



See You Out There

# NEBRASKA POND GUIDE



Private Waters  
Program



Management Assistance for  
Lakes, Ponds, Pits & Streams

## CONSTRUCTION

There is more to developing a good fishing pond than just pushing up some dirt and stocking fish. If a pond is well designed and has proper stocking and management, it will produce a quality fishery, benefit terrestrial wildlife, and be relatively maintenance free.

There are two types of ponds: embankment and excavated. An embankment pond is made by building a dam that typically impounds flowing water. An excavated pond (dugout) is created by digging a pit in a relatively flat, periodically wet area, or near a stream/river, and is normally sustained by groundwater and/or springs. Monitor water depths during excavation of a dugout to ensure sufficient depths for fish when completed.

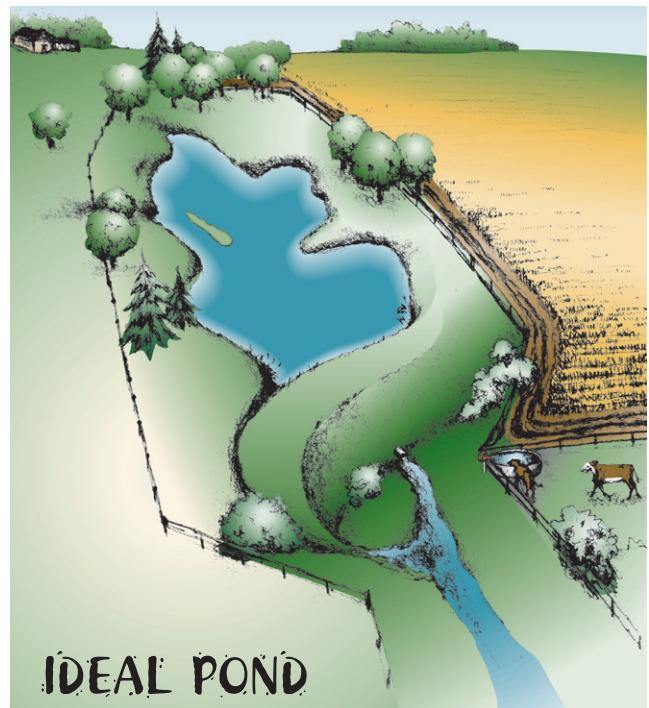
## SITE SELECTION

The site you choose can impact the success or failure of a pond as well as construction and maintenance costs. Also, a conveniently located, well planned pond will be used more and is easier to maintain.

An important aspect of site selection is the size of the **watershed** (drainage area) which includes the immediate pond site and all land that drains into it. The minimum watershed area needed for each acre-foot of water in a pond is called the watershed ratio. The ideal ratio varies from 20:1 in southeastern Nebraska to in excess of 50:1 in the Panhandle. This means a 1-acre pond containing 5 acre-feet of water built in the southeast needs a 100-acre watershed to maintain water levels, while a similar pond in the west would need a 250-acre watershed. The exact ratio for a specific location depends on annual precipitation, soil type, vegetation type and coverage, pond uses, slope of the watershed, and the runoff curve number (derived from the total annual yield of surface water

runoff). Personnel from the local U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS) can help determine the ratio for a site.

Ponds with very large watersheds, or very high ratios for their part of the state, typically require larger dams and extensive spillway structures and therefore cost more to build. They may also be unable to produce the quality of fishing desired. Major storm runoff events may cause flooding, erosion in the pond or spillway area, and bring in heavy sediment loads that fill in the pond and muddy the water. High levels of turbidity (muddiness of the water) negatively affect fish, their food organisms, and aquatic plants. Even runoff from normal rainfall can slow fish growth by causing temporary food shortages if most of the food items, particularly microscopic plants and animals, are flushed out. See **PG13-8** for



IDEAL POND



See You Out There

# NEBRASKA POND GUIDE



Private Waters  
Program



additional information on effects of muddy water and ways to resolve turbidity problems.

Fish movement is another problem associated with major runoff events. Fish may either exit the pond during high water or enter it from the watershed or downstream areas. Installation of an overflow drop structure in the dam will prevent most fish movement into the pond from downstream. Any undesirable fish in the pond's watershed should be removed, when feasible, prior to construction completion, or they may hamper fishery management efforts. See **PG13-5** regarding removal or control of unwanted fish species.

It is also difficult to maintain desirable fish populations in ponds with small watersheds. Water levels may recede so low during prolonged hot and dry periods that all aquatic life could be at risk. Terraces can be used to divert more water to ponds with small watersheds.

Another important aspect of site selection is immediate **topography** (land elevations and slopes). Earth moving costs can be reduced by selecting a site that requires the smallest dam to impound the largest amount of water and has an adequate volume of soil for dam construction nearby. An ideal site would be a natural draw, or low area with a moderate slope, that narrows at the site, resulting in a pond having adequate amounts of deep and shallow water. Avoid steep-sided sites because they will not contain sufficient shallow water for fish spawning/nursery areas and may slump during the filling process. Avoid sites having extensive flat areas that may result in high evaporation rates and excessive aquatic vegetation growth.

Determine the water holding capacity of the **soils** present at the site prior to construction; otherwise, the pond may not hold water. Since soils can vary at surface and subsurface levels, site core samples must be collected to depths deeper than the expected excavation depth. NRCS personnel should be contacted about soil suitability and testing.

The best soils for a pond site are those that allow water to penetrate very slowly, such as clay, silty clay, loams, and sandy clay/loams. When particles in these soils are compacted and moistened, they swell and seal the bottom. Clay may have to be imported from a nearby source if the site doesn't contain enough to build a reliable dam. Avoid soils containing primarily very porous components (sand or gravel) or bedded materials (shale or limestone) because they can allow impounded water to flow under or around the dam. Keep in mind some clay soils suspend easily in water and do not readily settle out, causing the water to remain turbid. Soil suitability can also be determined by checking nearby ponds for clarity and seepage problems.

**Land use** in the watershed is another consideration for site selection. The quality of the fish community in a pond is a reflection of the quality of the watershed. Vegetative cover greatly influences the quality, quantity, and flow of water that enters a pond. Undisturbed grassland would be the best land cover. The thick vegetation has minor erosion problems; it slows runoff and acts like a sponge to soak up rainfall and then gradually releases clear, filtered water to the pond. Various species of wildlife would immediately use a pond if it is located near established wildlife cover.

Land with row crops or construction sites can have major erosion and sedimentation problems that can fill in a pond in just a few years. Sediment-laden runoff from row crops may contain chemicals and nutrients that can result in fish kills, reduced fish numbers and/or growth rates, and excessive aquatic vegetation.

If a pond's watershed must include cultivated land and/or construction sites, the amount should be as small as possible. Check dams, terraces, minimum or no-till farming, strip-cropping, and vegetated buffer strips of at least 100 feet wide should be established before a pond is built. They will slow runoff which allows sediment to settle out before



See You Out There

# NEBRASKA POND GUIDE



Private Waters  
Program



it enters a pond, thus prolonging the life of the pond while maintaining good water clarity. Perhaps terraces can be used to divert excess water away from a pond. Consult NRCS and Commission Wildlife Division personnel about the various buffer programs that are available. Most of the programs provide cost-share and some even payments to establish and maintain buffers.

It is also necessary to determine whether there are potential **pollution sources** in the watershed that need to be addressed prior to pond construction. Runoff from high nutrient sources, such as a barnyard or feedlot, domestic sewage, or heavily grazed or fertilized pastures, will promote excessive growth of aquatic vegetation. Contain contaminated runoff with a check dam or divert it around the pond, if legal. Cattle should be excluded from the pond and dam to prevent shoreline erosion and their excrement from contaminating/enriching the water (see page 15 for additional livestock information). Contact the Nebraska Department of Environmental Quality (NDEQ) regarding barnyard or feedlot runoff and domestic sewage concerns. Use caution when applying insecticides, misuse could result in a fish kill or fish health problems.

## WATER SOURCES

A pond's water supply should be adequate to replenish losses due to evaporation and leakage, but not excessive to prevent erosion and flooding problems. Constructing a pond on a perennial (always flowing) stream should usually be avoided, particularly in eastern Nebraska, because large watersheds have numerous potential problems, as mentioned earlier, especially those containing mostly cultivated land. Perhaps a portion of a stream's flow can be diverted into a pond constructed off-channel, with steps taken to keep out sediment and unwanted fish. When dugouts are built near a stream or river to utilize groundwater, the excavated soil can then be used to make a berm around the dugout if the

area is prone to flooding, provided the berm will not affect the function of the flood plain. A pond may have to be constructed on a small or intermittent (not always flowing) stream in drier parts of the state in order to obtain sufficient water to fill and maintain it. NRCS personnel can help determine site feasibility, what size of pond can be built, and what permits would be needed.

Ponds shouldn't be constructed on most cold-water streams, especially if a naturally-reproducing trout population is present or the stream needs to be an open system to facilitate trout movement. Contact a local Commission fisheries biologist for advice.

Springs can be considered if flows are sufficient to compensate for seepage and evaporation rates. Determine a flow estimate by measuring flow volumes several times during the year.

Wells (irrigation or domestic) may be used if it is economically feasible. Pumped water should be piped to the pond to eliminate erosion problems. Most wells need to be registered with the Nebraska Department of Natural Resources (DNR) and permits may be required by the local Natural Resources District (NRD).

