BENEFICIAL MANAGEMENT PRACTICES

Avoiding, Minimizing, and Mitigating Impacts of Transportation Projects on State Natural Resources

TEXAS PARKS AND WILDLIFE DEPARTMENT
ECOLOGICAL AND ENVIRONMENTAL PLANNING PROGRAM
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DISCLAIMER: Application of Beneficial Management Practices (BMP) within this manual does not replace coordination or consultation with Texas Parks and Wildlife Department (TPWD) and U.S. Fish and Wildlife Service (USFWS). It is the responsibility of the project proponent to comply with all federal, state, and local laws that protect plants, fish, and wildlife. TPWD is available to provide further assistance on state-listed species, other Species of Greatest Conservation Need (SGCN), or rare plant communities that may be impacted by transportation projects. Please direct inquiries to TPWD at the following email address: WHAB_TxDOT@tpwd.texas.gov.

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SECTION 1: STATEWIDE STANDARD BMP

Under Section 12.0011 of the Texas Parks and Wildlife Code (PWC), Texas Parks and Wildlife Department (TPWD) is charged with "providing recommendations that will protect fish and wildlife resources to local, state, and federal agencies that approve, permit, license, or construct developmental projects" and "providing information on fish and wildlife resources to any local, state, and federal agencies or private organizations that make decisions affecting those resources."

The purpose of this section is to provide beneficial management practices (BMP) that should be implemented during design, construction, and maintenance activities statewide for transportation projects with the goal of avoidance and minimization of impacts on natural resources. By integrating natural resources considerations into the transportation planning process and incorporating wildlife-friendly designs, impacts to the state's natural resources can be reduced over the life of the transportation project. Statewide Standard BMP pertain to all fish and wildlife species, including state-listed species and other Species of Greatest Conservation Need (SGCN). Implementing the recommendations as outlined below will improve conservation of species and their habitat.

1.1 General Design and Construction BMP

- Employees and contractors will be provided information prior to the start of construction to educate personnel of the potential for:
    - All state-listed threatened species or other SGCN to occur within the project area and should be advised of relevant rules and regulations to protect plants, fish, and wildlife.
    - Equipment and vessels to transport and introduce invasive species and should be advised of the relevant regulations and procedures for preventing their spread.
- Contractors will be informed to avoid harming all wildlife species if encountered and allow them to safely leave the project site. Due diligence should be used to avoid killing or harming any wildlife species in the implementation of transportation projects.
- Direct animals away from the construction area with the judicious use and placement of sediment control fencing to exclude wildlife. Exclusion fence should be buried at least 6 inches and be at least 24 inches high, maintained for the life of the project, and removed after construction is completed. Contractors should examine the inside of the exclusion area daily to determine if any wildlife species have been trapped inside the area of impact and provide safe egress opportunities prior to initiation of construction activities.
- Apply hydromulching and/or hydroseeding in areas for soil stabilization and/or revegetation of disturbed areas around wetlands and in riparian areas. Hydromulch that contains microplastics should be avoided.
- Use wildlife-friendly erosion control blankets or mats from TxDOT's Approved Products List. Products should contain no netting or contain loosely woven natural fiber netting in which the mesh design allows the threads to move, therefore allowing expansion of the mesh openings to prevent wildlife entanglements. Plastic netting should be avoided.
- Project staging areas, stockpiles, temporary construction easements, and other project related sites should be situated in previously disturbed areas to avoid or minimize impacts to sensitive or unique habitats including intact native vegetation, floodplains, riparian corridors, wetlands, playa lakes, and habitat for wildlife species.

- When lighting is added, consider wildlife impacts from light pollution and incorporating dark-sky practices into design strategies. Minimize sky glow by focusing light downward, with full cutoff luminaries to avoid light emitting above the horizontal. The minimum amount of night-time lighting needed for safety and security should be used. Light sources should have a maximum Correlated Color Temperature of 3,000-Kelvin (i.e., warm-toned light).

1.2 Vegetation BMP

1.2.1 Terrestrial Vegetation

- Minimize the amount of vegetation cleared. Removal of native vegetation, particularly mature native trees and shrubs should be avoided. Impacted vegetation should be replaced with in-kind on-site replacement/restoration of native vegetation.
- To minimize adverse effects, activities should be planned to preserve mature trees, particularly acorn, nut, or berry producing varieties. These types of vegetation have high value to wildlife as food and cover.
- It is strongly recommended that trees greater than 12 inches in diameter at breast height (DBH) that are removed be replaced. TPWD's experience indicates that for ecologically effective replacement, a ratio of three trees for every one (3:1) lost should be provided to either on-site or off-site. Trees less than 12 inches DBH should be replaced at a 1:1 ratio.
- Replacement trees should be of equal or better wildlife quality than those removed and be regionally adapted native species.
- When trees are planted, a maintenance plan that ensures at least an 85 percent survival rate after three years should be developed for the replacement trees.
- The use of any non-native vegetation in landscaping and revegetation is discouraged. Locally adapted native species should be used.
- The use of seed mix that contains seeds from only regional ecotype native species is recommended.

1.2.2 Submerged Aquatic Vegetation

- Site and configure access routes, staging areas, work areas, and other project components to avoid and minimize impacts to submerged aquatic vegetation, including seagrasses, during all stages of the project.
- Use existing channels for access. Where existing channels are unavailable, use shallow draft or air propelled boats/barges where appropriate water levels are available to accommodate vessel drafts under load and use floating construction mats to minimize compaction and physical damage where appropriate water levels are unavailable.
- Do not use marsh buggies or tracked vehicles in seagrass beds, mudflats, or unvegetated shallows to avoid direct impacts from physical damage and indirect impacts from sediment disturbance.
- Use turbidity curtains, hay bales, vegetated swales, or other appropriate means to reduce suspended solids in stormwater runoff and elevated turbidity levels associated with dredge/fill activities.
- Compensate for unavoidable impacts to seagrass at a 3:1 ratio.

