

Chapter 4

Environmental Consequences

This chapter evaluates the potential direct and indirect impacts related to the No Action Alternative and each of the four action alternatives.

The federal action under consideration is primarily a planning and zoning action. The alternatives vary with respect to shoreline allocations, vegetation management, and consideration of specific zoning requests that, in turn, determine the potential number of private docks that could be built on the lake and the condition of the natural vegetation and habitats along the lakeshore. The alternatives would each have different buffer width ranges so there would be the potential for differential impacts.

Indirect effects also result from implementation, but are later in time or farther removed in distance, while still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems. For example, alternatives that allow for private docks would have the indirect effect of attracting residential development to the private lands adjacent to the government lands where private docks could be constructed. Therefore, the amount of Limited Development shoreline could have an indirect effect on resources through this influence on the location of residential development.

In general, the alternatives describe a continuum with respect to potential direct and indirect habitat impacts in the following order (from least to most significant potential negative impacts):

- Alternative 1
- Alternative 2
- No Action Alternative
- Alternative 3
- Alternative 4

To determine the significance of impacts, the severity of the potential impact is examined in terms of the type, quality and sensitivity of the resource involved, the duration of the effect (short- or long-term) and other considerations of context. A summary comparison of potential impacts by alternative is found in **Table 2-14** and **Table 4.12-1**.

4.1 Vegetation, Wetlands, and Aquatic Habitats

4.1.1 Assessment Methods and Significance Criteria (Vegetation, Wetlands, and Aquatic Habitats)

In considering potential impacts to terrestrial and aquatic habitats, this discussion begins with the No Action Alternative and progresses from Alternative 1, which emphasizes natural resource conservation,

sequentially through Alternative 4, which emphasizes recreational development opportunities and private shoreline uses.

The alternatives vary with respect to shoreline allocations, vegetation management, and consideration of specific zoning requests that, in turn, determine the amount of potential land disturbance and habitat alteration that might occur under each alternative. Potential direct and indirect effects of each alternative on existing terrestrial and aquatic habitats are evaluated. Direct effects result from implementation of an alternative and occur at the same time and place. For example, shoreline allocations allowed under a specific alternative would directly affect the number of docks that can be built and those docks will have direct effects on habitats and biota.

Indirect effects also result from implementation, but are later in time or farther removed in distance, while still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems. For example, alternatives that allow for private docks would have the indirect effect of attracting residential development to the private lands adjacent to the government lands, which would have an indirect effect on habitats outside of the government lands through the conversion of natural and agricultural lands to residential development.

To determine the significance of impacts, the severity of the potential impact is examined in terms of the type, quality and sensitivity of the resource involved, the duration of the effect (short- or long-term) and other considerations of context. Potential impacts to the habitat of an endangered or threatened species, for example, would be considered a significant negative impact if it would result in a “take” of that species. Filling of wetland habitat that cannot be mitigated would also be considered a significant negative impact. An alternative may also have a significant beneficial impact on habitat.

Fire suppression practices would not change under any of the alternatives because these practices are largely outside of USACE control; therefore, effects related to fire suppression are likely to be similar under all alternatives.

USACE generally honors past written commitments, such as permits related to vegetation modification practices. Any changes to vegetation management policies included within any proposed alternative would apply only to the issuance of new permits.

4.1.2 No Action Alternative (Vegetation, Wetlands, and Aquatic Habitats)

4.1.2.1 Potential Impacts on USACE Land

Vegetation Communities

Under the No Action Alternative, the future condition of the crosstimbers would likely be the same as that described for the existing condition outlined in Section 3.1.4.1. Therefore, this habitat would likely remain stable with losses concentrated in undeveloped areas adjacent to shorelines currently zoned Limited Development or Public Recreation.

The oak-hickory forest community resembles the crosstimbers in species composition and structure; therefore, the No Action Alternative would likely have similar potential impacts on both forested habitats. However, unlike the crosstimbers, spring 2012 habitat transects revealed very little variation in age structure in oak-hickory forests and little tree recruitment was evident. Therefore, the future condition under the No Action Alternative could become an unstable forest community if older trees die and are not

replaced, although, this would likely occur regardless of the SMP shoreline allocation or MP land classifications.

The future condition of oak-pine forests under the No Action Alternative would likely reflect the existing condition described in Section 3.1.4.3.

Under the No Action Alternative, the decreasing trend in the quantity and quality of riparian forests documented region-wide and in Section 3.1.4.4 would likely continue. While the largest tracts exist within the floodplains of the Deep Fork River and Gaines Creek, these bottomland forests are allocated to shoreline designations and land use classifications that are protective of natural habitats and would not be subject to shoreline reallocation. Therefore, the greatest habitat losses would likely occur in areas adjacent to shorelines currently zoned Limited Development or Public Recreation, particularly along smaller tributaries.

Under the No Action Alternative, the future condition of natural open habitats would likely be the same as the trend described under the existing condition. Prairie and savanna habitats would likely continue to exist in a poor and degraded condition. In addition to direct habitat conversion for human uses, natural open habitats are decreasing because woody species, especially eastern red-cedar, are expanding. This results in prairie habitats transitioning to savanna and savanna habitats to forest as a result of existing fire suppression practices, which are largely outside of USACE control.

Based on the analysis of impacts to vegetation over the past decade, it would be expected that similar trends would extend into the future. As adjacent private lands develop, forest and grassland vegetation is affected through vegetation clearing, permitted mowing, and both formal and informal lake access. On government lands adjacent to Limited Development shorelines between 1999 and 2011, forest cover decreased about 10 percent and grassland cover decreased about 34 percent. When the analysis focuses on areas that have actually experienced adjacent residential development over the last decade, forest cover on government lands still only declined about 10 percent but grasslands declined almost 50 percent. Grasslands on government lands appear to be converted to mowed grass and bare earth at a much higher rate than forest cover. Under the existing condition, there are 1,673 existing private boat docks. Using the minimum spacing of 50 feet between docks and an average dock width of 31.8 feet, there are approximately 26 miles of shoreline currently developed. If the observed declines in vegetative cover are assumed to be applied uniformly to the entire area currently developed, this would have affected about 3 percent of the total shoreline at Eufaula Lake.