Ponds filled by springs, wells, or small, coldwater streams may be considered for trout provided water temperatures stay below 70 degrees year-round. Such ponds may have water so cool that growth rates for largemouth bass, bluegill, and channel catfish are considerably less than statewide averages, but still too warm for trout. However, quality-sized largemouth bass, bluegill, and channel catfish can be produced – it will just take a little longer. These types of ponds typically have good water clarity, stable water temperatures, and excessive growth of aquatic vegetation if they are shallow.

## POND SIZE

An ideal fishing pond would cover 1 to 5 surface acres. Even though larger ponds would provide fishing





See You Out There

# NEBRASKA POND GUIDE



Private Waters  
Program



for more anglers, they can be more difficult and expensive to manage if problems occur. While fish populations can be managed in properly constructed ponds of any size, smaller ponds, especially those less than one-half surface acre, may have the following disadvantages:

- more susceptible to water level fluctuations; may even dry up in droughts
- typically shallower, more likely to have excessive aquatic vegetation growth
- more susceptible to summer and winter fish kills
- easier to overharvest fish, will likely need harvest restrictions, especially on bass, or even catch-and-release-only
- ponds less than one-half surface acre are not eligible for fish for initial stocking from the Commission.

## POND DEPTH, CAPACITY, and SLOPES

Deep and shallow water areas are needed to benefit fish and fishing. Advantages of deep water include:

- protects fish from winterkill
- discourages excessive growth of aquatic vegetation
- helps withstand water losses due to evaporation and leakage
- reduces negative effects of sedimentation.

Some shallow water is necessary for fish spawning and nursery areas, and to produce fish food, especially aquatic insects. However, excessive amounts of shallow water mean less water volume, resulting in the following disadvantages:

- water warms faster and holds less oxygen
- reduces the total pounds of fish a pond can support
- increases the likelihood of aquatic vegetation becoming overly abundant.

If a major vegetation die-off occurs in an excessively shallow pond, the subsequent decomposition can

reduce oxygen levels and cause a fish kill. See **PG13-9** regarding aquatic vegetation and **PG13-10** regarding fish kills.

As a general rule, 25% of the pond should be at least 10 feet deep in southeastern Nebraska and at least 12 feet deep in western and northern Nebraska; no more than 25% should contain water less than 4 feet deep; and about 50% should be at least 8 feet deep to prevent excessive growth of aquatic vegetation, especially in ponds with good water clarity.

Estimate pond capacity to be sure that enough water will be stored. Determine where the dam and normal pond-full water elevation will be and compute surface area in acres. Multiply the surface area by 0.4 times the maximum water depth in feet measured at the dam. For example: a pond with a surface area of 2.3 acres and a depth of 12 feet at the dam has an approximate capacity of 11 acre-feet ( $2.3 \times 0.4 \times 12 = 11$  acre-feet of water) (1 acre-foot = 325,851 gallons). NRCS personnel can help determine surface area and capacity of a pond. Also see the examples of surface area and volume calculations at the end of this guide.

Having deeper water doesn't necessarily mean more fish can be produced, especially if the pond is turbid. Fish production is based primarily on the abundance of tiny food organisms (microscopic plants and animals) occurring in the upper 3 to 5 feet of water. Also, fish may not be able to utilize water deeper than 15 feet during the summer months because low oxygen levels are usually present.

The slope from shoreline to a water depth of 4 or 5 feet should be no flatter than a 1 foot drop for every 3 horizontal feet. The slope should then taper to at least 8 feet in depth for two-thirds of the distance from the dam to the upper reaches of the pond. Although grading may have to be done to attain the 3:1 slope, it will likely be cheaper than future aquatic vegetation control costs. Slopes greater than 2:1 should be avoided because of safety



See You Out There

# NEBRASKA POND GUIDE



Private Waters  
Program



concerns and the likelihood of the shoreline slumping into the pond.

## SITE PREPARATION

All trees, brush, ground vegetation, roots, and stumps must be removed from the dam site; otherwise, the decay of organic materials will create passages that will allow water to seep through the dam. Large rocks also have to be removed because they will prevent proper compaction of the soil, which could also result in seepage. All trees, brush, and organically enriched topsoil removed should be stockpiled nearby and reused later.

Trees and brush should also be removed from areas that are planned for swimming and wading. Small ponds will likely need all organic materials removed, since most of the dam's fill material will likely have to come from the basin. Catfish-only ponds should also be devoid of all debris and the bottom left smooth to reduce spawning sites and lessen the likelihood of an overpopulation of small catfish.

However, trees and brush in non-excavated areas should be left intact, especially in larger ponds, where they will provide fish habitat and become substrate on which aquatic organisms can grow. Existing cover in draws and waterways leading into the pond site should also be left undisturbed to minimize impacts to wildlife, help enhance water clarity, and lessen shoreline erosion and sediment problems as the pond fills.

## DAM CONSTRUCTION

The material in the dam needs to be tied to the soil in the foundation. A cutoff or core trench should be cut lengthwise, along the dam's centerline, and deep enough so that all soil, sand, gravel, and loose rock are removed until either solid rock or clay (Page 6) is exposed. The trench should extend a minimum of 3 feet into impervious subsoil or be anchored into solid rock the length of the dam

and into the valley walls at each end of the dam. The trench should have a minimum base width of 8 feet and backfilled with clay, compacted in layers, to the top of the dam, thus creating a clay wall within the dam. Failure to install a core trench and wall can result in seepage through or even loss of a dam.

The actual dam should be constructed of impervious moist material that is compacted in continuous horizontal layers. A sheepsfoot roller or an earth-mover with rubber tires should be used to compact the material. Dams pushed up with a bulldozer and not compacted properly or not containing a clay core trench have a greater chance of failing.

The recommended dam top width is 12 feet for a dam less than 20 feet high. Width should be increased an extra 2 feet for each additional 5 feet increase of dam height. The actual dam height depends on pond size, along with the size, slope, and usage of the watershed. All dams should have at least 3 feet of extra height (freeboard), to prevent flood waters and waves from overtopping them.

The dam should be constructed with slopes that will not slump or slide. The steepness of the slope should not exceed 3:1 on the pond side of the dam and 2.5:1 on the downstream side.

Muskrats and beavers sometimes burrow into a dam which can cause it to erode or fail. Damage done by burrowers can be lessened by having adequate dam freeboard and width, or by constructing banks nearby that have steeper slopes than the dam since steeper slopes are preferred, especially by muskrats. Burrowing can also be deterred by lining the dam face with rock 2 feet above and 3 feet below the water surface. See **PG13-13** for additional information on beavers and muskrats.

## POND BOTTOM DESIGN

The least desirable design for a bass-bluegill-catfish pond is a bowl-shaped bottom with no irregular features. Bottom features can be made

# NEBRASKA POND GUIDE

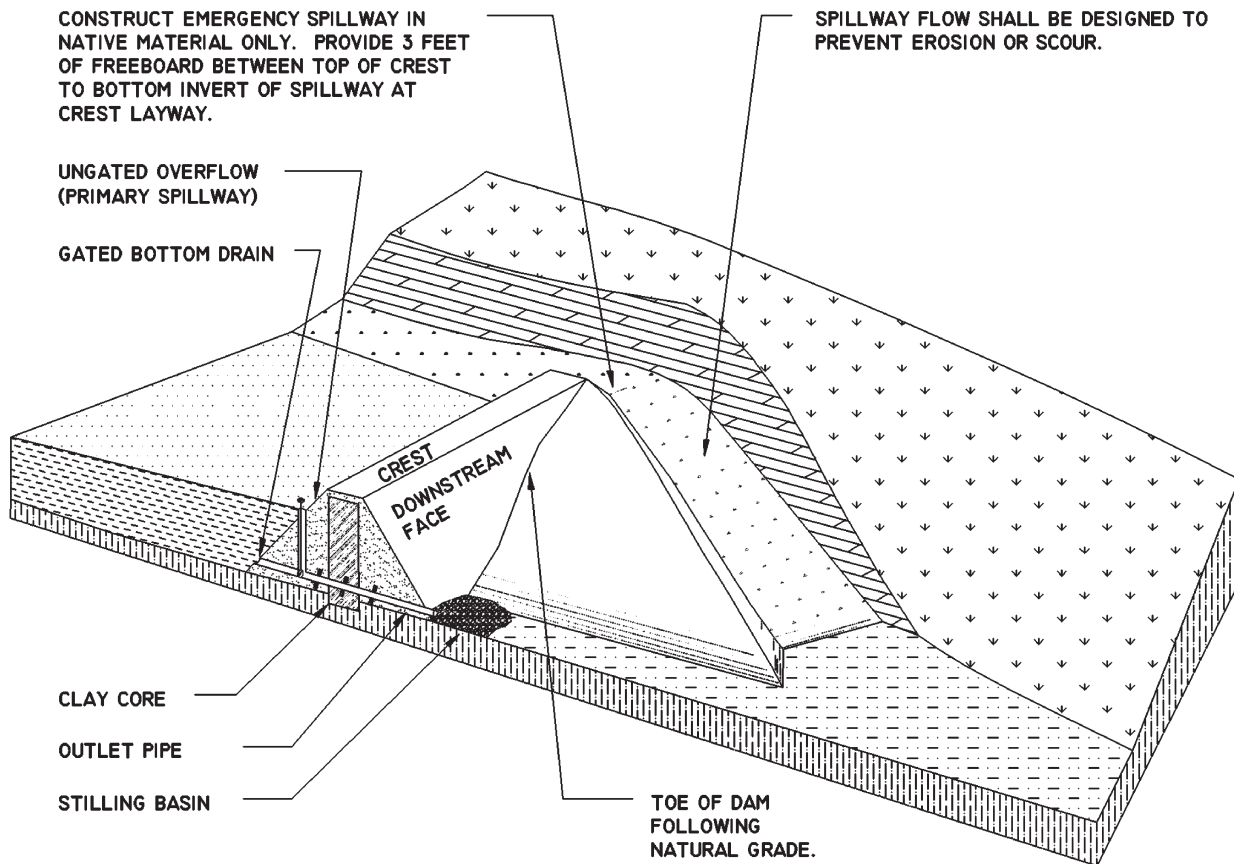


GOOD POND CONSTRUCTION REQUIRES PROPER SITE SELECTION, SOILS TESTING, POND DESIGN, PERMITTING, AND CONSTRUCTION MANAGEMENT. OWNER SHOULD CONSULT WITH A PROFESSIONAL ENGINEER WHEN CONSTRUCTING A DAM.