1.3 Invasive Species BMP

- For all work in_water bodies designated as 'infested' or 'positive' for invasive zebra (*Dreissena polymorpha*) or quagga mussels (*Dreissena bugensis*) on https://tpwd.texas.gov/zebramusselsmap as well as waters downstream of these lakes, all machinery, equipment, vessels, or vehicles coming in contact with such waters should be cleaned prior to leaving the site to remove any mud, plants, organisms, or debris; water drained (if applicable); and dried completely before use in another water body to prevent the potential spread of invasive mussels. If barges and other equipment is stored in the water on a lake with zebra mussels for more than a few days, invasive mussels are likely attached. TPWD should be contacted for guidance at ZMboats@tpwd.texas.gov a week or more prior to moving equipment from the lake. This equipment must be decontaminated with a high-pressure washer, heated (140° F) if possible, to remove and/or kill all mussels, and quarantined and dried for up to 2 weeks before launching in another water body. TPWD will provide specific guidance on the process on a case-specific basis.
- Barges and other equipment stored in the water may be inadvertently sourced from a water body with invasive mussels and could be carrying thousands to millions of attached mussels illegally, with potential to cause a new infestation in the water body where work will occur. Contractors should be made aware of this risk and provided with https://tpwd.texas.gov/zebramusselsmap as a resource for determining if the water body where sourced equipment was last used or stored in the water has invasive mussels. If yes, TPWD should be contacted at ZMboats@tpwd.texas.gov for guidance a week or more prior to moving equipment and the equipment must be decontaminated as described above prior to launch on the water body where the project will occur. Transport of live or dead zebra mussels is illegal, and such equipment is extremely high risk for causing a new infestation.
- Care should be taken to prevent the spread of aquatic and terrestrial invasive plants during construction activities. Educate contractors on how to identify common invasive plants and the importance of proper equipment cleaning, transport, and disposal of invasive plants in a manner and location that prevents spread when invasive plants are removed during construction.
- Care should be taken to avoid the spread of aquatic invasive plants such as giant Salvinia (*Salvinia molesta*), common salvinia (*Salvinia minima)*, hydrilla (*Hydrilla verticillata*), water hyacinth (*Eichhornia* spp.), Eurasian watermilfoil (*Myriophyllum spicatum*), water lettuce (*Pistia stratiotes*), and alligatorweed (*Alternanthera philoxeroides*) from infested water bodies into areas not currently infested. All machinery, equipment, vessels, boat trailers, or vehicles coming in contact with waters containing aquatic invasive plant species should be cleaned prior to leaving the site to remove all aquatic plant material and dried completely before use on another water body to prevent the potential spread of invasive plants. Removed plants should be transported for disposal in a secure manner to prevent dispersal.
- Colonization by invasive plants should be actively prevented on disturbed sites in terrestrial habitats. Vegetation management should include removing or chemically treating invasive species as soon as practical while allowing the existing native plants to revegetate the disturbed areas; repeated removal or treatment efforts may be needed. Only native or non-invasive plants should be planted. Care should be taken to avoid mowing invasive giant reed (*Arundo donax*), which spreads by fragmentation, and to clean equipment if inadvertently mowed to prevent spread. If using hay bales for sediment control, use locally grown weed-free hay to prevent the spread of invasive

species. Leave the hay bales in place and allow them to break down, as this acts as mulch assisting in revegetation.

- Aquatic invasive species (e.g., tilapias (*Oreochromis* spp., *Tilapia zillii*), suckermouth armored catfish (*Hypostomus plecostomus*, *Pterigoplichthys* spp.), Asian clams (*Corbicula fluminea*), zebra mussels (*Dreissena polymorpha*)) or those not native to the subwatershed should not be relocated but rather should be dispatched. Invasive mussels attached to native mussels should be removed and destroyed or disposed prior to relocation of the native mussels. Prohibited aquatic invasive species, designated as such in 31 TAC §57.112, should be killed upon possession. Refer to TPWD's list of Prohibited/Controlled Exotic Species available online at: Exotic Fish, Shellfish and Invasive Aquatic Plants (texas.gov).

1.4 Water Quality BMP

In addition to BMP required for a Texas Commission on Environmental Quality (TCEQ) Stormwater Pollution Prevention Plan (SWP3) and/or 401 Water Quality Certification:

- Minimize the use of equipment in streams and riparian areas during construction. When possible, equipment access should be from banks, bridge decks, or barges.
- When temporary stream crossings are unavoidable, remove stream crossings once they are no longer needed and stabilize banks and soils around the crossing. Avoid using hard features such as riprap, articulated concrete blocks, and gabion baskets for bank stabilization.
- Wet-bottomed detention ponds are recommended to benefit wildlife and downstream water quality. Consider potential wildlife-vehicle interactions when siting detention ponds.
- Rubbish found near bridges on TxDOT right-of-way (ROW) should be removed and disposed of properly to minimize the risk of pollution. Rubbish does not include brush piles or snags.

1.5 Stream Crossings and Aquatic Connectivity BMP

- Use spanning bridges rather than culverts.
- Culverts that concentrate low flows but provide conveyance of higher flows through staggered culverts placed at higher elevations are recommended. Evaluate incorporating modeled depths and current velocities to ensure passage for the majority of species or congeners that occur within the project area. Consult with the TPWD Transportation Liaison to gain access to a fish species passage tool developed from this work. Refer to Emadi et al. 2024 *in* Fishes "*Swimming Performance Assessments of Fish Species of Greatest Conservation Need to Inform Future Stream Crossing Designs in Texas"* available online at: https://doi.org/10.3390/fishes9060234.
- Bottomless culverts are recommended to allow for fish and other aquatic wildlife passage in the low flow channel. If bottomless culverts are not used, making a low flow channel for fish passage is recommended. Culverts should be embedded into the stream bed so that the substrate and water depth are similar to the surrounding stream bed to encourage natural substrates to accumulate and prevent perching due to erosion beneath the structure.
- Avoid placing riprap across stream channels and instead use alternative stabilization such as biotechnical stream bank stabilization methods including live native vegetation or a combination of vegetative and structural materials. When riprap or other bank stabilization devices are

necessary, their placement should not impede the movement of aquatic and terrestrial wildlife underneath the bridge. In some instances, riprap may be buried, back-filled with topsoil and planted with native vegetation.

- Following instream disturbance, stream substrates should be replaced with similar-sized substrate found within the system to provide proper habitat for aquatic taxa.
- Minimize the disturbance and/or removal of aquatic vegetation and woody debris from the stream channel during construction.
- Incorporate bat-friendly design into bridges and culverts.
- Design bridges for adequate vertical and horizontal clearances under the roadway to allow for terrestrial wildlife to safely pass under the road.
- A span wide enough to cross the stream and allow for dry ground and a natural surface path under the roadway is encouraged. For culverts, incorporation of an artificial ledge inside the culvert on one or both sides for use by terrestrial wildlife is recommended.
- Riparian buffer zones should remain undisturbed.

1.6 Dewatering BMP

- Follow the most recent TPWD Aquatic Resources Relocation Plan Guidelines (PWD LF T3200-1956).
- Impact avoidance measures for aquatic organisms, including *all native fish and freshwater mussel species, regardless of state-listing status*, should be considered during project planning and construction activities.
- Contractors should be aware Section 12.0011 (b)(1) of PWC, authorizes the department to investigate fish kills and any type of pollution that may cause loss of fish or wildlife resources, take necessary action to identify the cause and party responsible for the fish kill or pollution, estimate the monetary value of lost resources, and seek restoration. In addition, Section 12.301 of the PWC establishes liability to the state for any person who kills, catches, takes, possesses or injures any fish, shellfish, reptile, amphibian, bird or animal in violation of the PWC or of a rule adopted under the PWC.

1.7 Aquatic Mitigation

- In-kind compensatory mitigation should be considered for all unavoidable impacts to aquatic resources including, but not limited to streams, wetlands, oysters, seagrass and mudflats, regardless of their jurisdictional status.
- Compensatory mitigation plans should be developed in consultation with TPWD Transportation Liaison.
- A TPWD Permit to Introduce Fish, Shellfish or Aquatic Plants into Public Waters and a prerequisite Aquatic Resource Relocation Plan (ARRP), following the most recent TPWD ARRP Guidelines (PWD LF T3200-1956), will be required to relocate/introduce fish and/or shellfish into public waters of the state.