There are currently 992 vegetative modification permits and 1,673 dock permits. Not all dock permits are associated with mowing permits and not all mowing permits are associated with dock permits. However, it is reasonable to assume that there is considerable overlap as people with docks generally also have a residence and may want to manage the vegetation for access to their dock, for views, and for fire safety. Because the number of mowing permits is only 60 percent of the number of dock permits, the number of mowing permits that are not also associated with a dock permit is likely small.

At the current low levels of development around the lake, many residential lots are likely wider than the minimum necessary to accommodate a dock, which would mean that a mowing permit could affect a longer length of shoreline than might be needed for the minimum spacing of docks. However, as Limited Development shorelines are built out, developers are likely to design subdivisions with narrower lake frontage or provide common access points for community docks. These situations are currently found in

some areas of the lake and are included in the analysis of vegetation change over time. Therefore, assessing potential impacts to shoreline vegetation based on the number of docks that may occur is appropriate.

On government lands adjacent to shorelines allocated to Limited Development (Low Density Recreation land classification), the forests currently cover about 60 percent of the area and grasslands cover about 7 percent. Based on the observed trend, forest cover would be expected to decline to about 54 percent and grasslands to about 4.6 percent under the No Action Alternative. While these grasslands may include some remnant prairie habitats, they are more likely already modified through the introduction of non-native species and past grazing or other vegetation modification.

When more than 10 percent of the forest cover of a watershed is cleared, it can have impacts on stormwater runoff patterns which affect aquatic systems within the watershed (Booth *et al.* 2002). However, the watershed surrounding Eufaula Lake is already impacted beyond this 10 percent threshold through clearing for agriculture and residential development, and oil and gas exploration. In addition, the lake is a reservoir that is already a highly modified aquatic environment. While it is expected that forest cover on the government lands immediately adjacent to the shorelines allocated as Limited Development (approximately 33 percent of the total shoreline) would continue to decline by about 10 percent as adjacent private lands develop, this additional decline would only affect another 109 miles or 13 percent of the shoreline at full build out under the No Action Alternative. A 10 percent decline in forest cover along 13 percent of the lake shore would not likely be a significant impact on habitat; however, there could be potential impacts to other resources such as water or visual quality from this predicted loss of vegetative cover.

An additional consideration would be the fact that the implementation of mowing permits would result in the loss of recruitment of new trees in areas subject to mowing. Mowing would prevent young trees from becoming established and replacing aging trees. Over time, this would disrupt the natural regeneration process where mowing is allowed and result in the loss of forest canopy. This effect could potentially impact all of the government lands adjacent to Limited Development shorelines or 10,209 acres. However, because the native tree species commonly found in the region tend to be very long-lived, this effect would perhaps not be noticed for several hundred years.

Wetlands and Aquatic Habitats

For shallow-water and wetland habitats, the No Action Alternative would continue to experience moderate development in areas adjacent to shorelines designated Limited Development or Public Recreation. Therefore, sedimentation rates and nutrient inputs would likely be similar to those described for the existing condition in the short-term, with gradually increasing levels expected as the percentage of developed shoreline increases and recreation levels rise.

In addition to potential impacts to littoral zone wetland and open water habitats along the shoreline, each alternative could potentially affect palustrine emergent and scrub-shrub wetlands located along stream floodplains and in wet upland depressions within the Eufaula Lake study area. The No Action Alternative would likely reflect the continued downward trend in wetland quantity and quality as described under the existing condition.

Under the No Action Alternative, the future condition of areas of standing dead timber would be the same as that described under the existing condition. Areas of standing dead timber would slowly be reduced

due to wind and wave action and decay. Some standing dead timber may also be removed to reduce navigation hazards, but most areas would likely remain untouched to provide ideal fish habitat.

Invasive Species

Under the No Action Alternative, no changes in land use allocations or vegetation management would occur and the threat of introduction and establishment of aquatic invasive species, such as hydrilla or Eurasian watermilfoil, would likely be similar to that described under the existing condition. However, already established invasive species that are primarily restricted by their own dispersal ability, like *Salvinia*, would likely expand. Nearby populations of invasive species could be introduced due to increased recreational use in the Eufaula Lake study area. All of the likely aquatic invasive plant species can reproduce by fragmentation, with fragments easily becoming attached to boats, trailers, and any other objects placed in infested waters.

The No Action Alternative would likely result in a future condition with moderate levels of introduction and establishment of terrestrial invasive species similar to that described under the existing condition. Even if eradication efforts are implemented, disturbed open habitats would likely continue to support Chinese lespedeza, tall fescue, and other invasive grasses and forbs, whereas forested habitats close to human disturbance would likely contain Japanese honeysuckle or Chinese privet. The continued success of these invasive species would be due primarily to their superior competitive, reproductive, and dispersal abilities. The threat of new invasions would be moderate and the spread of existing invasive species would most likely continue along disturbance corridors (*e.g.*, roads and utility easements), especially in areas designated Limited Development that have not yet been developed.

Rare, Unique, and Imperiled Vegetation

Under the No Action Alternative, any current populations of Blackfoot quillwort, Kentucky wisteria, and dwarf pipewort would likely remain in existing suitable habitats associated with Protected allocated shorelines. However, populations in areas along shorelines designated as Limited Development or Public Recreation would be at risk of potential future development and potential impacts associated with human disturbance.