THESE DRAWINGS ONLY SHOW CONCEPTS. ACTUAL DESIGN MUST CONSIDER SUCH ITEMS AS RUNOFF EVENTS, GEOLOGY, POND CAPACITY, OUTLET CONTROL, SPILLWAY REQUIREMENT, DRAINAGE, ETC. THERE ARE SEVERAL TYPES OF VALVE AND GATE DRAIN STRUCTURE CONFIGURATIONS. CONSULT WITH AN ENGINEER TO DETERMINE THE TYPE OF DRAIN STRUCTURE NEEDED.

OUTLET DRAIN STRUCTURE MAY NOT BE NEEDED FOR THE FOLLOWING:

- WHEN THE POND IS MAINTAINED AT A CONSTANT WATER LEVEL.
- THE POND IS SHALLOW ENOUGH TO USE A SIPHON OR PUMP TO EMPTY.
- THERE ARE NO DOWNSTREAM HAZARDS THAT COULD REQUIRE EMERGENCY DRAWDOWN OF THE SYSTEM.



## COMPONENTS OF A SMALL DAM

NOT TO SCALE



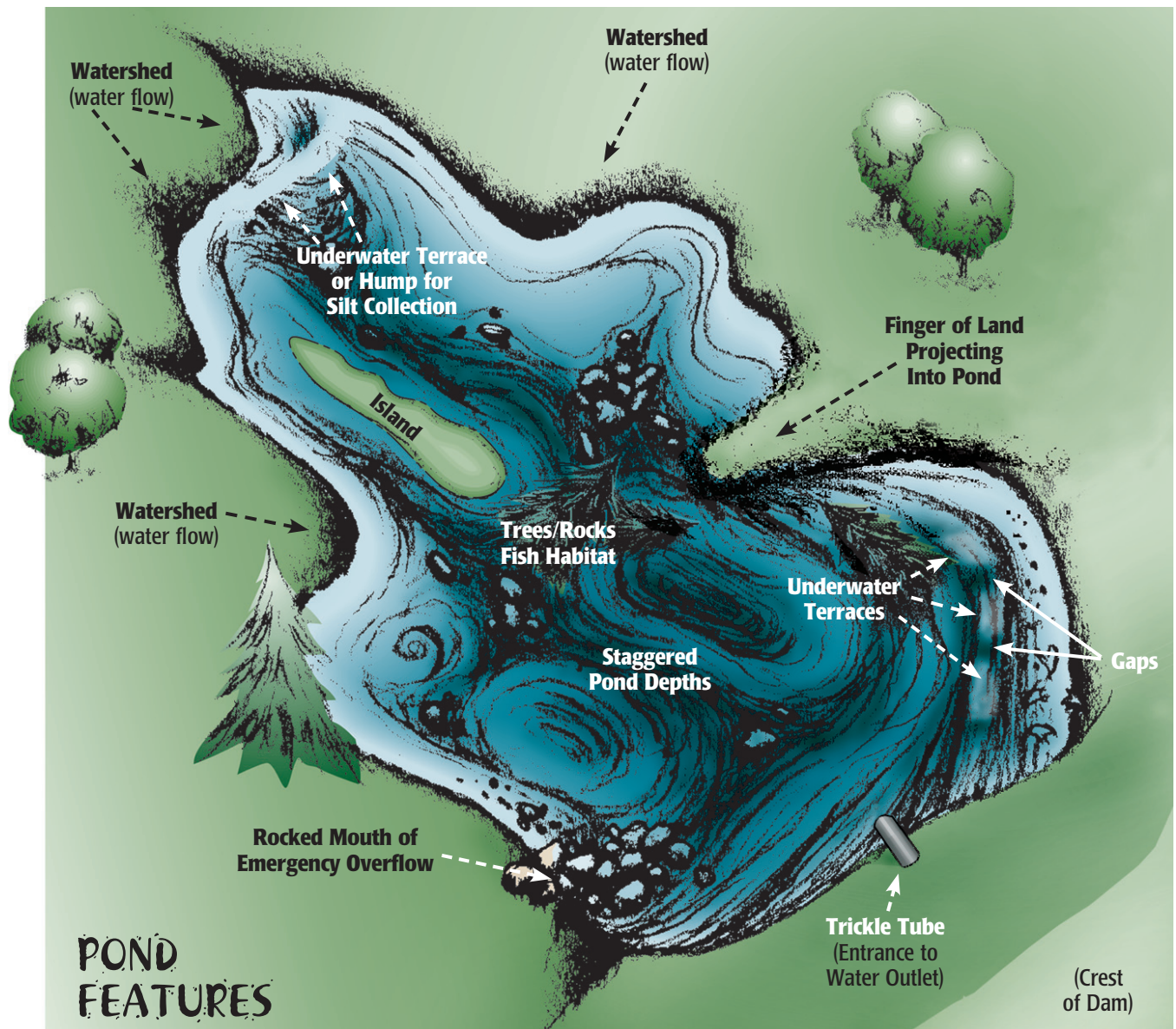
# NEBRASKA POND GUIDE



that will benefit fish production as well as angling opportunities, provided basin core samples indicate soil is suitable; otherwise, further excavation could result in the pond leaking.

Basin fish habitat can be diversified by building trenches and drop-offs (see below). Although deeper water near the shore will benefit fish and shoreline anglers, it should be avoided in wading and swimming

areas. Underwater terraces and humps should also be built, particularly in the upper reaches of the pond. They will provide additional structure and slow incoming water, allowing sediment to settle out in the upper reaches of the pond. They should be considered when it isn't feasible to install sediment/nutrient entrapment structures above the pond. Underwater terraces can also be built on the main





See You Out There

# NEBRASKA POND GUIDE



Private Waters  
Program



parts of the pond, especially near areas that will likely have shoreline erosion. These terraces will eventually become vegetated and create “calmer” water between the vegetative breakwater and the shoreline. These terraces should be periodically notched to create a diversity of depth habitat which will also facilitate fish movement.

Additional shoreline access and fish habitat can be created by using excess fill to build fingers of land that extend into the pond, or small islands. Make sure adequate depth is present adjacent to these structures to prevent excessive growth of aquatic vegetation.

## WATER CONTROL STRUCTURES

Ideally, the pond owner should have complete control of the water entering and exiting the pond, thus preventing/controlling many potential problems. Also, most waterfowl management efforts require some degree of water level manipulation along with a flooded food source. See **PG13-07** regarding waterfowl production.

When feasible, an inflow (inlet) control structure can be used to prevent entry of waters containing pollutants, sediments, or undesirable fish. The inlet structure can be screened and/or closed as needed with the undesirable water diverted around the pond.

Outlet structures are very beneficial. They can be used to: drain the pond to make repairs, manage fish populations, control nuisance plants, and encourage desirable aquatic plants. Installing only an earthen overflow spillway prevents water control and can result in erosion and dam failure if it isn't properly designed and maintained. Water levels can also be manipulated by pumping or siphoning, but this can be time consuming and expensive.

One type of outlet structure is a downward sloping trickle tube. Its upper opening is installed at the planned water level, while the lower opening is at or near ground level at the back base of the dam. The tube should be large enough to carry most

of the runoff, or at least be able to draw the water level down in a short period of time once storm flows subside.

Another option for ponds, especially those with large watersheds, is a drop outlet structure. It allows water to either drain quickly or trickle over the rim of an open, vertical pipe that is set at the desired water level and connected to a horizontal pipe through the dam.

Ponds with these two types of outlet structures can be drained by either installing a gated valve or stop logs inside the drop structure, or by installing a drain tube near the bottom of the dam. The drain tube should be installed with an accessible valve that is below the frost line in the earthen toe at the back of the dam.

