplies of certified genetically-pure native westslope and Yellowstone cutthroat trout are limited. Contact the FWP Fish Health Lab (Appendix C, #6) for sources of these unique native fish.

Brook Trout

Brook trout may not be introduced into watersheds where their presence conflicts with existing fisheries management goals. Brook trout, an introduced species from the eastern U.S., were first stocked in Montana in 1889. They are easy and fun to catch and good to eat. Because they do exceedingly well in small, spring-fed streams and ponds, brook trout can quickly overpopulate, and become stunted. Unlike rainbow trout and cutthroat trout, brook trout can usually spawn successfully in a spring source, and sometimes even on a windswept shoreline. Brook trout can hybridize with native bull trout; therefore, brook trout are not permitted for stocking in areas west of the divide in bull trout habitat. Brook trout stocking is allowed in private ponds on a case-by-case basis. Contact your local FWP office to learn if they will be allowed in your pond.

Brown Trout

Brown trout are another 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 and are quite piscivorous (fish eaters). Like the brook trout, they spawn in the fall and require spawning conditions similar to those needed by rainbow trout and cutthroat trout. A major drawback to brown trout is their generally low catchability in ponds and reservoirs. Many of our larger reservoirs have ample supplies of brown trout but they are seldom caught. With their inherent low catchability and tendency to prey on themselves and other trout, they are not generally regarded as a good pond fish. They are also less widely available from Montana commercial hatcheries than rainbow trout for private pond stocking, and they really do not offer any advantages over rainbow trout. Brown trout stocking is allowed in private ponds across the state on a case-by-case basis. Contact your local FWP office to learn if they will allow in your pond.

IV. AQUATIC NUISANCE SPECIES

Aquatic Nuisance Species (ANS) are non-native plants, animals or pathogens that threaten the diversity or abundance of native species, the ecological stability of infested waters, or commercial, agricultural, aquacultural, or recreational activities. In a sense, these are the “weeds” of the aquatic world. After introduction, populations often grow quickly and spread rapidly due to lack of natural controls (*e.g.*, pathogens or predators). Once introduced, ANS are almost impossible to eradicate; therefore, prevention is the key.

Many exotic species are European or Asian and reached the Midwestern U.S. via ballast water in foreign ships that entered the Great Lakes. In Montana, all public and private fish hatcheries are given an annual ANS inspection to help prevent the spread of invasive species via fish stocking. Movement of fish and water from out-of-state fish hatcheries, can be a major pathway for ANS. Therefore, Montana pond owners should carefully consider this risk and should seriously consider stocking only fish obtained from licensed Montana facilities. FWP has the resources and authority to control ANS in public and private hatcheries in Montana, but is unable to exert the same level of control outside our borders. In the short run, this means fewer fish species options, but this may offset the long-term benefit of reduced infestations by ANS.

Pathways of Introduction

ANS are introduced into new areas by a variety of pathways; some of the most common pathways include the movement of aquatic animals and plants attached to fishing equipment, boats, and trailers. Another common pathway is the release of baitfish and aquarium fish into public or private waters. The illegal stocking of ponds has also been known to introduce ANS into new watersheds. Pond builders should make every effort to prevent the introduction of ANS into their new pond.

It is illegal in Montana to move live fish, aquatic invertebrates, or plants from one body of water to another without FWP authorization. It is also unlawful to release any live aquarium fish or bait fish into public or private waters in Montana. In addition, many aquatic species are listed as prohibited for possession, sale, or transport within the state including: snakehead fish, Asian carp (black, silver, bighead, and grass), nutria, bullfrogs, African clawed frogs, rusty crayfish, zebra mussels, and New Zealand mudsnails. (In October 2006, zander, walking catfish and mute swans may also be listed as prohibited.) It is illegal to import and release any wildlife in Montana without FWP authorization. These rules are in place to protect the natural resources of Montana. There are very limited management options available to control or eradicate these invasive species once they are established in an area; therefore, every effort should be taken to prevent their introduction.