4.1.2.2 Potential Impacts on Adjacent Private Lands

The No Action Alternative may have slight negative impacts on habitats due to some increases in development in areas adjacent to government-owned lands, particularly with respect to spread of invasives and protected vegetation, which may now be in areas subject to development.

Based on the analysis of impacts to vegetation over the past decade, it would be expected that similar trends would extend into the future. Private lands adjacent to shorelines allocated as Limited Development would likely continue to develop because of the amenities provided by lake access and the opportunity to construct private docks. There would be about 109 miles or 13 percent of the lakeshore still available for private dock construction and therefore prone to adjacent private residential development.

As adjacent private lands develop, forest and grassland vegetation is affected through vegetation clearing, permitted mowing, and both formal and informal lake access. On private lands adjacent to Limited Development shorelines between 1999 and 2011, forest cover decreased over 24 percent and grassland cover decreased by only 9 percent. When the analysis focuses on areas that have actually experienced adjacent residential development over the last decade, forest cover on private lands declined by almost 38 percent but grasslands declined by only 25 percent.

On private lands within 0.5 mile of shorelines allocated to Limited Development (Low Density Recreation land classification), forests currently cover about 46 percent of the area and grasslands cover about 31 percent. Based on the observed trend, forest cover would be expected to decline to about 35 percent and grasslands to about 29 percent under the No Action Alternative. This additional decline would only affect another 109 miles or approximately 13 percent of the shoreline at full build out under the No Action Alternative. The potential impact to habitats would not likely be significant; however, there could be potential impacts to other resources such as water or visual quality from this predicted loss of vegetative cover.

4.1.2.3 Significance of Impacts

The No Action Alternative is not likely to result in significant impacts that cannot be avoided or mitigated.

4.1.3 Alternative 1 (Vegetation, Wetlands, and Aquatic Habitats)

4.1.3.1 Direct Impacts

Vegetation Communities

Under Alternative 1, the quantity and quality of crosstimbers, oak-hickory, and oak-pine habitat would likely increase as compared to the condition described under the No Action Alternative. The establishment of extended vegetation management policy buffers would conserve more upland forest habitat along the lakeshore than would be protected under the No Action Alternative. The potential increase in shoreline miles allocated as Protected would also reduce the effects of fragmentation caused by urbanization, road construction, and utility right of ways and would help stem the widespread loss of native understory vegetation due to the introduction of exotic forbs associated with human disturbance.

Potential impacts of Alternative 1, with its significant emphasis on habitat conservation, would likely result in a future bottomland hardwood forest community similar to that described under the No Action Alternative. However, Alternative 1 differs from the No Action Alternative in that it would prevent future human disturbance and development in many areas now allocated as Limited Development. Less development would likely result in fewer sediment and nutrient inputs into these forested wetlands and could improve overall forest health.

In contrast to the No Action Alternative, the extended buffers implemented under Alternative 1 would likely conserve a large proportion of these stream bank and lakeshore forests. Despite increased protections, Alternative 1 would not address degradation of many areas of bottomland forest cut off from periodic floodwaters due to channelized streams, armored banks, and water management policies.

In addition, because there would still be vegetation modification allowed with a permit, the effect of mowing would, over time, be to prohibit recruitment of young trees in the areas being mowed. However, under Alternative 1, only 1,084 acres would potentially be subject to a mowing permit and most of that area (943 acres) would require the protection of a 70-foot buffer from the normal pool elevation. Therefore, the area potentially affected would be considerably less than under the No Action Alternative.

Alternative 1 would likely protect existing areas of savanna and prairie in their existing condition and prevent direct land conversion in areas not allocated as Limited Development or Public Recreation. The establishment of extended management buffers would conserve any open habitats immediately adjacent to the shoreline; however, most open habitats exist in flat upland areas far from the lakeshore and buffers may have little impact on overall protection of this habitat type. Alternative 1, unless accompanied by a future change in land management policy, likely would not curb the expansion of eastern red-cedar and

other woody plants or the increased abundance of exotic grasses and forbs into savanna and prairie habitats.

Wetlands and Aquatic Habitats

Under Alternative 1, the lacustrine littoral zone would likely see improved substrate heterogeneity, fewer algal blooms, and a reduction in construction of flood control structures as compared to the No Action Alternative. Under Alternative 1, only 605 additional private boat docks would be allowed. These factors would likely result in an increase in ecological function and value of shallow-water habitats throughout the study area.

Similarly, in comparison to the No Action Alternative, protections derived from land allocation changes and extended buffer implementation under Alternative 1 would likely improve vegetated wetland quality and quantity.

Under Alternative 1, areas containing stands of dead timber would either be reallocated as Protected or would not see a change in shoreline designation. Therefore, under this alternative, the future condition of areas of palustrine forested dead wetlands would largely be similar to that described under the No Action Alternative with removal restricted to areas that pose a hazard to navigation.

Invasive Species

Alternative 1, with its emphasis on habitat conservation, would do the most of all of the proposed action alternatives to curtail the introduction and spread of invasive species. It is widely accepted that healthy, protected ecosystems are more resilient and are better able to withstand invasion than those threatened by human disturbance and associated edge effects and system inputs. Therefore, under Alternative 1, an increase in shoreline miles allocated to the Protected designation and the implementation of extended buffers on shorelines where Limited Development is allowed would conserve greater amounts of core habitat areas that are better equipped to resist invasion.

Rare, Unique, and Imperiled Vegetation

Under Alternative 1, additional habitat within the study area would be protected thereby increasing the likelihood that rare and imperiled plant populations would be conserved. The implementation of extended management buffers would also conserve more acres of potential habitat, thus increasing the probability of survival for rare species.

4.1.3.2 Indirect Impacts

Of all the alternatives, Alternative 1 has the least potential to result in significant indirect impacts. Under Alternative 1, only 605 additional private boat docks would be allowed to be constructed, greatly reducing the attractiveness of the lake for new lakeside residential development. This would likely greatly reduce the potential for residential development adjacent to government lands and thus would reduce the potential impacts to vegetation cover associated with such developments.