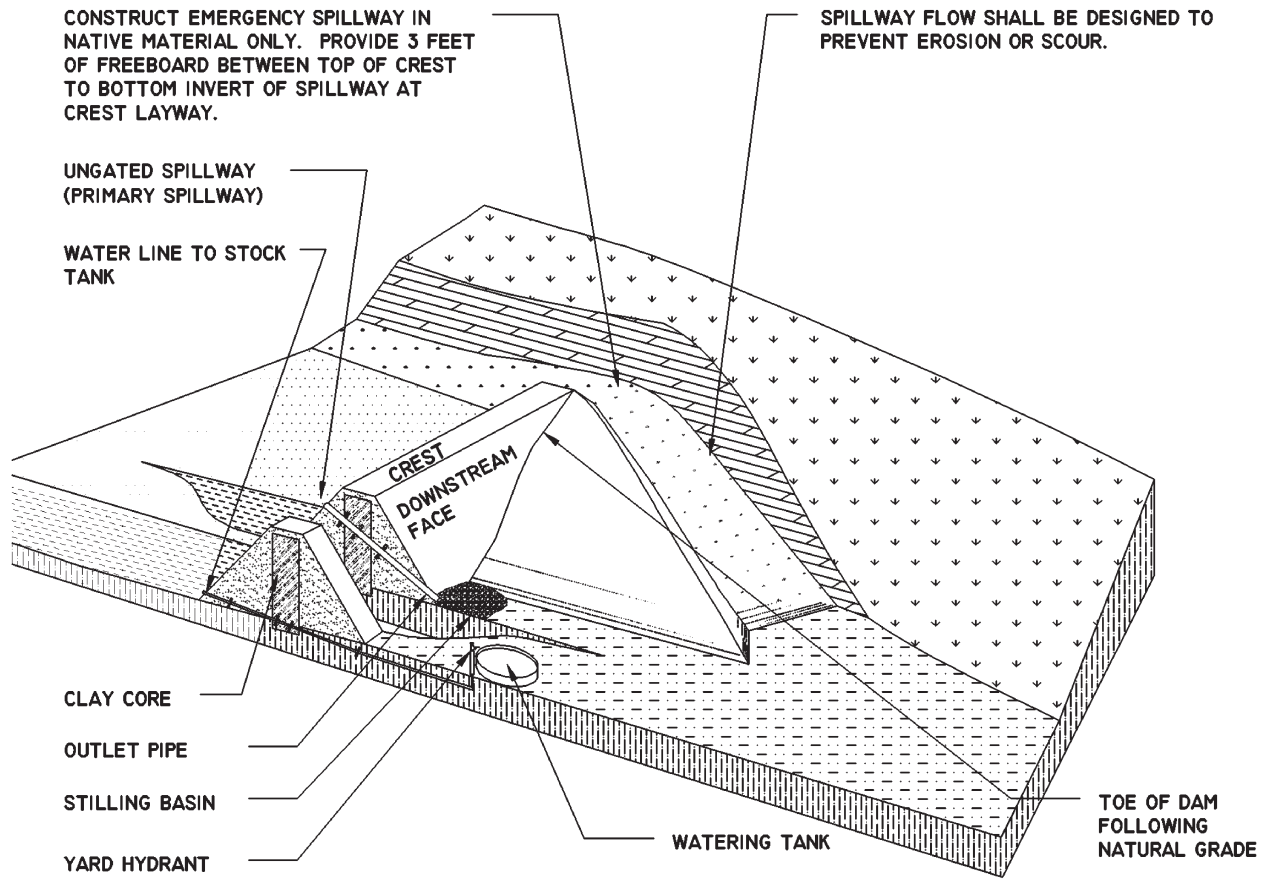
Another type of outlet structure is the bottom withdrawal spillway, which discharges water from the bottom of the pond. Most of the incoming muddy water passes through the pond, dam, and then discharged downstream, resulting in a minimal rise in the pond water level. It also maintains good water clarity by removing stagnant water, sediment, and organic materials from the pond bottom. This will improve pond productivity and extend the life of the pond by 50%.

Outlet structures, particularly drop structures, can prevent unwanted fish from entering the pond from downstream. Regardless of the type of outlet used, an optional watering pipe can be installed through the dam to facilitate livestock watering below the dam. Anti-seep collars should be installed around any pipe or tube that passes through the dam to prevent it from washing out. Trash guards or hooded inlets should also be installed on outlet structures and drain pipes, both for safety and to prevent them from becoming clogged with debris.

Another necessary feature for water overflow is an emergency earthen spillway. While the outlet structure carries water during normal runoff, an emergency spillway carries flood runoff away from



# NEBRASKA POND GUIDE



## COMPONENTS OF A SMALL DAM W/ WATER TANK

NOT TO SCALE

# NEBRASKA POND GUIDE

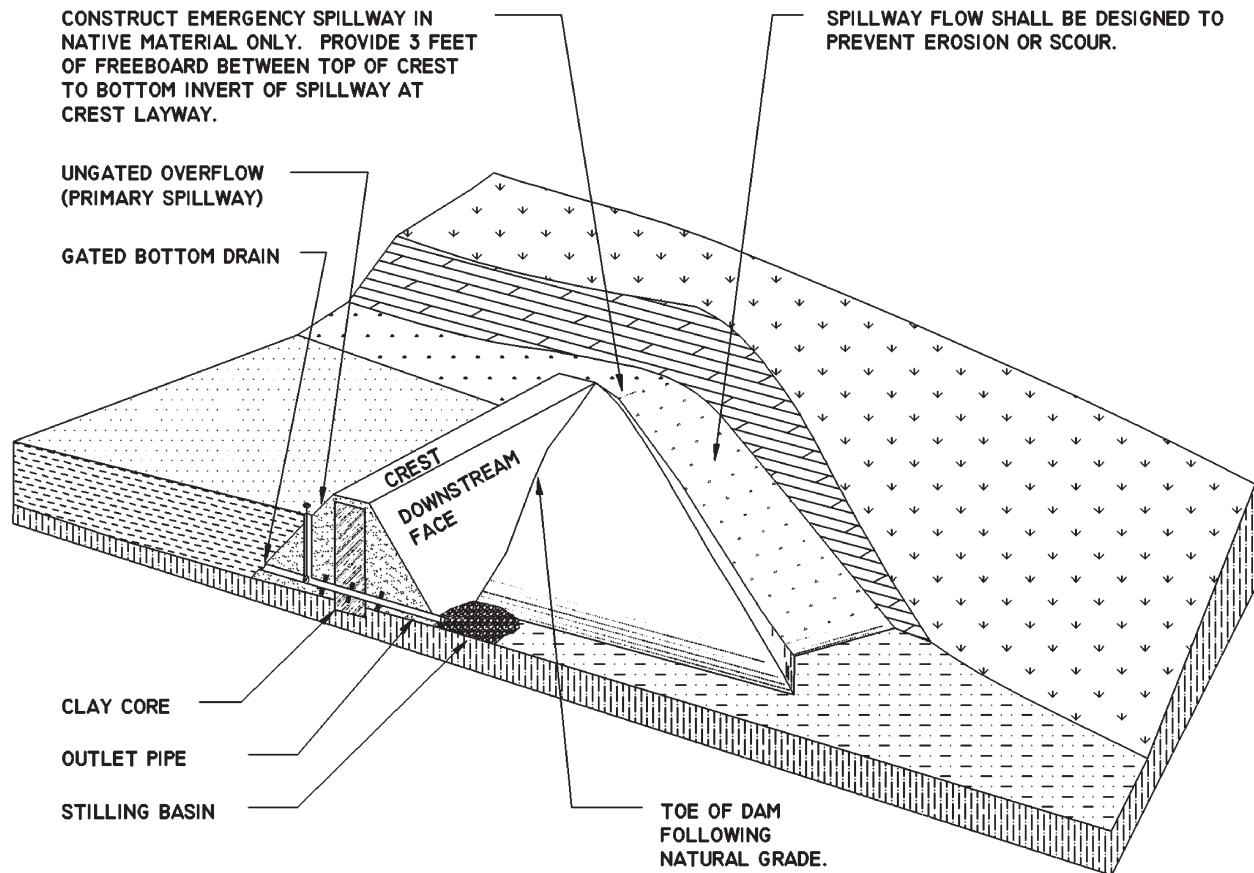

**NOTES:**

GOOD POND CONSTRUCTION REQUIRES PROPER SITE SELECTION, SOILS TESTING, POND DESIGN, PERMITTING, AND CONSTRUCTION MANAGEMENT. OWNER SHOULD CONSULT WITH A PROFESSIONAL ENGINEER WHEN CONSTRUCTING A DAM.

THESE DRAWINGS ONLY SHOW CONCEPTS. ACTUAL DESIGN MUST CONSIDER SUCH ITEMS AS RUNOFF EVENTS, GEOLOGY, POND CAPACITY, OUTLET CONTROL, SPILLWAY REQUIREMENT, DRAINAGE, ETC. THERE ARE SEVERAL TYPES OF VALVE AND GATE DRAIN STRUCTURE CONFIGURATIONS. CONSULT WITH AN ENGINEER TO DETERMINE THE TYPE OF DRAIN STRUCTURE NEEDED.

OUTLET DRAIN STRUCTURE MAY NOT BE NEEDED FOR THE FOLLOWING:

- WHEN THE POND IS MAINTAINED AT A CONSTANT WATER LEVEL.
- THE POND IS SHALLOW ENOUGH TO USE A SIPHON OR PUMP TO EMPTY.
- THERE ARE NO DOWNSTREAM HAZARDS THAT COULD REQUIRE EMERGENCY DRAWDOWN OF THE SYSTEM.