1.8 Wildlife Crossings BMP

- Evaluate incorporating wildlife crossings during the project planning and design phase to enhance safety for driving public and wildlife habitat connectivity. Refer to TxDOT's Technical Report 0-69710-1 "*Incorporation of Wildlife Crossings into TxDOT's Projects and Operations"* available online at: http://library.ctr.utexas.edu/ctr-publications/0-6971-1.pdf.
- Design roadways on new location to incorporate wildlife crossings with fencing, particularly in areas that bisect wildlife travel corridors or seasonal movement routes to avoid further habitat fragmentation and minimize wildlife-vehicle interactions.
- Monitor wildlife passage prior to and following incorporation of wildlife crossings to assess effectiveness of implemented measures to reduce wildlife-vehicle collisions and determine the need for additional measures to reduce conflict.
- Incorporate retrofit modifications into the design of existing bridges and culverts to further enhance wildlife passage by including fencing installation to direct animals to wildlife crossing structures.
- Incorporate cable median barriers into design rather than continuous concrete traffic barriers to increase permeability by creating openings or gaps at intervals for animals encountering barriers to movement.
- Create pathways or install passage benches (e.g., artificial ledges) to facilitate wildlife passage. Evaluate incorporating TxDOT's Bridge Division New Wildlife Accommodation Standard's "*Stone Riprap Wildlife Ledge (SRR-WL)*" or "*Wildlife Step for Box Culverts (WSBC)"* available online at: Bridge Standards (state.tx.us).
- Incorporate vegetative cover by wildlife crossings to encourage wildlife use of structures.
- Develop a maintenance plan to regularly clean out debris material from wildlife crossings to ensure wildlife use.
- Consider incorporating sensor-based animal detection systems to alert the driving public of well-known areas of wildlife-vehicle conflict.

SECTION 2: TAXA BMP

The purpose of this section is to provide BMP to minimize impacts from transportation projects to species or groups of species. Beneficial management practices are intended for state-listed threatened species or other SGCN as identified in the State Wildlife Action Plan for Texas and tracked on the TPWD Rare, Threatened, and Endangered Species of Texas by County (RTEST) online application. Implementing the recommendations outlined in the Taxa BMP will aid in the conservation of the state's wildlife and fish resources and prevent future species endangerment that may lead to regulation and protection under federal and state law. To aid in the scientific knowledge of a species status and current range, the 2021 Memorandum of Understanding (MOU) between TPWD and the Texas Department of Transportation (TxDOT) stipulates that TxDOT staff and contractors submit observations of SGCN to the Texas Natural Diversity Database (TXNDD) according to the data submittal instructions found on the TXNDD website.

2.1 Rare Plant BMP

The following plant BMP apply to projects within range of and in suitable habitat for all plant SGCN that are listed on TPWD's RTEST online application.

- Survey project area during appropriate seasons to allow for correct species identification. Habitat and survey seasons are usually during the flowering and/or fruiting period listed on the RTEST website, if available. Surveys should be performed within suitable habitat for the species. Survey effort is project-, species- and habitat-dependent. Botanical field surveys should be conducted by qualified individual(s) with botanical experience and according to commonly accepted survey protocols. Ensure that any equipment, tools, footwear and clothing are clean prior to entering the project site area to avoid introducing invasive species. Prior to surveying, TPWD is available to provide assistance with species identification and appropriate survey effort.
- If SGCN plants are located, the surveyor should attempt to determine the complete extent of the occurrence and the approximate number of individuals within the occurrence. Suitable GPS equipment should be used to map the boundaries of the population. Photographs should be taken and/or voucher specimens should be collected (if sufficient plants are present, i.e., more than 10 reproductive plants). Please note that a state collection permit is required from TPWD to collect voucher specimens of state-listed species and a federal collection permit is required from U.S. Fish and Wildlife Service (USFWS) to collect federally listed species. Photographs should capture diagnostic characters of the species for verification and should be discussed with TPWD prior to surveys if surveyors are unfamiliar with the species. Vouchers should be deposited with TPWD or in one of Texas' major herbaria (e.g., University of Texas at Austin, Botanical Research Institute of Texas, Texas A&M University, Sul Ross State University, etc.).
- If there is a known TXNDD SGCN plant population within the project area and project timing or other constraints do not allow for surveys, contact TPWD Transportation Liaison as soon as possible to discuss other options.
- If an SGCN plant species is located during surveys of the project area, then complete the following during the construction phase:
    a. Avoid impacts and minimize unavoidable impacts. Plant locations should be protected with temporary barrier fencing and contractors should be instructed to avoid protected areas. Conducting construction outside of the growing season or after a plant has produced mature fruit is the preferred way to avoid/minimize impacts to SGCN plant populations. Staging

areas, stockpiles, and other project related sites on TxDOT ROW should not impact SGCN plant populations. After construction begins, minimize herbicide use near SGCN plant populations (if possible, use hand-held spot sprayers, several meters from rare plants, on still or days with little wind).

b. If there are unintended impacts to SGCN populations, these impacts should be reported to TPWD Transportation Liaison.
c. If the project footprint is finalized or is subject to change AND impacts to SGCN plants cannot be avoided, notify TPWD Transportation Liaison as soon as possible. Early notification will allow adequate time and opportunity to seed bank or otherwise conserve populations prior to construction.

- Submit observation(s) of SGCN plant populations and associated data to the TXNDD and WHAB_TxDOT@tpwd.texas.gov. A TXNDD Reporting Form with shapefiles delineating the outer boundary of the population are preferable. Include detailed information on who identified and how a species was identified (resources/references used; diagnostic characters observed). If an SGCN plant population is located near non-native invasive plants, this should be recorded and reported in TXNDD Reporting Form.
- Although these BMP do not apply to federally listed species, the observation of federally listed species should also be submitted to TPWD.
- During project period, conduct work during times of the year when plants are dormant and/or conditions minimize disturbance of the habitat.
- Develop a plan based on growing season, mower height/season, etc. for protecting sites into the future. Maps should also be developed for rare plant areas, which include no mow areas. Known rare plant sites on ROWs and/or new sites found in future projects can be added to this map/plan.
- Conducting maintenance outside of the growing season or after a plant has produced mature fruit is the preferred way to avoid/minimize impacts to habitat.

2.2 Bird BMP

2.2.1 Nesting Bird BMP

The following Bird BMP apply to projects within the range and in suitable habitat for all bird SGCN listed on TPWD's RTEST application. Please note that projects within the range and in suitable habitat for the bald eagle (*Haliaeetus leucocephalus*) and golden eagle (*Aquila chrysaetos)* are required to comply with the Bald and Golden Eagle Protection Act (BGEPA).