4.1.3.3 Significance of Impacts

Alternative 1 would provide the greatest amount of protection to sensitive habitats of all the alternatives, including the No Action Alternative. Therefore, it has the greatest potential to result in a significant beneficial impact to vegetation communities, wetlands and aquatic habitats.

4.1.4 Alternative 2 (Vegetation, Wetlands, and Aquatic Habitats)

4.1.4.1 Direct Impacts

Vegetation Communities

In comparison to the No Action Alternative, an increase in shoreline miles allocated as Protected under Alternative 2 would reduce the potential for shoreline development (e.g., private dock construction), thereby conserving terrestrial habitats on properties unsuitable for docks or without existing adjacent subdivisions. The establishment of extended buffers would also conserve more natural resources than the No Action Alternative. However, Alternative 2 allocates far less shoreline as Protected in comparison to Alternative 1. Therefore, while Alternative 2 would offer less protection than Alternative 1, it would likely have similar types of potential impacts as Alternative 1 on terrestrial habitats due to the establishment of extended buffers and the likely decrease in development on adjacent lands associated with fewer areas of shoreline allocated as Limited Development.

While it would be expected that forest cover on the government lands immediately adjacent to the shorelines allocated as Limited Development (approximately 23 percent of the total shoreline under Alternative 2) would continue to decline as adjacent private lands develop, this additional decline would only affect another 65 miles or 8 percent of the shoreline at full build out under Alternative 2. It is also likely that with the implementation of the extended vegetation management buffer policy that the observed declines in forest cover would be less than the current observed rate of 10 percent. The vegetation management buffers would also likely be more protective of grasslands, resulting in a rate of decline less than the observed 34 percent. Therefore, potential impacts to habitats would not likely be significant.

In addition, because there would still be vegetation modification allowed with a permit, the effect of mowing would, over time, be to prohibit recruitment of young trees in the areas being mowed. However, under Alternative 2, only 5,367 acres would potentially be subject to a mowing permit and most of that area (4,325 acres) would require the protection of a 70-foot buffer from the normal pool elevation. Therefore, the area potentially affected would be considerably less than under the No Action Alternative.

Wetlands and Aquatic Habitats

In comparison to the No Action Alternative, an increase in shoreline miles allocated as Protected under Alternative 2 would reduce potential shoreline development, thereby conserving wetland areas on properties unsuitable for docks or without adjacent subdivisions. However, Alternative 2 allocates far less shoreline as Protected and allows more boat dock construction in comparison to Alternative 1 (which would only allow 605 new private boat docks to be constructed). Therefore, while Alternative 2 would likely have similar potential effects as Alternative 1 on open water and wetland habitats due to the establishment of extended vegetation management buffers, the potential benefits would be less pronounced due to fewer conserved shoreline miles and an increase in dock construction. Alternative 2 would result in fewer impacts than the No Action Alternative.

Invasive Species

In comparison to the No Action Alternative, Alternative 2, which increases areas designated Protected, would likely result in a decrease in the spread of established invasive species and would lessen the chances of new species introductions.

Rare, Unique, and Imperiled Vegetation

Under Alternative 2, there is less likelihood that protected species would be impacted than under the No Action Alternative. Although Alternative 2 designates less shoreline as Protected as compared to Alternative 1, it would likely have similar effects on populations of the rare and imperiled Blackfoot quillwort, dwarf pipewort, and Kentucky wisteria. These potential beneficial effects would result from the establishment of extended vegetation management buffers and the likely decrease in potential new development on adjacent lands.

4.1.4.2 Indirect Impacts

Similar to Alternative 1, Alternative 2 would offer more protection to habitats within and adjacent to the study area than the No Action Alternative and is therefore expected to have insignificant indirect habitat impacts.

Under Alternative 2, there would be about 65 miles or about 8 percent of the lakeshore still available for private dock construction and therefore prone to adjacent private residential development. Observed declines in vegetative cover on adjacent private lands would likely continue under Alternative 2 and would not be affected by the vegetation management buffers. It is also possible that with the reduced amount of shoreline available for private boat docks, adjacent residential developments could be designed to accommodate higher densities than has been typical in the region in the past.

While lot size is dependent on the amount of land needed to meet OKDEQ regulations for septic systems, development density would likely be regulated primarily by the limitations on the number of docks that could be constructed. Therefore, it is likely that the rates of vegetation conversion on private lands associated with high density developments would be more typical. The declines in forest and grassland cover can reach 23 percent and 77 percent, respectively, on private lands developed in high density residential. However, this potential for higher residential densities would be limited to the remaining 8 percent of the shoreline that would be available for private dock construction, and impacts may be partially offset by the 5 percent of the shoreline that would receive additional protection under Alternative 2; therefore, potential impacts would not likely be significant.

4.1.4.3 Significance of Impacts

Although the likelihood of negative impact to sensitive resources is greater under Alternative 2 than Alternative 1, it is less likely to have significant negative impacts than the No Action Alternative.

4.1.5 Alternative 3 (Vegetation, Wetlands, and Aquatic Habitats)

4.1.5.1 Direct Impacts

Vegetation Communities

Under Alternative 3, the potential for development of upland forest habitat would likely increase with the reallocation of lands from Protected to Limited Development. Limited Development would likely encourage the conversion of crosstimbers, oak-hickory, and oak-pine habitat due to an increasing number of private docks and associated infrastructure expansion. An increase in development would also likely result in an increase of herbicide use, which results in fewer closed-canopy forests and more open woodland and park-like settings (Schulz *et al.* 1992). This, in combination with mechanical vegetation removal of sub-canopy and ground layers, would favor a wildlife community that is more adapted to open woodland habitats. Despite the potential impacts of increased development, Alternative 3 establishes baseline vegetation management policy buffers, which, while smaller than the extended policy buffers,

would conserve more shoreline crosstimbers habitat than under conditions described for the No Action Alternative.