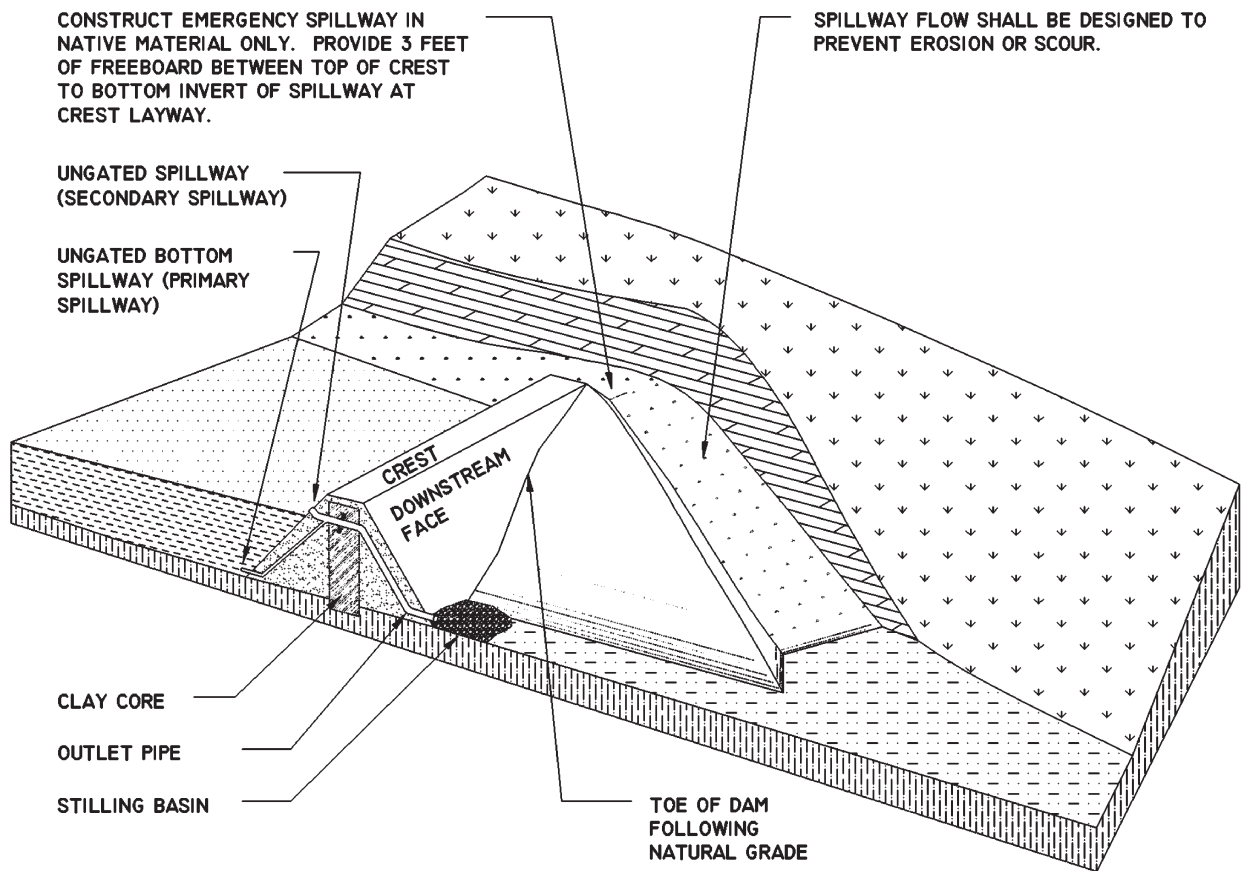


## COMPONENTS OF A SMALL DAM

NOT TO SCALE

W/ DROP STRUCTURE AND GATED DRAIN

# NEBRASKA POND GUIDE

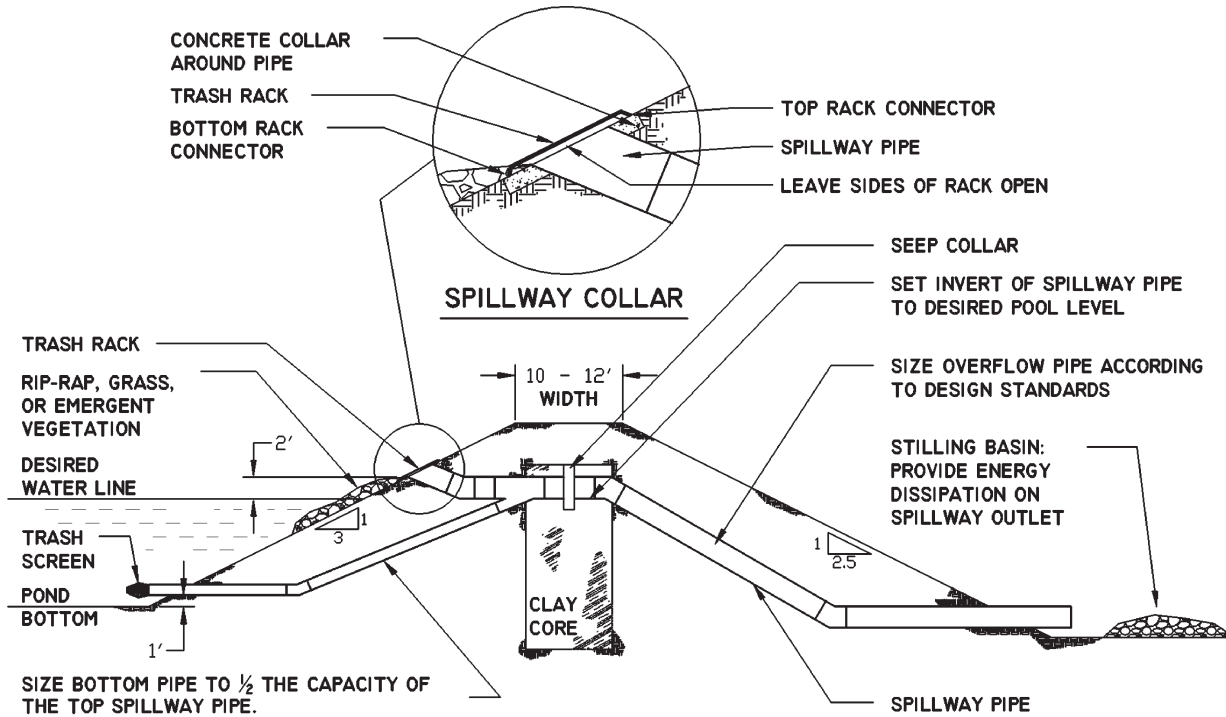


## COMPONENTS OF A SMALL BOTTOM DRAW DAM

NOT TO SCALE

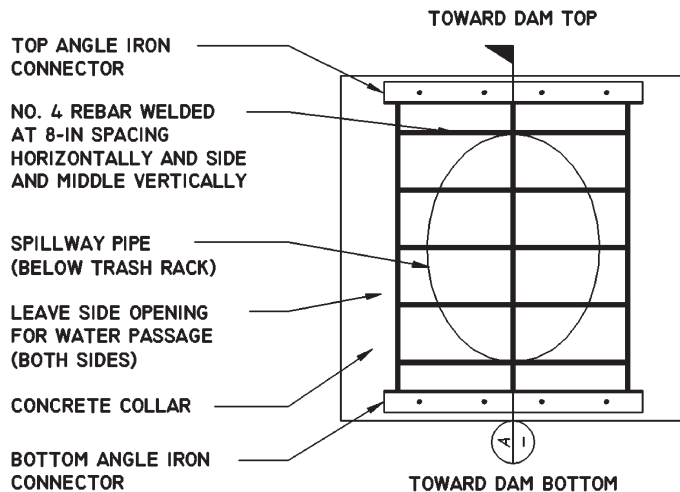


# NEBRASKA POND GUIDE

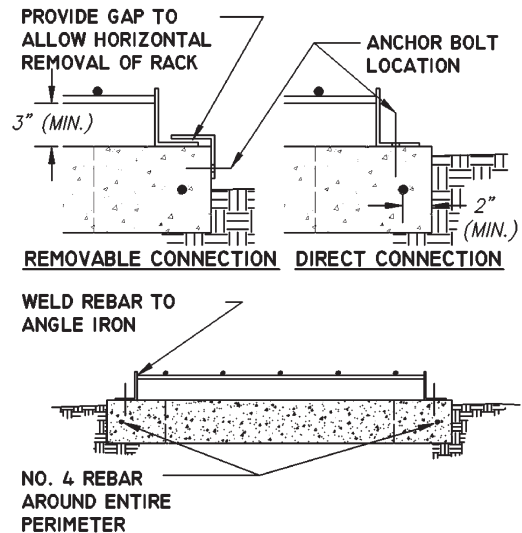


## BOTTOM DRAW SPILLWAY STRUCTURE SECTION

NOT TO SCALE



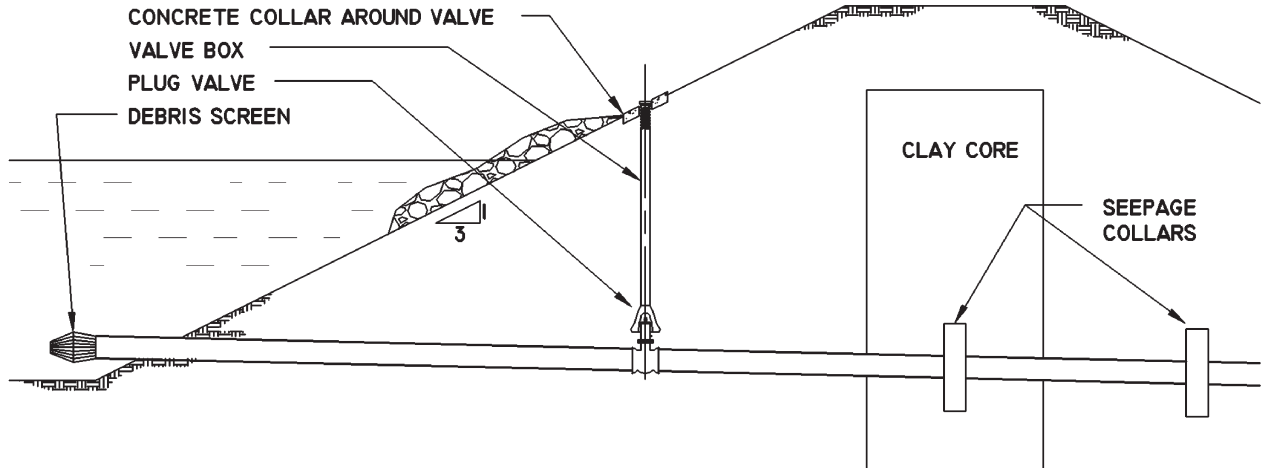
### RACK PLAN VIEW



### RACK SECTION A

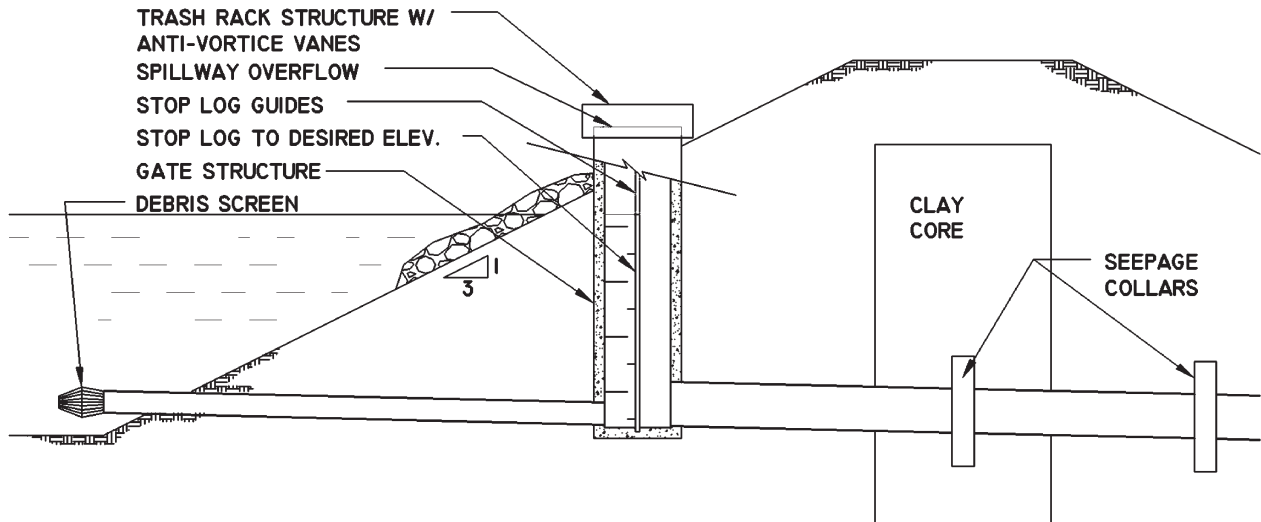
## SPILLWAY COLLAR & TRASH RACK DETAIL

NOT TO SCALE



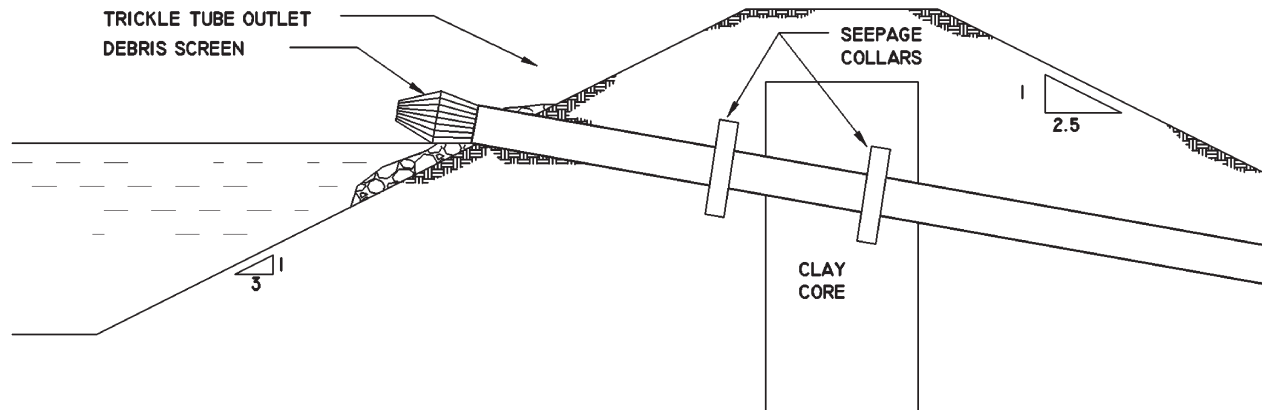
**OUTLET VALVE DRAIN STRUCTURE**

NOT TO SCALE



**OUTLET GATE DRAIN STRUCTURE**

NOT TO SCALE



## TRICKLE TUBE OVERFLOW STRUCTURE

NOT TO SCALE

the pond so the dam is not damaged or breached. The upper opening for an outlet structure is generally set at 12 inches below the spillway level. This keeps water from flowing across the spillway for an extended period of time, which would otherwise leave it moist and vulnerable to severe erosion during heavy rains. Spillway width is determined by a complex set of calculations that takes into consideration local rainfall duration and intensity, the slope of the watershed, and the type of ground cover anticipated in the spillway.

NRCS and NRD personnel need to be contacted regarding dam construction, water control structures, and appropriate emergency spillways for various pond sizes and levels of dam hazard.

### VEGETATION ESTABLISHMENT, HABITAT ENHANCEMENT, and SHORELINE STABILIZATION

Once construction is completed, the removed enriched topsoil can be spread over the dam and spillway to promote grass growth, and over the

