

Preparing for Golf Course Flooding

When it comes to flooding, an ounce of prevention is worth a ton of cure.

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Quick removal of silt and debris from turf surfaces is critical to prevent long-lasting damage after a flood.

One of the greatest challenges in maintaining high-quality playing conditions on a golf course is overcoming the effects of continuously changing weather. Occasionally, weather events are severe — completely disrupting operations and causing significant damage to property. Blizzards, hurricanes, thunderstorms, and tropical storms can bring destructive wind, hail, lightning, and excessive precipitation that causes floods. In the case of flooding, there is often some advance warning that presents an opportunity to

take steps to prevent costly damage to a golf course, its equipment, and its structures while also decreasing the recovery time needed to reopen for play when waters recede.

TYPES OF FLOODING

Water is the lifeblood of golf course turf. It is extremely precious, especially in regions that receive limited or inconsistent rainfall. However, too much water can be extremely problematic, considering the amount of damage that can occur during a flood. Flooding

can be separated into three broad categories:

River and Lake Floods: River and lake floods are typically caused by excessive rainfall over a short period of time or from very rapid melting of snow and ice.

Coastal Floods: Coastal floods are usually caused by various combinations of heavy rainfall, high tides, and strong winds.

Flash Floods: Flash flooding from excessive rainfall can occur independently of overflowing water bodies.

Areas that are flat, low-lying, have slow-draining soils, and numerous impermeable surfaces are especially prone to flash floods.

Storm surge is often independent of rainfall-related flooding and uniquely different from normal coastal flooding because damage is principally caused by the force of quickly rising coastal waters. The power of a storm surge can be difficult or practically impossible to stop or divert. Storm surge can crumble concrete walls and buildings, quickly destroying and displacing structures, vehicles, equipment, bridges, roads, and cart paths. In 2017, some golf courses along the southeastern U.S. coast were devastated by fast-moving coastal water pushed by winds from Hurricane Irma, even though they received little rainfall and the storm was more than 125 miles offshore. Around Savannah, Georgia, coastal waters rose 8 feet in less than 30 minutes. Unfortunately, dealing with storm surge is an entirely separate topic that is beyond the scope of this article. This article will focus on activities

around flooding associated with slowly rising waters.

DAMAGE ASSOCIATED WITH GOLF COURSE FLOODING

Identifying the risks associated with flooding will help guide preparations to minimize the potential damage and disruption.

Structural Damage Associated With Flooding: Flooding can cause structural damage that impacts buildings and equipment. Even slow-moving water can severely damage floors, walls, furniture, electrical components, and irrigation equipment. Damage from saline water is especially problematic because salt is corrosive to metal.

Other structural damage associated with flooding includes the toppling of trees, collapsing or weakening of bridges, erosion of turf areas, and damage to bunkers and cart paths. Often this damage is coupled with the deposition of large amounts of flood debris. Where power lines and transformers are underground, power outages caused by flooding can delay

cleanup and complicate recovery efforts.

Agronomic Damage Associated With Flooding: Removing silt, sand, rock, sticks, leaves, trash, and even fish from turf areas is the first step of repairing a golf course after a flood. If flooding occurs during the growing season, debris removal enables plants to receive necessary sunlight. Debris removal is also critically important for enabling the safe movement of people and equipment while they perform repair and maintenance activities. After any large-scale cleanup work has been completed, additional cultivation will likely be needed to address silt that may have been deposited on playing surfaces. If a silt layer is not addressed, it can reduce infiltration and porosity within the upper rootzone.

Yellowing and, in some cases, death of leaf tissue can occur from reduced photosynthesis when plants are underwater or covered with silt and mud for extended periods of time. When soils stay saturated, anaerobic conditions prevent turf root cells from receiving



Widespread flooding can impact all areas of a golf course, requiring an extensive cleanup effort and lengthy recovery time.



Bunkers that are submerged by floodwater can erode and collect silt and debris.

necessary oxygen. Waterlogged soils are also prone to tire rutting that can damage turf and compromise soil structure while creating an aesthetic eyesore.

Floodwaters can also contaminate soils with harmful chemicals or salts that can create chronic problems for turf. Such issues may take weeks or months to fully correct. Additional long-term concerns include increased pest pressure from insects, weeds, and diseases that take advantage of weakened, stressed turf following a flood.