As previously described for the three upland forest habitats, Alternative 3 establishes baseline vegetation management buffers in Limited Development areas that would likely preserve large areas of bottomland hardwood forest. While baseline buffers would protect more bottomland hardwood habitat than under the No Action Alternative, less acreage would be protected under Alternative 3 than in both Alternatives 1 and 2, which would apply the extended vegetation management buffers.

It would be expected that forest cover on the government lands immediately adjacent to the shorelines allocated as Limited Development (approximately 46 percent of the total shoreline under Alternative 3) would continue to decline as adjacent private lands develop, and this additional decline would affect another 157 miles or almost 20 percent of the shoreline at full build out under Alternative 3. It is also likely that with the implementation of the baseline vegetation management buffer policy that the observed declines in forest cover would be less than the current observed rate of 10 percent. The vegetation management buffers would also likely be more protective of grasslands, resulting in a rate of decline less than the observed 34 percent. A less than 10 percent reduction in forest cover over 20 percent of the shoreline would result in a less than 2 percent reduction in forest cover around the lakeshore as a whole. Therefore, potential direct impacts to habitats on government lands would not likely be significant.

In addition, because there would still be vegetation modification allowed with a permit, the effect of mowing would, over time, be to prohibit recruitment of young trees in the areas being mowed. Under Alternative 3, 16,855 acres would potentially be subject to a mowing permit but most of that area (12,270 acres) would require the protection of a 45-foot buffer from the normal pool elevation. The area subject to mowing permits would still be about 45 percent larger than under the No Action Alternative although critical shoreline edges would be protected.

Wetlands and Aquatic Habitats

Within the Eufaula Lake study area lacustrine littoral zone and wetland habitats, Alternative 3 would likely have both beneficial and adverse impacts. In comparison to the No Action Alternative, the implementation of the buffers associated with the baseline vegetation management policy would directly conserve large areas of aquatic habitat. However, the positives derived from the implementation of baseline buffers would likely be offset by potential indirect impacts related to the increased development allowed under Alternative 3. Increased construction of private boat docks would likely lower the productivity of littoral habitats, lead to direct vegetation removal, and could promote invasive species establishment. A greater number of private boat docks would also increase recreation activity on the lake. The presence of more recreational activity in the shallows could lead to the removal of shoreline aquatic vegetation, increased spills and discarded trash, and additional littoral zone disruptions, especially in sandy beach areas. Shallow-water and wetland habitats are extremely sensitive ecosystems and any changes to sediment and nutrient inputs, community structure, or hydrology can quickly transform areas into upland or open water habitats.

While Alternative 3 reallocates 96 miles of shoreline from Protected to Limited Development, there is no specific proposal that would remove standing dead timber under this alternative. Therefore, the future condition under Alternative 3 would likely be similar to conditions described under the No Action Alternative with removal restricted to areas that pose a hazard to navigation.

The baseline vegetation management buffers implemented under Alternative 3 would provide protection from human disturbance and would help decrease the likelihood of invasive species expansion compared to the No Action Alternative. However, there would be a greater amount of shoreline allocated to Limited Development with a greater potential for land disturbance and its associated impacts, resulting in changes that make habitats more susceptible to invasion.

Invasive Species

A likely result of Alternative 3 implementation is the potential impact of higher human traffic in adjacent upland forest areas as people cross the government lands to access the lake and private docks. Higher levels of human traffic often results in a disturbed ground cover layer due to direct trampling and the introduction of invasive species. Under Alternative 3, additional dock construction would facilitate more boat usage and recreational opportunities, which are proven pathways for invasive introduction and establishment. Human influence also contributes to the expansion of eastern red-cedar, a species that adapts well to disturbance.

Rare, Unique, and Imperiled Vegetation

While the establishment of baseline vegetation management buffers under Alternative 3 would better conserve rare and imperiled plants than existing vegetation management policies under the No Action Alternative, Alternative 3 would likely result in greater disturbance and conversion of many natural habitats more than under the No Action Alternative. New development and an associated increase in recreational activity would increase the likelihood that any existing populations of rare, unique, or imperiled plant species would be extirpated.

4.1.5.2 Indirect Impacts

Alternative 3 has a greater potential to result in indirect habitat impacts than the No Action Alternative or Alternatives 1 and 2, but less potential than Alternative 4. Increased development under Alternative 3 in areas adjacent to government-owned land would likely disrupt natural hydrology and increase sediment and nutrient inputs through land disturbance activities including construction, increased impervious surfaces, and active vegetation management.

Development in oak-pine forests may be disproportionately high because they often occupy lakeshore ridges ideal for residential communities. Fragmentation of large areas of forest habitat would likely increase edge effects and increase the susceptibility of disturbed areas to invasive exotics. An increase in development would also likely result in an increase of herbicide use, which results in fewer closed-canopy forests and more open woodland and park-like settings (Schulz *et al.* 1992). This, in combination with mechanical vegetation removal of sub-canopy and ground layers, would favor a wildlife community that is more adapted to open woodland habitats.

The greatest potential impact of shoreline reallocations under Alternative 3 on bottomland hardwood forests would likely result from upstream development. Increased development under Alternative 3 would likely disrupt natural hydrology and increase sediment and nutrient inputs through land disturbance activities including construction, increased impervious surfaces, and active vegetation management.

Savanna and prairie habitats located on adjacent private lands are often small and embedded within larger tracts of forest. As such, they are some of the first areas identified for residential developments and infrastructure projects including roadways and utility easements. Savanna areas would likely experience selective vegetation removal where all but the largest trees are removed to establish parkland, residential

lawns, and easy lake access. Prairies would likely be seeded with turf grass for landscaping purposes in residential and recreational areas. Potential indirect impacts to savanna and prairie habitats would likely include herbicide use in adjacent road and utility rights-of-way that reduce the abundance and diversity of native forbs and shrubs.