excavated basin to promote fertility and sealing. Some of the removed trees and brush should be placed back in the finished pond basin or the upper reaches. They will provide fish habitat, enhance production of fish food items, such as zooplankton and aquatic insects, and help trap sediment and debris. The finished basin should be further stabilized by seeding it with a cover crop (wheat, rye, oats, or sorghum), or allowed to weed-over, before it fills.

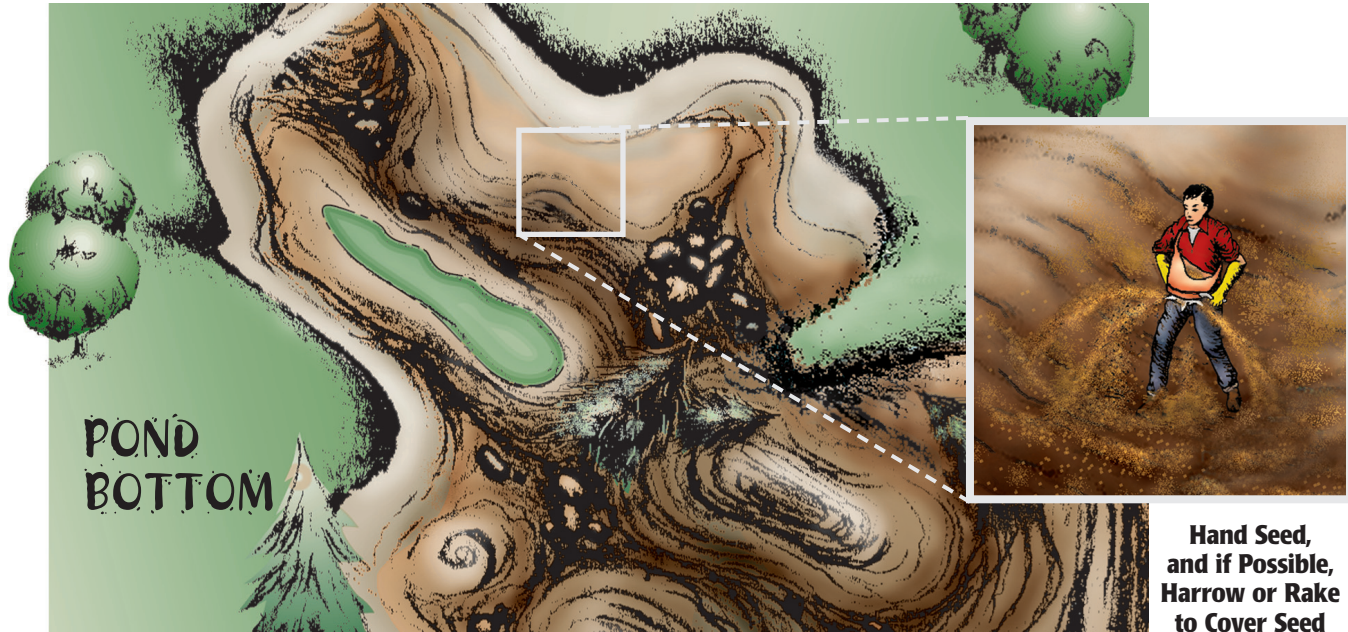
Subsequent inundation and/or decomposition of all types of flooded organic materials adds nutrients to the pond, improves water clarity by facilitating settling of suspended soil particles, provides a substrate that aquatic organisms can colonize, and lessens basin/shoreline erosion during the filling process. New ponds generally have an abundance of nutrients, so it is quite common for algae to become established in the first 2 or 3 years. Eventually, most algae is replaced naturally by the more desirable types of submergent and emergent vegetation; or, some desirable plants can be introduced.

Permanent native vegetation should be planted on the dam, spillway, terraces, waterways, banks,



# NEBRASKA POND GUIDE


**Private Waters  
Program**

 Management Assistance for  
Lakes, Ponds, Pits & Streams


and other disturbed areas as soon as possible after construction is completed. Utilize higher seeding rates in areas prone to erosion during the filling process and on steep slopes, particularly the front and back sides of the dam. Use a seed mixture of native grass, with emphasis on rhizomatous, sod-forming species. The root stock of emergent vegetation, such as cattails, bulrushes, and arrowhead, can also be introduced to colonize/stabilize shoreline areas and act as a sediment/nutrient trap in the upper end of the pond. Keep in mind the aggressive nature of these plants, particularly cattails.