In addition to complying with the Migratory Bird Treaty Act (MBTA) and Chapter 64 of the PWC regarding nongame bird protections, perform the following BMP:

- Avoid vegetation clearing activities during the general bird nesting season, March through August, to minimize adverse impacts to birds. Note that some birds, especially birds of prey, may begin nesting as early as October (i.e., bald eagles) or December (i.e., great horned owls (*Bubo virginianus*)).
- Prior to construction, perform daytime surveys for nests including under bridges and in culverts to determine if they are active before removal. Nests that are active should not be disturbed. An active nest is a nest that contains an egg, nestling, or is being used by a nestling or fledgling. If active

nests are observed during surveys, TPWD recommends a 150-foot buffer of vegetation remain around the nests until the young have fledged or the nest is no longer active.

- Do not disturb, destroy, or remove active nests, including those of ground nesting birds, during the nesting season.
- If unoccupied, inactive nests will be removed, ensure that nests are not protected under the Endangered Species Act (ESA), MBTA, or BGEPA.
- Prevent the establishment of active nests during the nesting season on TxDOT owned and operated facilities and structures proposed for replacement or repair.
- Do not collect, capture, relocate, or transport birds, eggs, young, or active nests without a permit.
- Minimize extended human presence near nesting birds during construction and maintenance activities. Protect sensitive habitat areas with temporary barriers or fencing to limit human foot-traffic and off-road vehicle use to alert and discourage contractors from causing any unintentional impacts.
- Minimize construction noise above ambient levels during general bird nesting season to minimize adverse impacts on birds.
- Minimize construction lighting during the general bird nesting season by scheduling work activities between dawn and dusk.

2.2.2 Rookeries BMP

In general, nesting dates for herons and egrets range from early February to late August in Texas, depending on the species. Great blue herons (GBHE) (*Ardea herodias*) are usually the first to nest. When GBHE get disrupted from the nest and abandon nesting, then the other species of herons and egrets may not attempt to nest at the colony that year. The status of a rookery can be verified by site surveys during the nesting season, which varies for different rookery species. Breeding dates for rookery species are approximately as follows:

Species	Dates
Black-crowned night heron	Early February to late July
Cattle egret	Early April to late October
Great blue heron	February to late August
Great egret	Early March to early August
Little blue heron	Late March to late July
Reddish egret	Early March through late July
Snowy egret	Late March to early August
White-faced ibis	Early April through late July

- TXNDD rookery occurrences within the project area should be surveyed during the nesting season to field-verify the rookery status as rookery location may have shifted in location or may no longer be active.
- If rookeries are encountered, avoid and minimize disturbance during nesting to protect rookery species and their habitat.

- Vegetation clearing in a primary buffer area of 300 meters (984 feet) from a rookery or heronry periphery should be avoided. Utilizing areas that have already been cleared within this buffer area may be acceptable depending on site-specific characteristics. Additionally, human foot-traffic or machinery use should not occur within this buffer area during the nesting season.
- Clearing activities or construction using heavy machinery in a secondary buffer area of 1,000 meters (3,281 feet) from the heronry periphery should be avoided during the breeding season (courting and nesting).

2.3 Fish BMP

The following Fish BMP apply to projects for all fish species in waters of the state to minimize impacts to water quality and aquatic passage from transportation projects.

- For projects in waters of the state and work is adjacent to water: Water Quality and Stream Crossing BMP.
- For projects in waters of the state and work is in the water: Water Quality, Stream Crossing, and Dewatering BMP.

2.4 Invertebrate BMP

2.4.1 Aquatic Invertebrate BMP

The following Aquatic Invertebrate BMP apply to projects within the range and in suitable habitat for all aquatic invertebrate SGCN and that are also listed on TPWD's RTEST online application.

- For projects within the range of a SGCN or state-listed species and work is adjacent to water: Water Quality and Stream Crossing BMP.
- For projects within the range of a SGCN or state-listed species and work is in the water: Water Quality, Stream Crossing, and Dewatering BMP.
- For spring-seep associated caddisflies (*Cheumatopsyche morsei, Chimarra holzenthali*, and *Hydroptila ouachita*): Avoid or minimize impacts to the natural riparian buffer along stream channel including native shrubs and trees.

2.4.2 Crayfish BMP

The following Crayfish BMP apply to projects within the range and in suitable habitat for all crayfish SGCN and that are also listed on TPWD's RTEST online application. It is difficult to confirm absence of some aquatic and burrowing crayfish species depending on the season, rainfall conditions, and drought or flood conditions; therefore, assume presence in suitable habitat from reported historic locations, and implement the following BMP.

- For projects within the range of a SGCN or state-listed species and work is adjacent to water: Water Quality and Stream Crossing BMP.
- For projects within the range of a SGCN or state-listed species and work is in the water: Water Quality, Stream Crossing, and Dewatering BMP.

- Avoid or minimize impacts to the natural riparian buffer that provides terrestrial and aquatic plant matter for the diet of most crayfish species.

2.4.3 Freshwater Mussel BMP

The following Freshwater Mussel BMP apply to projects within the range and in suitable habitat for all freshwater mussel SGCN listed on TPWD's RTEST online application.

- In addition to Water Quality and Stream Crossing BMP, follow the most recent, *"TPWD–TxDOT Annual Work Plan for Pre-Construction Surveys, Aquatic Resources Relocations, and Other Best Management Practices to Avoid, Minimize, and Mitigate Impacts to Freshwater Resources."*
- When work is adjacent to the water: Water Quality BMP implemented as part of the TCEQ Stormwater Pollution Prevention Plan (SWP3) for a construction general permit or any conditions of the 401 Water Quality Certification for the project will be implemented. (Note: SWP3 and 401 BMP are not listed in this document).

2.4.4 Insect Pollinator BMP

The following Insect Pollinator BMP apply to projects within the range and in suitable habitat for insect SGCN found below and that are also listed on TPWD's RTEST online application.

- Mowing should only be applied to 30% or less of a site in a given year when practical. In general, mowing is inadequate for management of native insect pollinator habitat in the long term, except to remove annual non-native plants during establishment (i.e., high-mowing before they flower) or to facilitate a light disking. When conducted, it should be done post bloom or when host plants have gone dormant for the growing season. This can also be done by leaving strips of habitat farthest from road or highway corridors un-mowed when practical.
- If mowing is required during a period of active bloom or high pollinator activity it should be implemented during the heat of the day and with a high mower deck to allow for pollinators to escape and to give late season blooming species a chance to recover and bloom.
- Deep soil disturbances, such as tilling or deep disking in areas that host aggregations of ground-nesting bees should be avoided. Tilling and disking also may promote the invasion or germination of non-native plants. Different species of native ground-nesting bees prefer different soil conditions, although research suggests that many ground nesting bees prefer sandy, loamy sand or sandy loam soils. In areas with these soil types consider leaving open patches of soil.
- Allow dead trees to stand (so long as they do not pose a risk to property or people) and protect shrubs and herbaceous plants with pithy or hollow stems (e.g., cane fruits, sumac, elderberry), as these provide nesting habitat for tunnel-nesting native bees.
- Retain dead or dying branches whenever it is safe and practical at the edges of the ROW. Wood-boring beetle larvae often fill dead trees and branches with narrow tunnels into which tunnel-nesting bees will establish nests. Additionally, bumble bees may choose to nest in wood piles.
- Retain rotting logs at edges of the ROW where some bee species may burrow tunnels in which to nest.
- Protect sloped or well-drained ground sites where plants are sparse and direct access to soil is available. These are the areas where ground-nesting bees may dig nests. Turning the soil destroys

all ground nests that are present at that depth and hinders the emergence of bees that are nesting deeper in the ground.