Preventing Dispersal

The spread of ANS via non-commercial fish ponds can be prevented by following some guidelines. Do not stock fish without the proper permits (*i.e.*, Non-Commercial Private Fish Pond License and/or Import Permit). Through the Non-Commercial Private Fish Pond License process, fish can only be stocked from approved in-state fish hatcheries that are certified as ANS free and from out-of-state sources with an Import Permit. The Import Permit is designed to prevent fish from being stocked from out-of-state sources that may be contaminated with ANS. Do not transfer water, vegetation, or animals to or from your fish pond. ANS movement can be prevented by cleaning all sediment and vegetation from fishing equipment, excavating equipment, etc. before and after use at the pond. Fishing equipment should be washed and dried prior to use at a pond and when leaving the pond to fish elsewhere. This will help prevent the spread of ANS to and from the pond. Care should be taken in purchasing aquatic vegetation, as you may be purchasing a nonindigenous plant species. Do not relocate aquarium fish into your pond, only stock what is on your permit. For more information, contact the Montana ANS Coordinator (406-444-2448). More information on ANS can be found at FWP web site link: <http://fwp.mt.gov/fishing/fishingmontana/ANS/default.html>.

V. POND MANAGEMENT

Professional design and construction of the pond should allow for minimum maintenance of the pond. Now it is necessary to follow some general principles of fishery management. Although these will vary widely among individual pond sites and owners, the basic principles discussed in this chapter should be useful to pond owners.

Water Management

As you will recall, the first step to take in controlling water quality is to address the problem of sedimentation. After limiting erosion, it will be necessary to monitor the turbidity in the inflow stream and in the pond to "troubleshoot" any problem areas. If any problems should arise, they can be dealt with using approaches 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 help control

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 that 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. Generally, rooted, submerged aquatic plants will only grow in water shallower than ten to twelve feet deep; therefore, maintaining a depth greater than ten feet will minimize rooted aquatic plants. Limiting nutrient sources (*e.g.*, fertilizer, livestock, or waterfowl) in the pond and its watershed will help control vegetation and algal growth in 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. A redeeming quality of the raked out material is its value as a fertilizer in the garden.

Bottom-rooted wetland plants are vigorous competitors periodically requiring human interference. Regularly hand thinning the dominant species by pulling them up from the root, is usually all that is necessary. If the situation gets out of hand, however, measures that are more drastic may be necessary. These measures include opaque plastic sheets laid over problem areas to kill all of the plants, mechanical mowers for cutting down large areas of dense vegetation, lowering the water level to dry out wetland areas, or raising the water level (with appropriate water rights) to increase depth. In any case, dead foliage should be removed from the pond immediately, as decomposing bacteria also consume dissolved oxygen and nutrients released from the decaying plants can further spur plant growth.

Herbicides and algaecides can be used to control aquatic vegetation. Most of these must be applied by a licensed professional, and the Department of Environmental Quality (DEQ) Water Quality Bureau must be notified. Chemicals are expensive, they must be applied frequently, and they can kill fish if used improperly; therefore, their use is not usually recommended. Using chemicals to kill existing plants without flushing nutrients from the pond will usually result in a major algae bloom. For information on their use, contact the Montana Department of Agriculture, Weed Specialist (Appendix C, #2).

Wildlife browsing on newly planted terrestrial nursery stock is another potential problem. The young plants will be regarded as irresistible forage by many animals such as mice, rabbits, deer, and beavers. Fencing can be used to protect new plants. Another 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 wet areas around the pond. 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, 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 (Appendix C, #2). Rapid revegetation with desirable plants will often prevent noxious plants from establishing.

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 stock 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 you allow the pond one growing season to establish a food base and covering foliage prior to stocking fish.

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

The pond food base 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. However, it is usually a mistake to add minnows to a trout pond, as they tend to eat more trout food than they themselves provide. Most pond-trout prefer to feed on insects and crustaceans (scuds) rather than on minnows. A healthy pond ecosystem will provide plenty of natural food for adequate growth without supplemental feeding, if it is not overstocked. Feeding fish is not a desirable practice. Commercial fish foods have a high nutrient content that is quickly passed along into the water. In this manner, fish foods can cause algae blooms or nuisance plant growth.