The dam should be protected from wave erosion with rock rip-rap or dense grass, such as prairie cordgrass or switchgrass. Trees should not be planted or allowed to grow on the dam because their roots can cause water leakage problems, nor should they be planted along the northwest corner of ponds. Prevailing northwest winter winds are needed to prevent excessive snow accumulation on the ice, lessening the chance of a winter fish kill.

See **PG13-2** for more detailed information regarding vegetation and habitat establishment.

## OTHER POND USES

The intended uses of a pond should be carefully considered before it is designed or a site is even selected.

**Livestock watering** will typically interfere with fish production if no precautions are taken to restrict their access to the pond's shoreline and/or feeder stream. Unlimited livestock access (especially cattle) results in:

- trampled banks which causes shoreline erosion with subsequent loss of fish spawning/nursery areas and pond depth
- weakened dam and spillway which shortens the life of the pond
- muddied water and increased nutrient inputs which prevents establishment of desirable fish populations.

Ponds less than 5 acres should be fenced with a 100-foot minimum buffer to exclude livestock from the dam, emergency spillway, entire pond perimeter, and feeder stream; they should also be set up with auxiliary watering techniques. If a pond or feeder

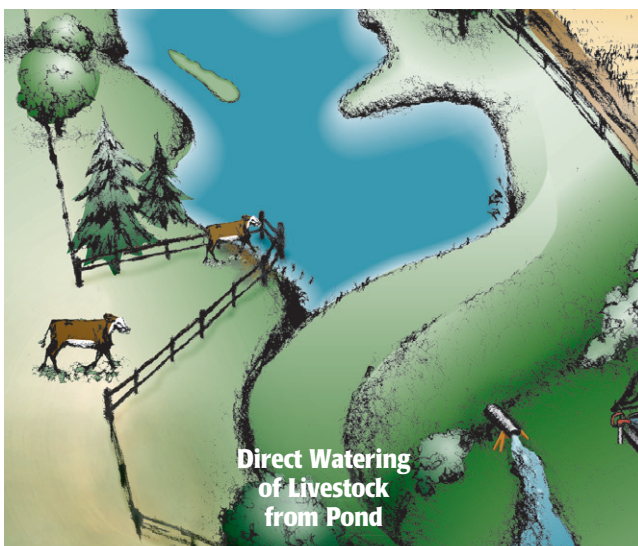
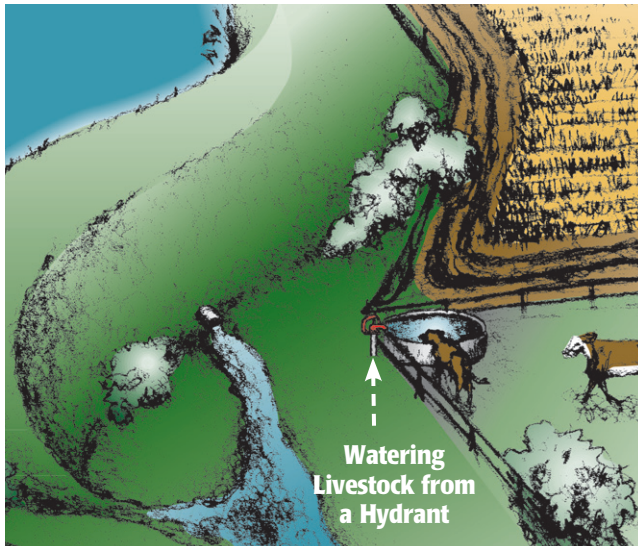
# NEBRASKA POND GUIDE


**Private Waters  
Program**

 Management Assistance for  
 Lakes, Ponds, Pits & Streams

stream has to be used for direct watering, both should be fenced to limit cattle access to small areas.

Another auxiliary watering technique is to install a pipe through the dam and out to a stock tank located outside the fenced area below the dam. This will provide cattle with clean, quality water, which can increase their weight gains. The 2-inch diameter pipe should extend into the pond and connect with a standpipe that has a top 4 feet lower than the water surface when full. The standpipe should contain



coarse gravel that will filter the water and prevent fish from entering. A float valve can be installed in the stock tank to maintain a consistent water level.

Contact NRCS personnel about available buffer and cost-share programs regarding buffer establishment, fencing, and auxiliary watering. Contact Commission wildlife staff about using prescribed grazing to manage enclosed upland and wetland vegetation.

Fishing and **irrigation** are usually not compatible uses, especially if the pond is used as a return catch basin for irrigation runoff water. Using a pond as a source for irrigation water usually results in widely fluctuating water levels that will hinder fish reproduction and growth, and can cause fish kills. However, a pond can be used for small irrigation projects, such as gardens or lawns, provided inflows are sufficient to replace the water used and/or lost to leakage and evaporation, and a permit is obtained from the DNR. Ponds can provide water for **firefighting**, provided precautions are taken to prevent fish and vegetation from plugging up the intake system.

**Flood control** ponds designed specifically to retain sediment and high volumes of runoff water generally do not make good fishing ponds. Runoff events normally result in turbid conditions that last for extended periods of time and deposited sediments gradually fill in the ponds. Sight feeding fish like largemouth bass and bluegill will do poorly under turbid conditions (water clarity less than 12 inches) while channel catfish can produce a viable fishery. Catfish success will depend on food availability, pond depth, and population density if natural recruitment (spawned fish survive to adult size) occurs.

Ponds less than 5 acres can provide many hours of fishing, canoeing, and **other recreational activities**. Power boating and skiing are not recommended because wave action will cause shoreline erosion and resuspension of sediment, resulting in turbid water and reduced productivity. Swimming areas should





See You Out There

# NEBRASKA POND GUIDE



Private Waters  
Program



be marked, all obstacles removed, and life-saving devices (ring buoys, rope, and long poles) should be placed nearby to facilitate rescue operations for summer and winter activities. Consult with an attorney and insurance agent regarding lawsuit protection if an accident should occur.

## ENVIRONMENTALLY SENSITIVE AREAS

There are places where ponds should not be built, such as areas where:

- existing wildlife or habitats are unique or pristine
- watershed functions/usage above and below the site would be negatively affected
- Threatened and Endangered (T&E) species would be impacted
- wetlands or waters of the state would be affected.

Usually, there are no concerns for ponds constructed on upland sites.

## TECHNICAL ASSISTANCE

If you need additional information or would like to discuss any topic in greater detail, contact the Commission's district fisheries management staff in your area or the Private Waters Specialist at the Lincoln headquarters. The Commission's Wildlife Habitat Partners section staff can provide information about establishment and management of wildlife habitat and various buffer programs (CRP). The Commission's Natural Heritage Program staff should be contacted about known locations of T&E species.

The local county Natural Resources Conservation Service (NRCS) office should be contacted regarding construction considerations, permits needed, various buffer programs (CRP), wetlands, and the possibility of any construction cost-sharing programs. They have a publication, "Ponds – Planning, Design, Construction," that is very informative. The Natural Resources District (NRD) should also be contacted

about construction cost-sharing programs. The local county UNL Cooperative Extension office can also be contacted for technical assistance.

## PERMIT REQUIREMENTS

No permits are required if the finished structure, whether new or restored, has a low hazard dam less than 25 feet high, a storage capacity of less than 15-acre feet of water at the spillway crest or overflow, less than 50-acre feet of total flood storage capacity at the top of the dam, and no diversion or withdrawal of water. If a water storage permit is required, it must be obtained from the Nebraska Department of Natural Resources (DNR) prior to construction; otherwise, the dam is subject to removal, or impounded water may have to be released for downstream water-rights holders. DNR staff also regulate water pumping/diversion permits. If construction will affect a wetland, a flood plain, or waters of the state, or if habitat materials will be added to any waters in the state, contact the U.S. Army Corps of Engineers and inquire about a Section 404 permit.

The Nebraska Department of Environmental Quality should be contacted about permitting concerns regarding barnyard and/or feedlot runoff or domestic sewage.

If you are unsure a permit is necessary, contact the sources provided above or your local NRCS office. Also, check property deed for recorded easements for overhead lines, buried pipelines and/or power cables, which could affect where a pond can be built. Pond construction cannot affect a public road or a neighbor's property.

---

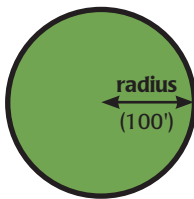
**Contacts:** Jeff Blaser, Private Waters Specialist  
Nebraska Game and Parks Commission  
2200 North 33<sup>rd</sup> Street  
Lincoln, NE 68503  
402-471-5435  
or area Commission fisheries biologist.