- Protect grassy thickets or other areas of dense, low cover from mowing or other disturbance. These are the sites where bumble bees might find the nest cavities they need, as well as annual and perennial wildflowers that can provide important food resources.
- Where available and economical, native plants and seeds should be procured from local eco-type providers. Seed mixes should be diverse and include as many ecoregion natives as possible ensuring full season floral resources. Species by Texas ecoregion can be found in the Texas Management Recommendations for Native Insect Pollinators in Texas document: https://tpwd.texas.gov/publications/pwdpubs/media/pwd_bk_w7000_1813.pdf.
- Planting at least three different native flowering plants within each of three blooming periods are recommended (spring, summer, early fall) in high rainfall regions of Texas. In drier regions of the state, a target of three native flowering plants within each of two blooming periods can be used.
- In areas along the I-35 corridor of central Texas, consider increasing fall blooming nectar resources as this is a critical time period of monarch butterflies (*Danaus plexippus*) and nesting bees and has been identified as a critical need for these species in Texas.
- Habitat enhancements for native pollinators should include at least one native bunchgrass adapted to the site.
- Utilize an Integrated Pest Management Strategy (IPM) strategy for controlling weedy or invasive plants by minimizing broad use of certain herbicides and surfactants in close proximity to intact habitats utilized by native pollinators. Reduce application timing to periods of low pollinator activity and not during peak bloom season.

Insects		
Common Name	**Status**	**Scientific Name**
a leafcutter bee		*Megachile parksi*
a moth		*Syssphinx blanchardi*
American bumblebee		*Bombus pensylvanicus*
Bay skipper		*Euphyes bayensis*
Blanchards sphinx moth		*Adhemarius blanchardorum*
Chisos metalmark		*Apodemia chisosensis*
Chisos skipperling		*Piruna haferniki*
Dolan Falls perdita		*Perdita dolanensis*
Manfreda giant-skipper		*Stallingsia maculosus*
Poling's hairstreak		*Satyrium polingi*
Sage sphinx moth		*Lintneria eremitoides*
Scarce streaky-skipper		*Celotes limpia*
Tamaulipan agapema		*Agapema galbina*
Variable cuckoo bumble bee		*Bombus variabilis*

2.5 Mammal BMP

2.5.1 Small Mammal BMP

The following Mammal BMP apply to projects within the range and in suitable habitat for mammal SGCN below and that are also listed on TPWD's RTEST online application:

- For state-threatened Coues' rice rat (*Oryzomys couesi aquaticus):*
    - Minimize impacts to wetland, resaca, oxbow lake, and marsh habitats.
    - Water Quality BMP.

2.5.2 Fossorial Mammal BMP

The Fossorial Mammal BMP apply to projects within the range and in suitable habitat for mammal SGCN found below and that are also listed on TPWD's RTEST online application:

- If black-tailed prairie dog (BTPD) (*Cynomys ludovicianus*) burrows or pocket gopher mounds are to be excavated/directly impacted inform TPWD Transportation Liaison during initial collaborative review phase.
- When a construction zone is adjacent to active BTPD burrows or pocket gopher mounds, erect barriers to discourage individuals moving through or into the construction area.
- When seeding or revegetation is planned in an area adjacent to BTPD burrows or pocket gopher mounds, a vegetative barrier should be considered in the planting to discourage dispersal into the ROW.

Fossorial Mammals		
Common Name	**Status**	**Scientific Name**
Black-tailed prairie dog		*Cynomys ludovicianus*
Guadalupe southern pocket gopher		*Thomomys bottae guadalupensis*
Limpia Creek pocket gopher		*Thomomys bottae texensis*
Limpia southern pocket gopher		*Thomomys bottae limpiae*
Llano pocket gopher		*Geomys texensis texensis*

2.5.3 Bat BMP

The following Bat BMP apply to projects within the range and in suitable habitat for all bat SGCN and that are also listed on TPWD's RTEST online application. Review the habitat descriptions for species of interest on RTEST and other trusted resources to determine the appropriate beneficial management practice to avoid or minimize impacts to bats. All bat surveys and other activities that include direct contact with bats shall comply with USFWS-recommended white-nose syndrome response protocols located at: https://www.whitenosesyndrome.org/mmedia-education/national-wns-decontamination-protocol-u-s.

The following survey and exclusion protocols should be followed prior to commencement of construction activities. For the purposes of this document, structures are defined as bridges, culverts (concrete or metal), wells, and buildings.

- Inform TPWD Transportation Liaison during initial collaborative review phase for projects that may impact any SGCN bat species.
- If identification of a bat species is in question, consult with TPWD or a qualified TxDOT biologist during initial collaborative review phase. To assist with species identification, please take photographs without disturbing bat species, particularly if they are in torpor.
- For activities that have the potential to impact structures, cliffs or caves, or trees; a qualified biologist will perform a habitat assessment and occupancy survey of the feature(s) with roost potential as early in the planning process as possible or within one year before project letting. Surveys should also be conducted at the time of year at which planned activities will take place (i.e., if construction activities are scheduled to take place in winter, then a qualified biologist should perform occupancy surveys at the site during winter and not during the summer).
- For roosts where occupancy is strongly suspected but unconfirmed during the initial survey, revisit feature(s) at most four weeks prior to scheduled disturbance to confirm absence of bats.
- Bat surveys of structures should include visual inspections of structural fissures (cracked or spalled concrete, damaged or split beams, split or damaged timber railings), crevices (expansion joints, space between parallel beams, spaces above supports piers), and alternative structures (drainage pipes, bolt cavities, open sections between support beams, swallow nests) for the presence of bats.
- If bats are present or recent signs of occupation (i.e., piles of guano, distinct musky odor, or staining and rub marks at potential entry points) are observed, take appropriate measures to ensure that bats are not harmed, such as implementing non-lethal exclusion activities or timing or phasing of construction.
- If feature(s) used by bats are removed as a result of construction, replacement structures should incorporate bat-friendly design or artificial roosts should be constructed to replace these features.
- Conversion of property containing cave or cliff features to transportation purposes should be avoided.
- Avoid unnecessary removal of dead fronds on native and ornamental palm trees in south Texas (Cameron, Hidalgo, Willacy, Kenedy, Brooks, Kleberg, Nueces, and San Patricio counties) from April 1 through October 31. If removal of dead fronds is necessary at other times of the year, limit frond removal to extended warms periods (nighttime temperatures $\geq$ 55°F for at least two consecutive nights), so bats can move away from the disturbance and find new roosts.
- Large hollow trees, snags (dead standing trees), and trees with shaggy bark should be surveyed for colonies and, if found, should not be disturbed until the bats are no longer occupying these features. Post-occupancy surveys should be conducted by a qualified biologist prior to tree removal from the landscape.
- Retain mature, large diameter hardwood forest species and native/ornamental palm trees.
- If gating a cave or abandoned mine is desired, consult with TPWD before installing gates. Gating should only be conducted by qualified groups with a history of successful gating operations. Gate designs must be approved by TPWD.
- In all instances, avoid harm or death to bats. Bats should only be handled as a last resort and after communication with TPWD.
- Coordinate with TPWD about the latest bat handling restrictions and protocols involving COVID-19 and bat handling. In general, all staff must follow the guidelines listed below:

    - Do not handle bats if not part of a critical or time-sensitive research project. *Contact TPWD to discuss your project needs before beginning work.*
    - Bats should only be handled by rabies vaccinated individuals with valid checks within the last two years.
    - All participants must be COVID-vaccinated with the most up-to-date vaccine. Anyone displaying COVID symptoms should be tested prior to working with bat species. Research has shown that COVID is easily transmittable to bats.
    - Wear a face mask to minimize the exchange of respiratory droplets, such as a surgical mask, dust mask, or cloth mask when within 6 feet of a living bat.
    - Use disposable exam gloves or other reusable gloves (e.g., rubber dish-washing gloves) that can be decontaminated to prevent the spread of pathogens. Do not touch your face or other potentially contaminated surfaces with your gloves prior to handling bats.
    - Limit handling to as few handlers as possible.
    - Do not blow on bats for any reason.
    - Do not eat, drink, or smoke in proximity to bats.
    - Use separate temporary holding containers for each bat such as fabric bags that can be decontaminated between bats. Fabric bags should be turned inside out so that bats do not get caught on loose threads and should be hung up to allow the bat to maintain a roosting position. Disposable paper bags can be used if fabric bags are not feasible.
    - Caves housing bats should be avoided unless absolutely necessary.
- Before excluding bats from any occupied structure, bat species, weather, temperature, season, and geographic location must be incorporated into any exclusion plans to avoid unnecessary harm or death to bats. Winter exclusion must entail a survey to confirm either, 1) bats are absent or 2) bats are present but active (i.e., continuously active – not intermittently active due to arousals from hibernation).
    - Avoid using materials that degrade quickly, like paper, steel wool or rags, to close holes.
    - Avoid using products or making structural modifications that may block natural ventilation, like hanging plastic sheeting over an active roost entrance, thereby altering roost microclimate.
    - Avoid using chemical and ultrasonic repellents.
    - Avoid use of silicone, polyurethane or similar non-water-based caulk products.
    - Avoid use of expandable foam products at occupied sites.
    - Avoid the use of flexible netting attached with duct tape.
    - Avoid the use of tape.
- In order to avoid entombing bats, exclusion activities should be only implemented by a qualified individual. A qualified individual or company should possess at least the following minimum qualifications:
    - Experience in bat exclusion (the individual, not just the company).
    - Proof of rabies pre-exposure vaccinations.
    - Demonstrated knowledge of the relevant bat species, including maternity season date range and habitat requirements.
    - Demonstrated knowledge of rabies and histoplasmosis in relation to bat roosts.
- Exclusion devices can be installed by a qualified individual between September 1 and March 31. Exclusion devices should be used for a minimum of seven days, when minimum nighttime

temperatures are above 50°F AND minimum daytime temperatures are above 70°F. Prior to exclusion, ensure that alternate roosting habitat is available in the immediate area. If no suitable roosting habitat is available, installation of alternate roosts is recommended to replace the loss of an occupied roost. If alternate roost sites are not provided, bats may seek shelter in other inappropriate sites, such as buildings, in the surrounding area.

- Contact TPWD for additional resources and information to assist in executing successful bat exclusions that will avoid unnecessary harm or death in bats.

2.6 Amphibian and Reptile BMP

2.6.1 Aquatic Amphibian and Reptile BMP

The following Aquatic Amphibian and Reptile BMP apply to projects within the range and in suitable habitat for herpetofauna SGCN listed below and that are also listed on TPWD's RTEST online application. Please note that some species may require both aquatic and terrestrial BMP. It is difficult to confirm absence for most species of amphibians and reptiles; therefore, assume presence in suitable habitat and implement the following BMP.

- Inform TPWD Transportation Liaison during initial collaborative review phase for projects that may affect habitat for the following species:
    - Black-spotted newt (*Notophthalmus meridionalis)*
    - Cascade Caverns salamander (*Eurycea latitans)*
    - Texas salamander (*Eurycea neotenes)*
    - Brazos water snake (*Nerodia harteri)*
    - Concho water snake (*Nerodia paucimaculata)*
- For projects within existing ROW when work is in water or will permanently impact a water feature and potential habitat exists for the target species complete the following:
    - Minimize impacts to wetlands, temporary and permanent open water features, including depressions and riverine habitats.
    - Maintain the existing hydrologic regime and any connections between wetlands and other aquatic features.
    - Use barrier fencing to direct animal movements away from construction activities and areas of potential wildlife-vehicle collisions in construction areas directly adjacent, or that may directly impact, potential habitat for the target species.
    - Apply hydromulching and/or hydroseeding in areas for soil stabilization and/or revegetation of disturbed areas around wetlands and in riparian areas. If erosion control blankets or mats will be used, select wildlife-friendly products from TxDOT's Approved Products List. Products should contain no netting or contain loosely woven natural fiber netting in which the mesh design allows the threads to move, therefore allowing expansion of the mesh openings to prevent wildlife entanglements. Hydromulch that contains microplastics and plastic netting should be avoided.
    - Project specific locations (PSLs) proposed within state-owned ROW should be located in uplands away from aquatic features.
    - Limit use of herbicides for vegetation management around aquatic habitat to minimize impacts to aquatic species.

    - When work is directly adjacent to the water, minimize impacts to shoreline basking sites (e.g., downed trees, sand bars, exposed bedrock) and refugia/overwinter sites (e.g., brush and debris piles, crayfish burrows, aquatic logjams, and leaf packs).
    - If gutters and curbs are part of the roadway design, install gutters that do not include the side box inlet and include sloped (i.e., mountable) curbs to allow small animals to leave roadway. If this modification to the entire curb system is not possible, install sections of sloped curb on either side of the storm water drain for several feet to allow small animals to leave the roadway. Priority areas for these design recommendations are those with nearby wetlands or other aquatic features.
- For projects that require acquisition of additional ROW and work within that new ROW is in water or will permanently impact a water feature, implement BMP for projects within existing ROW above plus those below:
    - For sections of roadway adjacent to wetlands or other aquatic features, install wildlife barriers that prevent climbing. Barriers should terminate at culvert openings in order to funnel animals under the road. The barriers should be of the same length as the adjacent feature or 80 feet long in each direction, or whichever is the lesser of the two.
    - For culvert extensions and culvert replacement/installation, incorporate measures to funnel animals toward culverts, such as concrete wingwalls and barrier walls with overhangs.
    - When riprap or other bank stabilization devices are necessary, their placement should not impede the movement of terrestrial or aquatic wildlife through the water feature. Biotechnical streambank stabilization methods using live native vegetation or a combination of vegetative and structural materials should be used.