PREPARING FOR FLOODS

Maps and Planning: It is imperative to identify flood-prone areas on the golf course to prioritize where action will be needed. The [FEMA Flood Map Service Center](#) provides floodplain maps that can be compared with maps

created by architects and builders to better understand where water accumulation can be expected.

Preparing for Water Movement, Diversion, and Collection: During a flood, sand bags and barriers can help divert water to drains. Drains should be checked and cleared prior to any weather that could result in floods to ensure quick and thorough drainage. Depending on the age of installed drain lines and the type of debris that may be present, clearing drains could take weeks and should be done sooner rather than later. Right before a flood, mark drain openings with tall stakes for easy location should they become clogged underwater or consider temporarily removing drainage grates to minimize blockage. Rapid drainage will not only facilitate drying and decrease downtime, it also helps reduce the risk

of diseases and other issues associated with waterlogged soil.

Many golf courses rely on retention ponds to collect runoff for irrigation. Periodic dredging to remove silt and debris from retention ponds is an important management practice to maintain sufficient holding capacity. Immediately prior to flooding, pumping water from ponds and lakes can also help them accommodate excess water and minimize the risk of overflow.

Agronomic Preparations: Flood duration, temperatures, sunlight intensity, and the amount of silt deposited are a few key factors that influence the severity of turf damage caused by flooding. The first step in flood preparation is choosing an appropriate turf species. Each turf species varies in its flood tolerance. If a golf course is adjacent to salt or brackish water, salt-

tolerant turf species such as seashore paspalum or bermudagrass should be considered. For northern climates, creeping bentgrass is more flood tolerant than tall fescue or Kentucky bluegrass, while *Poa annua* and perennial ryegrass are least tolerant of flooding.

areas ample time to fully dry out before mowing is required and freeing up labor for more critical cleanup tasks. Waiting to mow until flooded areas are fully dry also reduces the risk of damaging wet, muddy areas with mowers.

Wet conditions can be prolonged after a flood if internal drainage is an

taining a healthy stand of turf along bunker perimeters can help reduce the risk of collapse and soil erosion during a flood. Even with properly designed and functioning bunkers, having a stockpile of extra sand onsite prior to a forecast flood is recommended to expedite possible repairs.



Heavy equipment may be required to unearth buried turf from the soil deposited by a flood.

Equipment for monitoring salinity levels is a must for golf courses with irrigation reservoirs that could be contaminated with salt water. Start recording salinity levels before a flood to establish baseline values for irrigation sources that can be compared with post-flood values. The article [“Interpreting Turfgrass Irrigation Water Test Results,”](#) is a helpful guide. If soluble salts are a concern, it is recommended to have ample supplies of gypsum available to use in conjunction with flushing once floodwaters recede. Like flood tolerance, turf species also vary in their tolerance of salt.

If discoloration can be tolerated, certain plant growth regulators such as trinexapac-ethyl can be applied at a high rate before a flood. High rates of growth regulator significantly slow turf growth and respiration, giving flooded

issue. Cleaning out clogged drainage lines to facilitate water movement through and out of putting greens is especially imperative. Some diseases such as Pythium root rot are exacerbated by extended periods of waterlogged conditions. Most fungicides labeled for root diseases recommend irrigation after application to facilitate fungicide delivery to the roots. If the soil is saturated, it will be impossible to perform this task. For this reason, it is far easier and more effective to apply fungicides labeled for root diseases in a preventive manner before flooding.

Many bunkers also have internal drainage systems. Ensure that these drains are cleared and functioning prior to a potential flood. When bunkers are designed so that surface water moves around them rather than into them, flooding can be less of an issue. Main-

Irrigation Systems: Modern putting greens, such as those built according to USGA recommendations, are designed and constructed to readily drain. As such, even after heavy rainfall events, putting greens may require regular irrigation to stimulate growth and recovery. Access to water following a flood is also critical to wash away debris. Large, mobile water tanks that can be shuttled from one green to the next are extremely helpful if a storm or flood has rendered the irrigation system inoperable. Access to a large temporary generator that can power an entire irrigation system may be needed if electrical service is unavailable for an extended period.

Immediately prior to flooding, all irrigation system satellites, control boxes, pumps, and variable frequency drives should be powered down and, if

possible, moved to a secure location. In areas that have flooded in the past, consider permanently relocating vulnerable components to higher ground or mounting them on concrete pedestals above historical flood levels. Having spare controllers and irrigation heads on hand can facilitate quick replacement after a flood.