## CALCULATING THE SURFACE AREA AND VOLUME OF A POND

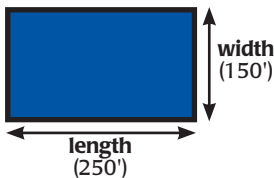
Presented below are formulas for calculating the **surface area** of a pond. Pick a shape that most closely resembles the pond and measure the necessary distances in feet. Put these measurements into the appropriate equation and multiply to find the surface area in square feet. Surface area in acres is simply obtained by dividing the surface area by the number of square feet in an acre (43,560). If a pond is irregular in shape, the best thing to do is divide it into workable shapes and then add the areas of the smaller units together to get the area of the whole.

$$\text{CIRCLE} = 3.14 \times \text{radius}^2$$



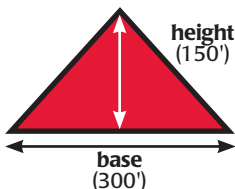
EXAMPLE: pond radius 100 feet x 100 feet x 3.14 = 31,400 square feet total surface area ÷ 43,560 = .72 surface acre

$$\text{RECTANGLE} = \text{length} \times \text{width}$$



EXAMPLE: pond length 250 feet x width 150 feet = 37,500 square feet total surface area ÷ 43,560 = .86 surface acre

$$\text{TRIANGLE} = \frac{\text{base} \times \text{height}}{2}$$



EXAMPLE: pond base 300 feet x height 150 feet = 45,000 square feet ÷ 2 = 22,500 total surface area ÷ 43,560 = .52 surface acre

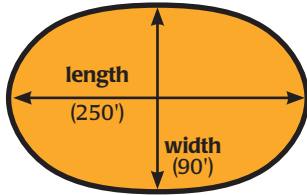


See You Out There

# NEBRASKA POND GUIDE



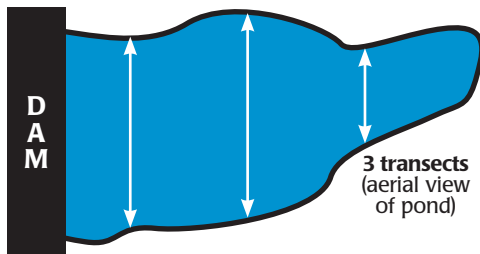
**ELLIPSE = length x width x 0.8**



EXAMPLE: pond length 250 feet x pond width 90 x 0.8 = 18,000 square feet total surface area  
 $\div 43,560 = .41$  surface acre

The formula for calculating a pond's **volume** is surface area (acres) x average depth (feet). Average pond depth can be estimated by measuring the depth of the water in a number of places throughout the pond, adding these measures together to get a total, and then dividing the total by the number of measurements. Several transects should be established across the pond (from one side straight across to the other side). Depth measurements should be taken/recorded every 40 feet with an electronic depth finder or a weight attached to a string marked in feet.

**VOLUME (acre-feet) = surface area (acres) x average depth (feet)**



EXAMPLE: forty measurements were taken while conducting three transects across the surface of a .75 acre pond; average depth calculated to be 4 feet; therefore,  $.75 \times 4 = 3$  acre-feet

NOTE: Average depth can be estimated by multiplying the maximum depth by 0.4

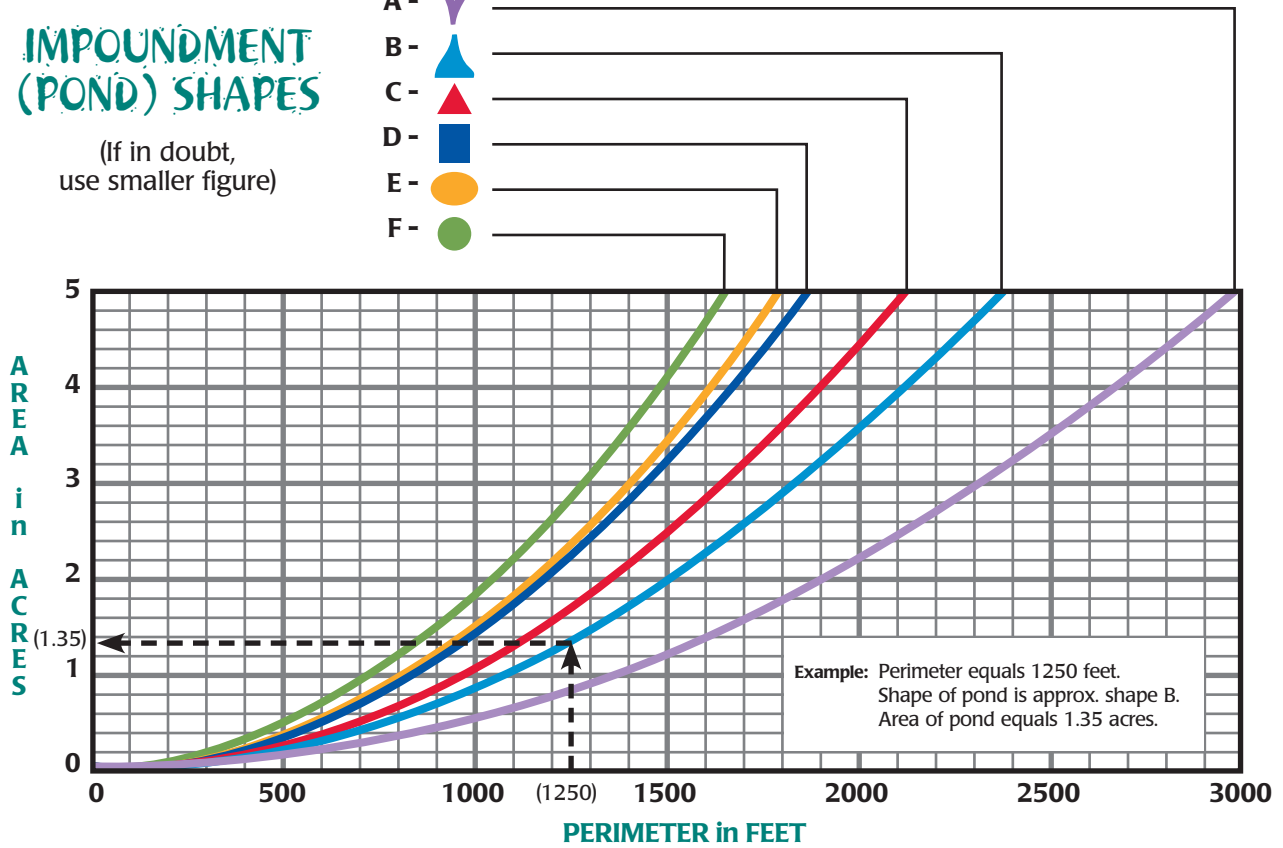
# POND AREA ESTIMATOR

If the distance around the entire pond can be measured, this pond estimator can be used.

## IMPOUNDMENT (POND) SHAPES

(If in doubt, use smaller figure)

- A -
- B -
- C -
- D -
- E -
- F -





See You Out There

# NEBRASKA POND GUIDE



Private Waters  
Program



Management Assistance for  
Lakes, Ponds, Pits & Streams

## TECHNICAL ASSISTANCE CONTACTS

### Nebraska Game and Parks Commission (Commission)

2200 N 33rd Street PO Box 30370  
Lincoln, NE 68503  
Private Waters Specialist 402-471-5435  
Natural Heritage Program 402-471-5419

#### Northwest (NW) District - Alliance

Game and Parks Commission  
299 Husker Road PO Box 725  
Alliance, NE 69301  
308-763-2940  
Fisheries Division or  
Wildlife Habitat Partners Section

#### Northwest (NW) Field Office - Valentine

Valentine State Fish Hatchery  
90164 Hatchery Road  
Valentine, NE 69201  
402-376-8080 or 402-376-2244

#### Southeast (SE) District - Lincoln

Game and Parks Commission  
2200 N 33rd Street PO Box 30370  
Lincoln, NE 68503  
402-471-7651 or 402-471-5561  
Fisheries Division or  
Wildlife Habitat Partners Section

#### Northeast (NE) District - Norfolk

Game and Parks Commission  
2201 N 13th Street  
Norfolk, NE 68701  
402-370-3374  
Fisheries Division or  
Wildlife Habitat Partners Section

#### Northeast (NE) Field Office - Bassett

Game and Parks Commission  
524 Panzer Street PO Box 508  
Bassett, NE 68714  
402-684-2921  
Fisheries Division or  
Wildlife Habitat Partners Section

#### Southwest (SW) District - Kearney

Game and Parks Commission  
1617 First Avenue  
Kearney, NE 68847  
308-865-5310  
Fisheries Division or  
Wildlife Habitat Partners Section

#### Southwest (SW) Field Office - North Platte

Game and Parks Commission  
301 East State Farm Road  
North Platte, NE 69101  
308-535-8025  
Fisheries Division or  
Wildlife Habitat Partners Section





See You Out There

# NEBRASKA POND GUIDE



Private Waters  
Program



Management Assistance for  
Lakes, Ponds, Pits & Streams

## United States Department of Agriculture - Natural Resources Conservation Service (NRCS)

Federal Building, Room 152  
100 Centennial Mall North  
Lincoln, NE 68508  
Statewide Wildlife Biologist  
402-437-4100  
or contact Local County Office

## University of Nebraska - Lincoln, Cooperative Extension

211 Agricultural Hall - UNL East Campus  
Lincoln, NE 68583  
Main Office 402-472-2966  
or contact Local County Office;  
Water Quality Questions 402-643-2981, ext. 115

## Nebraska Department of Natural Resources (DNR)

301 Centennial Mall South, PO Box 94676  
Lincoln, NE 68509  
Water Storage Permits 402-471-2363 or  
Dam Safety Guidelines 402-471-1222

## U.S. Army Corps of Engineers (ACOE)

8901 S. 154th Street, Suite 1  
Omaha, NE 68138 402-896-0723  
or contact the Kearney office at:  
1430 Central Avenue  
Kearney, NE 68847  
308-234-1403

## Nebraska Department of Environmental Quality (NDEQ)

1200 N Street, PO Box 98922  
The Atrium, Suite 400  
Lincoln, NE 68509  
402-471-0096

## Nebraska Association of Resources Districts (NARD)

601 S. 12th Street, Suite 201  
Lincoln, NE 68508  
402-471-7670  
or contact your local Natural Resources District (NRD)  
listed in White Pages of the phone book