2.6.2 Terrestrial Amphibian and Reptile BMP

The following Terrestrial Amphibian and Reptile BMP apply to projects within the range and in suitable habitat for herpetofauna SGCN listed below and that are also listed on TPWD's RTEST online application. Please note that some species may require both aquatic and terrestrial BMP. It is difficult to confirm absence for most species of amphibians and reptiles; therefore, assume presence in suitable habitat and implement the following BMP.

- Inform TPWD Transportation Liaison during initial collaborative review phase for projects that may affect habitat for the following species:
    - Black-spotted newt (*Notophthalmus meridionalis)*
    - Brazos water snake (*Nerodia harteri)*
    - Concho water snake (*Nerodia paucimaculata)*
    - Tamaulipan spot-tailed earless lizard (*Holbrookia subcaudalis)*
    - Texas tortoise (*Gopherus berlandieri)*
- For open trenches and excavated pits, install escape ramps at an angle of less than 45 degrees (1:1) in areas left uncovered. Visually inspect excavation areas for trapped wildlife prior to backfilling.
- Avoid or minimize disturbing or removing cover objects, such as downed trees, rotting stumps, brush piles, and leaf litter. If avoidance or minimization is not practicable, consider removing cover objects prior to the start of the project and replace them at project completion.

- Examine heavy equipment stored on site before use, particularly after rain events when reptile and amphibian movements occur more often, to ensure use will not harm individuals that might be seeking temporary refuge.
- Due to increased activity (mating) of reptiles and amphibian during the spring, construction activities like clearing or grading should be scheduled outside of the spring (March-May) season. Also, timing ground disturbing activities before October when reptiles and amphibians become less active and may be using burrows in the project area is also encouraged.
- When designing roads with curbs, consider using Type I or Type III curbs to provide a gentle slope to enable turtles and small animals to get out of roadways.
- Evaluate incorporating the use of a conveyor belt gate to allow vehicle and equipment access across gated areas required for the exclusion of wildlife. Refer to Adhock et. Al. 2018 in Wildlife Society Bulletin's "*Partially buried conveyor belt to allow vehicular access across wildlife fencing*" available online at: https://doi.org/10.1002/wsb.906.
- If Texas tortoises (*Gopherus berlandieri*) or box turtles (*Terrepene* spp.) are present in a project area, they should be removed from the area and relocated no more than200 meters from the project area (i.e., short-distance translocation). The translocation of tortoises over longer distances should be avoided. Consult TPWD if a long-distance translocation is required. After removal of the individuals, the area that will be disturbed during active construction and project specific locations should be fenced off to exclude reentry by turtles, tortoises, and other reptiles. The exclusion fence should be constructed and maintained as follows:
    - The exclusion fence should be constructed with metal flashing or drift fence material.
    - Rolled erosion control mesh material should not be used.
    - The exclusion fence should be buried at least 6 inches deep and be at least 24 inches high.
    - The exclusion fence should be maintained for the life of the project and only removed after the construction is completed and the disturbed site has been revegetated.
- After project is complete, revegetate disturbed areas with an appropriate locally sourced native seed mix. If erosion control blankets or mats are used, select wildlife-friendly products from TxDOT's Approved Products List. Products should contain no netting or contain loosely woven natural fiber netting in which the mesh design allows the threads to move, therefore allowing expansion of the mesh openings to prevent wildlife entanglements. Plastic netting should be avoided.

Amphibians			
Common Name	**Status**	**Scientific Name**	**BMP**
Black-spotted newt	T	*Notophthalmus meridionalis*	1) Aquatic Amphibian and Reptile BMP 2) Terrestrial Amphibian and Reptile BMP 3) Water Quality BMP 4) Vegetation BMP
Blanco blind salamander	T	*Eurycea robusta*	1) Aquatic Amphibian and Reptile BMP 2) Water Quality BMP

Amphibians			
Common Name	**Status**	**Scientific Name**	**BMP**
Blanco River Springs salamander		*Eurycea pterophila*	1) Aquatic Amphibian and Reptile BMP 2) Water Quality BMP
Cascade Caverns salamander	T	*Eurycea latitans*	1) Aquatic Amphibian and Reptile BMP 2) Water Quality BMP
Eastern tiger salamander		*Ambystoma tigrinum*	1) Aquatic Amphibian and Reptile BMP 2) Terrestrial Amphibian and Reptile BMP 3) Water Quality BMP 4) Vegetation BMP
Gulf Coast waterdog		*Necturus beyeri*	1) Aquatic Amphibian and Reptile BMP 2) Water Quality BMP
Mexican burrowing toad	T	*Rhinophrynus dorsalis*	1) Aquatic Amphibian and Reptile BMP 2) Terrestrial Amphibian and Reptile BMP 3) Water Quality BMP 4) Vegetation BMP
Mexican tree frog	T	*Smilisca baudinii*	1) Aquatic Amphibian and Reptile BMP 2) Terrestrial Amphibian and Reptile BMP 3) Water Quality BMP 4) Vegetation BMP
Southern crawfish frog		*Lithobates areolatus areolatus*	1) Minimize impacts to wetland habitats including isolated ephemeral pools 2) Aquatic Amphibian and Reptile BMP 3) Terrestrial Amphibian and Reptile BMP 4) Water Quality BMP 5) Vegetation BMP
Spotted dusky salamander		*Desmognathus conanti*	1) Aquatic Amphibian and Reptile BMP 2) Terrestrial Amphibian and Reptile BMP 3) Water Quality BMP 4) Vegetation BMP

Amphibians			
Common Name	**Status**	**Scientific Name**	**BMP**
Strecker's chorus frog		*Pseudacris streckeri*	1) Aquatic Amphibian and Reptile BMP 2) Terrestrial Amphibian and Reptile BMP 3) Water Quality BMP 4) Vegetation BMP
Texas salamander	T	*Eurycea neotenes*	1) Aquatic Amphibian and Reptile BMP 2) Water Quality BMP
Valdina Farms sinkhole salamander		*Eurycea troglodytes*	1) Aquatic Amphibian and Reptile BMP 2) Water Quality BMP
White-lipped frog	T	*Leptodactylus fragilis*	1) Aquatic Amphibian and Reptile BMP 2) Terrestrial Amphibian and Reptile BMP 3) Water Quality BMP 4) Vegetation BMP
Woodhouse's toad		*Anaxyrus woodhousii*	1) Aquatic Amphibian and Reptile BMP 2) Terrestrial Amphibian and Reptile BMP 3) Water Quality BMP 4) Vegetation BMP

Reptiles			
Common Name	**Status**	**Scientific Name**	**BMP**
Alligator snapping turtle	T	*Macrochelys temminckii*	1) Minimize impacts to wetland and riverine habitats, including large woody debris. 2) Aquatic Amphibian and Reptile BMP 3) Water Quality BMP
Big Bend slider		*Trachemys gaigeae*	1) Aquatic Amphibian and Reptile BMP 2) Water Quality BMP