Controlling Fish Populations

Keeping out undesirable fish species is crucial to long-term pond management. Occasionally, unwelcome strains of fish may invade the pond. Once a species is in the pond, it may be difficult or impossible to remove it. Drawing down the water level by pumping or decreasing inflow will help isolate the invaders, making netting or other means of removal 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 causes more problems. Remember, the fewer fish species the better.

Chemical treatment can be used to eradicate unwanted fish. Depending on the pond construction and location, treatments may not be feasible. Rotenone is a commercially available chemical used to eradicate undesirable fish. It must be applied by a licensed applicator. The use of chemicals is expensive and requires careful planning. Chemical treatment should not be attempted without first contacting the DEQ, Water Quality Protection Bureau, and FWP (Appendix C, #3). Improperly applied chemicals 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 primary predator. Other predators such as birds and mammals (*e.g.*, herons, cormorants, and otters) may prey on the fish in your pond, but they will usually have little or no adverse effect on fishing quality except in shallow ponds, where bird predation can be significant. To maintain a diverse age and size structure, some mature fish should be caught and kept over the course of the summer and fall. If spawning is possible, some adult fish may be left overwinter to spawn in the spring. Think carefully about your goals for the pond fishery to balance stocking and harvest. If you want large fish, you should stock low numbers and harvest lightly to maximize growth potential. If you want good meals, you can plant more fish and harvest them at a smaller, tastier size.

Overview

By following the guidelines in this handbook, you should have the resources to properly plan, design, and manage your new pond for the benefit of either warmwater or coldwater fisheries. Properly developed ponds that are regularly maintained to manage a quality fishery are also valuable and pleasing wildlife areas that will attract numerous birds and animals. If you implement the suggestions and practice the cautions outlined here, you will enjoy your pond for many years.

APPENDIX A TABLE OF PERMITS

NOTE: Most permits except the Montana Water Use Act "Certificate of Water Right" require *approval prior to commencing construction*. The Non-Commercial Private Fish Pond License and the Import Permit are approved after construction of the pond.

Permit or Regulation	Fees	Length of Application Process	Information	Agency
Beneficial Water Use Permit Authorization to Change a Water Right (permit 600 and 606)	\$400	Up to 390 days (Up to 180 days for initial review, 30 days public notice and 180 days to resolve objections)	Any person intending to acquire new or additional water rights, or change existing water rights. Applies to all surface water and ground water greater than 35 gallons per minute and 10 acre-feet per year.	DNRC Water Rights Bureau
Certificate of Water Right (permit 602)	\$50	File within 60 days of water being put to use	Ground water appropriation of 35 gallons per minute or less, but not exceeding 10-acre feet per year.	DNRC Water Rights Bureau
310 Permit	No Fee	30-60 days	Any activity that will modify the bed or banks of a perennial stream.	Local Conservation District Office
318 Permit	\$150	30-60 days	Any work (e.g., construction) which may cause short-term violation of water quality standards (i.e., turbidity, total dissolved solids or temperature)	DEQ
401 Water quality Certification	Fees Vary	60-90 days	Any activity that might discharge into State or Tribal waters including wetlands	DEQ
Floodplain Permit	Fees vary	Up to 60 days	Any construction proposed within a designated 100-year floodplain (check with DNRC Water Resources Division to find out floodplain designation of pond location)	MT Association of Counties to find local Floodplain Office
404 permit	Fees vary	30 -120 days	Any activities that will result in the excavation, discharge, placement of dredged or fill material into lakes, ponds, rivers, streams, and wetlands.	U.S. Army Corps of Engineers
Non-Commercial Private Fish Pond License	\$10	6-8 weeks	Private fish pond that does not sell fish or eggs	FWP
Import Permit	No Fee	10 days	All importations of live fish or fish eggs for introduction into private ponds must be accompanied by a permit.	FWP