Wetlands and aquatic habitats would likely also be affected by increased development, which would increase impervious surfaces and fertilizer use; thereby, increasing runoff of sediment and nutrients into Eufaula Lake's shallow-water habitats.

In addition to creating additional disturbance through development and associated road and infrastructure construction, residential development results in increased landscaping activities, which often introduce invasive species when they escape cultivation.

Under Alternative 3, there would be about 157 miles or about 20 percent of the lakeshore still available for private dock construction and therefore prone to adjacent private residential development. Observed declines in vegetative cover on adjacent private lands would likely continue under Alternative 3 and would not be affected by the vegetation management buffers. Since there would be more shoreline available for private dock construction than under the No Action Alternative, it is likely that development densities would be similar to the existing condition. Therefore, it is likely that the rates of vegetation conversion on private lands associated with residential developments would reflect the average rates described under the No Action Alternative. Under Alternative 3, over 10 percent of the forest cover on private lands within 0.5 miles of the government lands allocated as Limited Development could be lost under full build out; therefore, potential indirect impacts would likely be significant.

4.1.5.3 Significance of Impacts

The likelihood of significant impacts under Alternative 3 is greater than under the No Action Alternative.

4.1.6 Alternative 4 (Vegetation, Wetlands, and Aquatic Habitats)

4.1.6.1 Direct Impacts

Vegetation Communities

Compared to all other alternatives (including the No Action Alternative), Alternative 4 would likely result in potential terrestrial habitat impacts that are magnified and more widespread due to an increase in the number of shoreline miles being reallocated from Protected to Limited Development. In addition, eight miles of shoreline, most of which are concentrated adjacent to the proposed Carlton Landing development property, would be reallocated from Protected to Public Recreation. Shorelines designated Public Recreation are not subject to proposed vegetation management policy buffers and could result in greater potential impacts to terrestrial habitats in those areas.

Due to the fact that the majority of the proposed Carlton Landing development property consists of crosstimbers and oak-pine habitat, the level of development on this property would determine the quantity and quality of these habitats in that region. Full build-out allowed under Alternative 4 would lead to conversion of crosstimbers and oak-pine habitat to parkland and recreational facilities. Although the proposed public recreational facilities would retain areas of native vegetation, these areas would be highly disturbed by landscaping activities and high levels of foot and vehicle recreational traffic. Habitat conversion in the area could also impact future forest composition. Removal of nearby crosstimbers forests could eventually result in a greater percentage of oak-pine forest as shortleaf pine often regenerates faster than post or blackjack oak.

Savanna habitats are also present at the proposed Carlton Landing development property and occur in small openings within surrounding crosstimbers and oak-pine forests. Therefore, the potential impacts associated with Alternative 4 on savanna habitats would be similar to those described for the two forested habitats.

It would be expected that forest cover on the government lands immediately adjacent to the shorelines allocated as Limited Development (approximately 60 percent of the total shoreline under Alternative 4) would continue to decline as adjacent private lands develop, and this additional decline would affect another 213 miles or almost 26 percent of the shoreline at full build out under Alternative 4. It is also likely that with the implementation of the baseline vegetation management buffer policy that the observed declines in forest cover would be less than the current observed rate of 10 percent. The vegetation management buffers would also likely be more protective of grasslands, resulting in a rate of decline less than the observed 34 percent. A less than 10 percent reduction in forest cover over 26 percent of the shoreline would result in a less than 3 percent reduction in forest cover around the lakeshore as a whole. Therefore, potential direct impacts to habitats on government lands would not likely be significant; however, there could be potential impacts to other resources such as water or visual quality from this predicted loss of vegetative cover and localized impacts could be significant.

In addition, because there would still be vegetation modification allowed with a permit, the effect of mowing would, over time, be to prohibit recruitment of young trees in the areas being mowed. Under Alternative 4, 24,737 acres would potentially be subject to a mowing permit but most of that area would require the protection of either a 45-foot buffer or a 70-foot buffer from the normal pool elevation (17,305 and 2,980 acres, respectively). The area subject to mowing permits would be about 118 percent larger than under the No Action Alternative although critical shoreline edges would be protected.

Wetlands and Aquatic Habitats

Alternative 4 would likely result in types of aquatic habitat impacts similar to those described for Alternative 3. However, in comparison to all other alternatives (including the No Action Alternative), potential impacts would likely be magnified and more widespread due to an increased number of shoreline miles being reallocated from Protected to Limited Development and from Protected to Public Recreation. Additionally, more boat docks would be allowed under Alternative 4 than under Alternative 3. This increase in potential dock construction would also likely magnify potential impacts to shallow-water and wetland habitats.

Due to the extent of planned littoral zone development, potential impacts to shallow-water habitats under Alternative 4 would be most evident in and around the Carlton Landing area. The type of littoral zone activities planned for this area, including Roundtree Landing, would likely result in the clearing of native aquatic vegetation, removal of riparian vegetation, altering depth profiles, and removing native substrates. These activities would likely result in increased sedimentation, decreased water quality, and degraded habitat for aquatic invertebrates and fish.

Due to proposed removal of approximately 50 acres of standing dead timber to create a channel in Longtown Arm at Carlton Landing, Alternative 4 would have the greatest potential of all alternatives (including the No Action Alternative) to impact palustrine forested dead wetlands and other standing dead timber habitats. Removal of standing dead timber greatly impacts the underwater environment. It deprives fish of optimal habitat and may disrupt water flow and substrate immediately surrounding the dead trees.

Invasive Species

In comparison to all other alternatives (including the No Action Alternative), potential impacts would likely be magnified and more widespread due to an increased number of shoreline miles being reallocated from Protected to Limited Development and Public Recreation. Invasive introduction and expansion into aquatic and terrestrial habitats would be likely because both development and recreational activities provide primary pathways for the immigration of invasive species.