Reptiles			
Common Name	**Status**	**Scientific Name**	**BMP**
Black-striped snake	T	*Coniophanes imperialis*	1) Terrestrial Amphibian and Reptile BMP 2) Vegetation BMP
Brazos water snake	T	*Nerodia harteri*	1) Minimize impacts to suitable riverine habitats, particularly rock substrate within waterway and along the shoreline, along the upper Brazos River drainage 2) Avoid temporarily or permanently impounding water flow within suitable habitat 3) Aquatic Amphibian and Reptile BMP 4) Terrestrial Amphibian and Reptile BMP 5) Water Quality BMP
Cagle's map turtle	T	*Graptemys caglei*	1) Minimize impacts to riverine habitats in the Guadalupe and San Antonio River drainages 2) Minimize impacts to gently sloping sand banks within 30 feet of shoreline 3) Aquatic Amphibian and Reptile BMP 4) Water Quality BMP
Chihuahuan mud turtle	T	*Kinosternon hirtipes murrayi*	1) Aquatic Amphibian and Reptile BMP 2) Water Quality BMP
Concho water snake		*Nerodia paucimaculata*	1) Aquatic Amphibian and Reptile BMP 2) Terrestrial Amphibian and Reptile BMP 3) Water Quality BMP
Eastern box turtle		*Terrapene carolina*	1) Terrestrial Amphibian and Reptile BMP 2) Vegetation BMP
Gray-checkered whiptail		*Aspidoscelis dixoni*	1) Terrestrial Amphibian and Reptile BMP 2) Vegetation BMP
Keeled earless lizard		*Holbrookia propinqua*	1) Terrestrial Amphibian and Reptile BMP 2) Vegetation BMP

Reptiles			
Common Name	**Status**	**Scientific Name**	**BMP**
Mexican black-head snake		*Tantilla atriceps*	1) Terrestrial Amphibian and Reptile BMP 2) Vegetation BMP
Mexicanhooknose snake		*Ficimia streckeri*	1) Terrestrial Amphibian and Reptile BMP 2) Vegetation BMP
Mountain short-horned lizard	T	*Phrynosoma hernandesi*	1) Terrestrial Amphibian and Reptile BMP 2) Vegetation BMP
Northern cat-eyed snake	T	*Leptodeira septentrionalis septentrionalis*	1) Terrestrial Amphibian and Reptile BMP 2) Vegetation BMP
Pygmy rattlesnake		*Sistrurus miliarius*	1) Terrestrial Amphibian and Reptile BMP 2) Vegetation BMP
Plateau spot-tailed earless lizard		*Holbrookia lacerata*	1) Terrestrial Amphibian and Reptile BMP 2) Vegetation BMP
Prairie skink		*Plestiodon septentrionalis*	1) Terrestrial Amphibian and Reptile BMP 2) Vegetation BMP
Rio Grande river cooter		*Pseudemys gorzugi*	1) Aquatic Amphibian and Reptile BMP 2) Water Quality BMP
Salt marsh snake		*Nerodia clarkii*	1) Aquatic Amphibian and Reptile BMP 2) Water Quality BMP
Slender glass lizard		*Ophisaurus attenuatus*	1) Terrestrial Amphibian and Reptile BMP 2) Vegetation BMP
Smooth softshell		*Apalone mutica*	1) Aquatic Amphibian and Reptile BMP 2) Water Quality BMP
Southern painted turtle		*Chrysemys dorsalis*	1) Aquatic Amphibian and Reptile BMP 2) Water Quality BMP

Reptiles			
Common Name	**Status**	**Scientific Name**	**BMP**
Speckled racer	T	*Drymobius margaritiferus*	1) Terrestrial Amphibian and Reptile BMP 2) Vegetation BMP
Tamaulipan spot-tailed earless lizard		*Holbrookia subcaudalis*	1) Terrestrial Amphibian and Reptile BMP 2) Vegetation BMP
Texas diamondback terrapin		*Malaclemys terrapin littoralis*	1) Avoid disturbing basking and nesting sites 2) Aquatic Amphibian and Reptile BMP 3) Water Quality BMP
Common garter snake		*Thamnophis sirtalis*	1) Terrestrial Amphibian and Reptile BMP 2) Vegetation BMP
Texas horned lizard	T	*Phrynosoma cornutum*	1) Avoid harvester ant mounds in the selection of Project Specific Locations (PSLs). 2) Terrestrial Amphibian and Reptile BMP 3) Vegetation BMP
Texas map turtle		*Graptemys versa*	1) Aquatic Amphibian and Reptile BMP 2) Water Quality BMP
Texas scarlet snake	T	*Cemophora lineri*	1) Terrestrial Amphibian and Reptile BMP 2) Vegetation BMP
Texas tortoise	T	*Gopherus berlandieri*	1) Utility trenches should be covered overnight or visually inspected before filling to avoid burial of the species 2) Terrestrial Amphibian and Reptile BMP 3) Vegetation BMP
Trans-Pecos black-headed snake	T	*Tantilla cucullata*	1) Terrestrial Amphibian and Reptile BMP 2) Vegetation BMP
Western box turtle		*Terrapene ornata*	1) Terrestrial Amphibian and Reptile BMP 2) Vegetation BMP

Reptiles			
Common Name	**Status**	**Scientific Name**	**BMP**
Western chicken turtle		*Deirochelys reticularia miaria*	1) Aquatic Amphibian and Reptile BMP 2) Terrestrial Amphibian and Reptile BMP 3) Water Quality BMP 4) Vegetation BMP
Western massasauga		*Sistrurus tergeminus*	1) Terrestrial Amphibian and Reptile BMP 2) Vegetation BMP

APPENDIX A: TPWD ONLINE RESOURCES

Below is a list of online resources available on the Texas Parks and Wildlife Department's (TPWD) website.

Texas Parks and Wildlife Department
https://tpwd.texas.gov/

Ecological and Environmental Planning Program:
https://tpwd.texas.gov/huntwild/wild/wildlife_diversity/habitat_assessment/

State Wildlife Action Plan for Texas (SWAP):
State Wildlife Action Plan for Texas - TPWD

Texas Natural Diversity Database (TXNDD):
https://tpwd.texas.gov/huntwild/wild/wildlife_diversity/txndd/

Rare, Threatened, and Endangered Species of Texas By County Application (RTEST):
Rare, Threatened, and Endangered Species of Texas

Texas Ecosystem Analytical Mapper (EMST):
TEAM: Texas Ecosystem Analytical Mapper

Aquatic Resources Permitting and Consultation:
https://tpwd.texas.gov/landwater/water/environconcerns/permitting_consultation/index.phtml

Kills and Spills Team (KAST):
Kills and Spills Team Index (texas.gov)

Aquatic Invasive Species:
https://tpwd.texas.gov/huntwild/wild/species/exotic/

White-nosed Syndrome, Bats, State Parks, and Wildlife Management Areas:
https://tpwd.texas.gov/huntwild/wild/diseases/whitenose/

Management Recommendations for Native Insect Pollinators in Texas:
https://tpwd.texas.gov/publications/pwdpubs/media/pwd_bk_w7000_1813.pdf.

Wildlife Fact Sheets:
https://tpwd.texas.gov/huntwild/wild/species/

Texas Game Warden: Find Warden:
Texas Game Wardens - TPWD

Maps and GIS:
https://tpwd.texas.gov/gis/