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 FWP. (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; 87-3-111; 87-5-701 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 87-5-701 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 12.7.502-507).
4. An Import Permit is required to import non-salmonid fish or eggs into Montana. (MCA 87-3-210)
5. 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 or a private fish pond may apply to the director for a fish pond license. The holder of a private fish pond license may stock the fish pond with fish procured from a lawful source. The department may designate the species of fish that may be released in the pond and otherwise condition the license if there is a possibility of fish escaping from 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, the license holder shall furnish a corporate surety bond to the state for \$500, conditioned to the effect that the license holder will not sell fish or spawn from any of the public waters of this state or violate the conditions of the license and also conditioned to the effect that the license holder will submit an annual report on transactions to the director.
(2) (a) "Artificial lake or pond" or "private fish pond", as used in this section, means a body of water that is:
 - (i) created by artificial means or by a diversion of water that does not exceed 500 acres in surface area; or
 - (ii) an instream pond that does not exceed 500 acres with a tributary spring or stream that does not support game fish or fish species of special concern; and
 - (iii) not determined by the department to pose an unacceptable risk to game fish or fish species of special concern in adjacent waters.
(b) The term does not include all other natural ponds or bodies of water, including streams or rivers and impoundments or reservoirs of or on a natural stream, river, lake, or pond.

(3) An applicant for licensing of an instream private fish pond shall present to the department verification that game fish or fish species of special concern do not occur in the tributary, spring, or stream and that the instream private fish pond does not pose an unacceptable risk to game fish or fish species of special concern in adjacent waters.

Verification must be in the form of:

- (a) a formal report from a department-approved professional fisheries consultant; or
- (b) other reliable data and documentation.

(4) 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.

(5) (a) A 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 purchases;
- (iii) names of purchasers or sellers; and
- (iv) locations to or from which fish or eggs are transferred.

(b) On or before January 31 of each year, a 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 (5)(a).

(6) A person who owns or controls an artificial lake or pond may request an inspection by the department to ascertain the presence of disease in fish or the illegal introduction of fish species. Whenever the department has reasonable cause to believe that a fish species in the body of water may have been illegally introduced or may have a disease that may affect fish in another body of water, the department shall notify the landowner or landowner's agent by mail or in person of the intention to enter upon the land and shall enter only after notice has been given to the landowner or agent or after every reasonable effort has been made to notify the landowner and receive permission to enter upon the land. Thereafter, the department may enter upon land under the provisions of this subsection for the purposes of inspecting the pond or the body of water, the species of fish in the pond or the body of water, the presence of disease in a fish species, the construction of any impoundment, dam, or fish barrier, and the physical connection of an artificial lake or pond to an adjacent natural lake, pond, or body of water, including a stream or river. The department is responsible for actual damages to any property.

(7) If the department finds an illegal introduction of fish or the presence of disease in fish in a licensed fish pond, an artificial lake or pond, or a natural lake, pond, or body of water, the department shall consult with the landowner or the landowner's agent to determine the appropriate action unless an emergency exists. In an emergency situation, the department may order or take appropriate action to address any threat to the state's fisheries resources, including quarantine or destruction of fish, eggs, or the source of a disease. Whenever privately owned fish are destroyed and the private owner is not responsible for an illegal introduction or the introduction of fish with a disease, the department may replace the destroyed fish without charge to the private owner. A landowner or agent who has granted permission for the department to enter is not considered responsible for an illegal introduction of fish or disease unless proved otherwise.

The following is a summary of pertinent laws and regulations administered by agencies other than FWP. Information that is more detailed can be obtained using addresses and telephone numbers listed in Appendix C.

1. Fish Toxicants. Rotenone based fish toxicants are a restricted use product and may only be used by a certified applicator or a certified farm applicator. In addition, the product must be one that is registered for this use with the Department of Agriculture. The Department of Agriculture expects to have a manual regarding the use of fish toxicants completed by January 2006. A 308 permit through the DEQ may be needed prior to applying fish toxicant if the pond discharges into state waters.
2. Herbicides. Most aquatic herbicides (weed killers) are classified as restricted-use pesticides that may be applied only by applicators specifically licensed by the Department of Agriculture to use them. Please contact Department of Agriculture for a list of approved pesticides and licensed applicators.
3. 318 Permit. Authorization must be obtained from the DEQ before undertaking any activity that will violate Montana surface water or ground water quality standards. Authorization for a temporary increase in turbidity (318 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.
4. 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 DNRC for a hazard classification.
5. 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.
6. 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 Trust Land Management Division, DNRC before undertaking any activity that will disturb the streambed.
7. 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.
8. 401 Water Quality Certification. Projects that might discharge into State or Tribal waters, including wetlands must obtain a 401-water quality certification from the Montana DEQ.
9. 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 DNRC. The exception is groundwater appropriation of 35 gallons per minute or less, not to exceed 10-acre feet per year.