Rare, Unique, and Imperiled Vegetation

Compared to all other alternatives (including the No Action Alternative), Alternative 4 has the greatest potential to result in impacts to Blackfoot quillwort, dwarf pipewort, and Kentucky wisteria populations. Potential impacts would likely be magnified and more widespread due to an increased number of shoreline areas that would be reallocated from Protected to Limited Development and Public Recreation. The increased scope of potential impacts under Alternative 4 would increase the probability that rare and imperiled plant communities would be affected by activities associated with development and recreation.

Full build-out of the proposed Carlton Landing development would not be likely to have any impacts on the three rare and imperiled species because the property proposed for development lacks the specific habitat conditions necessary for the growth of these species.

4.1.6.2 Indirect Impacts

Of all the alternatives, Alternative 4 has the greatest potential to have indirect habitat impacts because it is likely to result in the greatest amount of development in areas adjacent to government-owned lands. Development would likely disrupt natural hydrology and increase sediment and nutrient inputs through land disturbance activities including construction, increased impervious surfaces, and active vegetation management.

Under Alternative 4, there would be about 213 miles or about 26 percent of the lakeshore still available for private dock construction and therefore prone to adjacent private residential development. The observed declines in vegetative cover on adjacent private lands would likely continue under Alternative 4 and would not be affected by the vegetation management buffers. Since there would be more shoreline available for private dock construction than under the No Action Alternative, it is likely that the pattern of residential development and typical densities would be similar to the existing condition. Therefore, it is likely that the rates of vegetation conversion on private lands associated with residential developments would reflect the average rates described under the No Action Alternative. Under Alternative 4, over 14 percent of the forest cover on private lands within 0.5 miles of the government lands allocated as Limited Development could be lost under full build out; therefore, potential indirect impacts would likely be significant.

4.1.6.3 Significance of Impacts

Alternative 4 has the greatest likelihood of all alternatives to result in significant negative impacts to vegetation communities, wetlands and aquatic habitats.

4.1.7 Potential Mitigation Measures (Vegetation, Wetlands, and Aquatic Habitats)

Mitigation includes avoidance, minimization, rectification, reduction, and compensation for potential impacts associated with an action (40 CFR 1508.20). To mitigate for potential impacts of human

disturbance on terrestrial and aquatic habitats and the natural resources that reside therein, USACE would implement the mitigation measures described in the following sections as appropriate.

4.1.7.1 Shoreline Construction

Under the No Action Alternative and the four action alternatives, the majority of potential shoreline construction on government land would likely consist of paths, boardwalks, fencing, and other structures involved with lake and boat dock access. Construction contractors would implement Best Management Practices (BMPs) to avoid and minimize potential temporary construction impacts for the installation of shoreline structures. These BMPs would be included as conditions of shoreline permit approvals and include:

- Minimize the amount of clearing and exposed soil to control potential sedimentation and erosion.
- Bring in suitable fill as needed.
- Protect existing drain inlets from debris, soil, and sedimentation.
- Install sedimentation and erosion controls prior to beginning construction activities.
- Schedule land stabilization activities, such as landscaping, immediately after land has had final contouring.
- Protect streams, wetlands, forests, and other natural areas from any unnecessary construction activities or disturbance.

4.1.7.2 Boat Dock/Marina Construction

Most of the potential shoreline construction activity under the alternatives would likely be connected to boat dock and marina construction. Although no shoreline reallocation is proposed under the No Action Alternative, the maximum number of boat docks that could be potentially constructed would be significantly more than the number of existing docks; therefore, construction activity would be expected. The four action alternatives would likely result in varying degrees of boat dock and marina construction. Alternatives 1 and 2 would allow less than the potential total allowed under the No Action Alternative. Alternatives 3 and 4 would allow more than the potential total allowed under the No Action Alternative. In addition, Alternative 4 would allow for the construction of a marina at the proposed Carlton Landing development site.

Boat dock construction would likely adversely impact shoreline wetlands and littoral zones and the species occupying these fragile habitats. Approvals for boat dock and marina construction would include the following measures to minimize potential impacts to the surrounding shoreline:

- Adherence to the National Oceanic and Atmospheric Administration's (NOAA) voluntary Clean Marina Initiative. Lakes under this program typically require foam floats encapsulated with concrete, wood, galvanized steel, plastic, or fiberglass. Foam floats on new docks at Eufaula Lake are currently required to be encapsulated.
- Mitigation for minor potential impacts to local fisheries and other aquatic wildlife as suggested by USFWS and ODWC.

Within the Eufaula Lake study area, only floating docks are permitted. Therefore, mitigation for environmental concerns specifically attributed to floating docks should be considered and already established BMPs should be continued. According to the *Flotation Analysis for Boat Docks on U.S. Army Corps of Engineers Projects* published by the Little Rock District, the most common type of dock flotation is expanded polystyrene foam (EPS) (Marcy and Jackson 2009).

BMPs for floating facilities and flotation product recommendations include:

- using floatable foams encapsulated in polyethylene or other surface covering,
- closed-cell polyethylene, and
- dedicated plastic float drums.

Several additional measures may minimize the potential impact of floating dock construction and long-term deployment on the surrounding shoreline environment. Additional BMPs are related to construction techniques and the recycling of old flotation where feasible and available (Marcy and Jackson 2009). These measures may be added to shoreline permit approvals as appropriate.