Equipment, Materials, and

Structural Preparations: The most important flood preparation is to collect and move all valuable electronics, equipment, and documents far away

from areas most likely to flood. Keep spare batteries and items important for communication close at hand. Move large equipment such as carts and mowers to high ground where possible. Plant protectants and fertilizers should be secured in areas that are safe from flooding and rainfall to prevent off-site movement and contamination of adjacent areas or water bodies.

Equipment should be greased and fueled prior to moving to high ground. Spare gasoline, oil, gas cans, chainsaws, trash pumps, and generators are

essential. When preparing chainsaws, ensure all chains are sharpened along with backup chains.

Having access to a boat that can be used to move personnel and equipment to isolated areas of a golf course can be very helpful if floodwaters persist for several days. Shutting off power prior to flooding is also suggested to minimize potential damage to expensive electrical equipment from short circuiting or power surges.

Personnel: The resource most in demand following any storm is labor. If short on labor throughout the season, prior to a storm is a good time to contract with companies that supply temporary labor. It is important to remember that existing staff and their families may be affected if a storm or flood is catastrophic. Following Hurricane Matthew in 2016, power was out for weeks, and some golf courses supplied temporary housing for staff and their families.

Keep in mind that floodwater is a potential health hazard, so check with the local health department to determine if staff will require any immunizations or booster shots for tetanus, hepatitis, or other diseases before they spend time working in floodwater. The [Centers for Disease Control and Prevention](#) publishes recommendations for the safe handling of [floodwater after a disaster or emergency](#).

Insurance, Attorneys, and Retainer Contracts: It is often said that the worst time to realize you need insurance is after a storm, so review insurance policies to determine if additional coverage is needed before severe weather hits. It is a good idea to seek the advice of an attorney, especially one who is familiar with insurance terminology, policies, and contracts. Stay in contact with the attorney and, if need be, consider paying a retainer to ensure that he or she is readily available in the event of need after a flood.

Companies that provide cleanup work — whether they are contractors, tree removal services, or equipment suppliers — typically offer right of first refusal contracts. These contracts vary, but they essentially obligate a company to provide you with their

Strategies to Lessen Flood Damage and Promote a Speedy Recovery		
	<i>Short-term tactics (1-3 days before a flood)</i>	<i>Long-term tactics (3-6 months before a flood)</i>
Drainage	Mark surface drains with a stake so they can be easily located and cleaned of debris	Improve surface drainage and add subsurface drainage in low-lying areas
Bunkers	Collect and store rakes that could float away	Stockpile extra sand, gravel, and drain lines
Salt management	Acquire and apply gypsum and flush if salts are high	Record and establish baseline salinity for soil and irrigation water
Turf	Apply a high rate of plant growth regulator and preventative fungicides	Research and plant the best-adapted turf for your region
Water retention ponds	Lower water levels in advance of excess precipitation	Dredge ponds to increase holding capacity and reinforce embankments
Equipment	Move equipment to high ground and reserve needed equipment such as generators	Have properly working chainsaws, trash pumps, blowers, squeegees, and mowers that can cut high turf
Labor	Secure contractors well ahead of time to assist with cleanup and rebuilding efforts	Communicate proper training procedures to employees
Insurance	Take pictures and video to properly document before and after conditions	Investigate coverage limits, deductibles and exceptions, and secure appropriate policies
Irrigation system	Power down equipment and remove satellites in low-lying areas	Acquire large, mobile water tank(s) that can be used to irrigate turf



Areas adjacent to creeks and streams may need reinforcement to minimize the risk of future flood damage.

services if and when needed before accepting other work. These types of contracts can be invaluable following a widespread flood when these companies will be in high demand. Contracts with right-of-first-refusal clauses and retainer fees are ways to ensure that you get the help and equipment you need as soon as possible; they essentially put at the top of the list.

CLOSING COMMENTS

When it comes to golf course management, perhaps the guiding axiom

should be “an ounce of prevention is worth a ton of cure.” Unfortunately, it is not easy to prevent or minimize every risk associated with flooding. Preparing well in advance, in addition to having an emergency plan for quick implementation, can reduce costly damage and lead to a quick reopening after a flood. It is also important to communicate with golfers about the time needed to prepare for and recover from floods. While above-ground damage will certainly be obvious, the less-apparent agronomic concerns will require more

time to fully correct. Rushing to reopen a golf course to cart traffic before flooded areas are dry and fully recovered can often cause as much damage as the flood itself.

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