APPENDIX C DIRECTORY OF AGENCIES

1. **Department of Natural Resources and Conservation**

Water Resources Division Regional Offices (<http://dnrc.mt.gov/wrd/default.asp>).

For information on water rights and dam safety requirements contact:

Billings Regional Office

Airport Industrial Park
1371 Rintop Drive
Billings, MT 59105-1978
(406) 247-4415

Counties served: Big Horn, Carbon, Carter, Custer, Fallon, Powder River, Prairie, Rosebud, Stillwater, Sweet Grass, Treasure, and Yellowstone

Bozeman Regional Office

2273 Boot Hill Court, Suite 110
Bozeman, MT 59715
(406) 586-3136

Counties served: Gallatin, Madison, and Park

Glasgow Regional Office

P.O. Box 1269
222 6th Street South
Glasgow, MT 59230
(406) 228-2561

Counties served: Daniels, Dawson, Garfield, McCone, Phillips, Richland, Roosevelt, Sheridan, Valley, and Wibaux

Havre Regional Office

P.O. Box 1828
210 6th Avenue
Havre, MT 59501
(406) 265-5516

Counties served: Blaine, Chouteau, Glacier, Hill, Liberty, Pondera, Teton, and Toole

Helena Regional Office

1424 9th Avenue
PO BOX 201601
Helena, MT 59620
(406) 444-6999

Counties served: Beaverhead, Broadwater, Deer Lodge, Jefferson, Lewis & Clark, Powell, and Silver Bow

Kalispell Regional Office

109 Cooperative Way, Suite 110
Kalispell, MT 59901
(406) 752-2288

Counties served: Flathead, Lake, Lincoln, and Sanders

Lewistown Regional Office

613 NE Main Street, Suite E
Lewistown, MT 59457
(406) 538-7459

Counties served: Cascade, Fergus, Golden Valley, Judith Basin, Meagher, Musselshell, Petroleum, and Wheatland

Missoula Regional Office

P.O. Box 5004 (zip 59806)
1610 South 3rd Street West, Suite 103
Missoula, MT 59801
(406) 721-4284

Counties served: Granite, Mineral, Missoula, and Ravalli

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

Trust Land Management Division
Montana Department of Natural Resources and Conservation
1625 11th Avenue
Helena, MT 59620
(406) 444-2074
<http://www.dnrc.mt.gov/trust/REMB/Default.asp#leasing>

2. Montana Department of Agriculture

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

Technical Services Bureau
Montana Department of Agriculture
Sixth and Roberts Street
Helena, MT 59620
(406) 444-5400

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

Weed Specialist
Montana Department of Agriculture
PO Box 200201
Helena, MT 59620-0201
(406) 444-7819
<http://www.agr.mt.gov/weedpest/aquatics.asp>

3. Montana Department of Environmental Quality

For information on whether a 308 permit is needed prior to applying a fish toxicant contact:

Water Protection Bureau
Permitting and Compliance Division
Montana Department of Environmental Quality
1520 E. Sixth Avenue
Helena, MT 59620
(406) 444-2783
<http://deq.mt.gov/wqinfo/OtherCert/308Authorization.asp>
<http://www.agr.mt.gov/weedpest/pdf/308Permit.pdf>

For information on Montana's surface or ground water quality standards, 318 permit, and 401 Water Quality Certification contact:

Water Protection Bureau
Montana Department of Environmental Quality
1520 E. Sixth Avenue
PO BOX 200901
Helena, MT 59620
(406) 444-4626
<http://www.deq.mt.gov/pcd/wpb/index.asp>

4. County Conservation Districts

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 a list of local offices contact:

Montana Association of Conservation Districts
501 N. Sanders
Helena, MT 59601
406-443-5711
<http://www.macdnet.org/conservationdistrictdirectorycontact.htm>

5. United States Army Corps of Engineers

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
10 West 15th Street, Suite 2200
Helena, MT 59626
(406) 441-1375
<http://www.nwo.usace.army.mil/html/od-rmt/mthome.htm>

6. Montana Fish, Wildlife & Parks.

For a current list of licensed, commercial, aquaculture facilities, and information on importation of live fish contact:

FWP Fish Health Lab
4801 Giant Springs Rd.
Great Falls, MT 59405
(406) 452-6181

7. For a Non-Commercial Private Fish Pond License

(<http://fwp.mt.gov/fishing/regulations/ponds.html>), additional information on laws and rules, or information on fish management (<http://fwp.mt.gov/fishing/default.html>), contact any of the following FWP offices:

State Headquarters

1420 East Sixth Ave.
PO Box 200701
Helena, MT 59620-0701
(406) 444-2449

Region 4 - Great Falls

4600 Giant Springs Rd.
Great Falls, MT 59405
(406) 454-5840

Region 1 - Kalispell

490 North Meridian Rd.
Kalispell, MT 59901
(406) 752-5501

Lewistown Area Office

2358 Airport Rd.
Lewistown, MT 59457
(406) 538-4658

Region 2 - Missoula

3201 Spurgin Rd.
Missoula, MT 59804
(406) 542-5500

Region 5 - Billings

2300 Lake Elmo Dr.
Billings, MT 59105
(406) 247-2940

Region 3 - Bozeman

1400 South 19th St.
Bozeman, MT 59718
(406) 994-4042

Region 6 - Glasgow

Rural Route 1-4210
Glasgow, MT 59230
(406) 228-3700

Butte Area Office

1820 Meadowlark Lane
Butte, MT 59701
(406) 494-1953

Havre Area Office

2165 Highway 2 East
Havre, MT 59501
(406) 265-6177

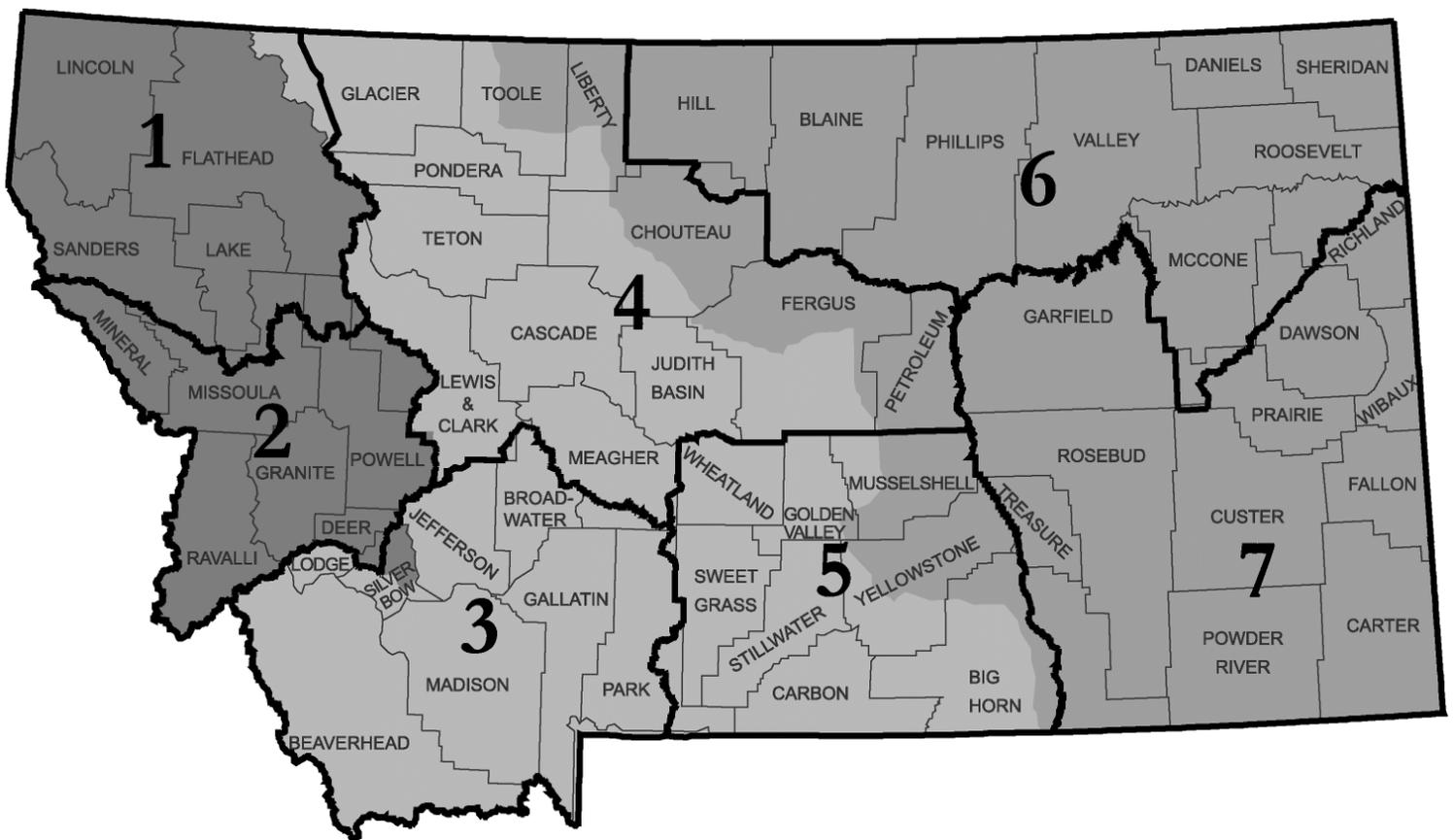
Helena Area Office

930 Custer Avenue West
Helena, MT 59620
(406) 495-3260

Region 7 - Miles City

P.O. Box 1630
Miles City, MT 59301
(406) 232-0900

APPENDIX D MONTANA FISH, WILDLIFE & PARKS REGIONAL MAP



The map above shows each of the seven Montana Fish, Wildlife & Parks Regions (Regions 1 through 7) and the three Fishing Districts:

Western District = Dark Gray, Regions 1 & 2

Central District = Light Gray, Regions 3 and most of 4 & 5

Eastern District = Medium Gray, Regions 6 & 7 and some of 4 & 5.

APPENDIX E SUGGESTED READING

Brown, C.J.D. and N. Thoreson. "Ranch Fish Ponds in Montana: their construction and management," 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.

Holton, G. D., and H. E. Johnson. "A Field Guide to Montana Fishes." Montana Fish Wildlife and Parks, Helena, Montana, 2003, 94 pages. Information on identification, habitat, and origin of Montana fishes.

LeBeau, Michelle. "A Guidebook for Montana Ponds" Montana Watercourse, Bozeman, 2005; web page: www.mtwatercourse.org. Evaluates ponds and alternatives; contacts and references for technical details.

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. Includes information on planning the pond and trout stocking and management.

Montana Association of Conservation Districts. "A Guide to Stream Permitting in Montana," MACD, Helena, 2005. A complete reference to pertinent permits. Web page: <http://www.dnrc.mt.gov/cardd/strmpmt/stream.htm>

Montana Department of Natural Resources and Conservation, Legislative Environmental Quality Council, Montana University System Water Center. "Water Rights in Montana," DNRC, Helena, 2005, 51 pages. Background, current policy, description of process and explanation of terms.

Montana Department of Natural Resources and Conservation, Water Resources Division, Dam Safety Program. "Small Earthen Dam Construction", DNRC, Helena, 2005. A guidebook for planning and construction of small earthen dam embankments.

Montana Fish, Wildlife & Parks. "The Montana Lake Book," Montana Fish, Wildlife & Parks, Helena; web page <http://fwp.state.mt.us/insidefwp/lakebook/lakebook.asp> Sections on watersheds, vegetation, water quality and protection, landscaping, aquatic nutrients, local and national sources.

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

Soil Conservation Service. "Ponds -- Planning, Design, Construction," U.S. Dept. of Agriculture, Ag. Handbook Number 590, Washington, 1997, 85 pages. Deals primarily with the design of ponds.