Additional best practices include:

- Dock structure protection – to keep floats from contacting the lake bottom, add legs to the float when installed to keep it a few inches off the lake bottom to prevent punctures. The legs should be cut to the lake bottom contour and allow the dock to rest fairly level for extended periods of time when the lake level is low.
- Management of existing materials during construction and remodeling - All foam and debris would be contained with a floating boom; old foam would be recycled through the foam installer, contractor, or garbage hauler; and the area would be cleaned of dislodged foam particles prior to the close of construction.
- Ultra-violet protection - Protection against ultra-violet deterioration would be addressed with ultra-violet inhibitors and/or carbon black pigment
- Impermeability - Flotation material should be fire resistant and impervious to water and damage from gasoline and other marine fuels
- Protected species requirements - Additional flotation design requirements would be used as applicable for protected species

4.1.7.3 Wetlands and Surface Waters

Alternatives 1 and 2, which emphasize shoreline conservation, would likely result in less disturbance and degradation of wetlands and surface waters over time than the No Action Alternative or Alternatives 3 and 4. Under the No Action Alternative and Alternatives 3 and 4, the potential construction of significant numbers of additional boat docks in areas designated as Limited Development would likely result in wetland and surface water degradation.

BMPs that could avoid and minimize disturbance to shoreline wetlands and surface waters would include the following measures that would be included in shoreline permit approvals as appropriate:

- Do not remove or damage vegetation growing in wetlands.
- Do not operate heavy equipment in wetlands.
- Do not disturb the ground surface in wetlands, except in the fill area specified in a permit issued by USACE.
- Reestablish vegetation on exposed soil as soon as possible.
- Implement and maintain erosion and sedimentation control measures sufficient to prevent deposition of sediment and eroded soil in onsite and offsite wetlands and to prevent erosion in onsite and offsite surface water areas.
- Provide compensatory mitigation for unavoidable wetland impacts (this mitigation measure would be implemented through a Section 404 permit issued by USACE).

4.1.7.4 Shoreline Erosion

The majority of the water pollution in the Eufaula Lake study area, including siltation, pesticides, suspended solids, and nutrients, comes from non-point sources. In particular, this potential impact is exacerbated by highly erodible soils and bank instability throughout the watershed. Once physical processes such as shoreline erosion have begun in Oklahoma reservoirs, it often takes human intervention to stabilize the shoreline long enough to establish the littoral zone as a functioning community. Bioengineering techniques may halt the erosive processes long enough to allow for the establishment of a healthy aquatic plant community and may be a low-cost long-term erosion control solution (OWRB 2006).

Coir Geotextile Rolls (CGR) with live staking is a simple treatment that was proven more effective at reducing bank erosion and facilitating plant growth than cedar tree breakwaters and unprotected herbaceous plantings during shoreline stabilization activities at Lake Carl Blackwell in Payne County, Oklahoma (OWRB 2006). This treatment results in a very dense stand of willow trees heavily armoring an eroding bank and may be complemented with herbaceous aquatics planted within the bottom tier. Since willow trees formed by live staking create dense thickets, this method would be inappropriate where broad lake access or viewing is desired.

Fluctuating lake levels are a prominent issue in regard to plant survival in shoreline stabilization projects. Field reconnaissance and the development of a shoreline erosion control plan would identify suitable sites and methods available for shoreline stabilization. Site selection would consider shoreline type, shoreline sediment and its capability to support plantings, and adequate access to bring in materials (OWRB 2006).

4.1.7.5 Invasive Plant Species

Through active management of government lands, lease agreement terms, and education of lakeshore residents and recreationists, USACE would control the spread of invasive plants listed by the Oklahoma Invasive Plant Council or organisms listed in the Oklahoma Aquatic Nuisance Species Management Plan.

4.2 Fish and Wildlife

4.2.1 Assessment Methods and Significance Criteria (Fish and Wildlife)

Each of the five alternatives (including the No Action Alternative) have potential impacts on the fish and wildlife species within the study area. Many of these impacts are the direct result of impacts to terrestrial and aquatic habitats, which are summarized in Section 4.1. A complete characterization of potential impacts of all alternatives on fish and wildlife species can be found in Appendix B.

The assessment methods and significance criteria are generally the same for fish and wildlife as for vegetation, wetlands, and aquatic habitats in Section 4.1. As in that section, the discussion begins with the No Action Alternative and progresses from Alternative 1, which emphasizes natural resource conservation, sequentially through Alternative 4, which emphasizes recreational development opportunities and private shoreline uses. Direct and indirect impacts are considered, as well as the relative significance of the impact – whether negative or beneficial.

In general, the alternatives are along a continuum with respect to direct and indirect habitat impacts in the following order (from least to most significant potential negative impact):

Alternative 1, Alternative 2, No Action, Alternative 3, Alternative 4

4.2.2 Federally-listed Species

For this study, USACE determined that habitat and life history requirements for the interior least tern, piping plover, and Arkansas River shiner preclude effects to these species resulting from development activities on the Eufaula Lake shoreline (USACE 2012d). Therefore, proposed activities under any of the alternatives would have “no effect” on these species and they are not discussed in this section. Similarly, whooping crane habitat is unlikely to be in the study area; therefore it is not addressed herein.

Potential effects on the American burying beetle are discussed under each alternative in the following sections.

4.2.2.1 No Action Alternative Potential Effects on American Burying Beetle

Under the No Action Alternative, the future condition of American burying beetle populations within the study area would be expected to be similar to the distributions and trends described under the existing condition. The proposed shoreline development on USACE-owned lands at Carlton Landing would not be approved and the expected development on the adjacent private lands would be limited to the development of 170 lots. Therefore, the No Action Alternative would be *not likely to adversely affect* the American burying beetle.

4.2.2.2 Alternative 1 Potential Effects on American Burying Beetle

Alternative 1 would likely preserve existing American burying beetle populations and could support range expansion. The implementation of extended vegetation management policy buffers and the emphasis on natural resource conservation would likely limit habitat alteration and fragmentation. This, combined with reduced edge effects, would benefit carrion species, preserve preferred American burying beetle habitats, and reduce predator and competitor densities.

The results of field surveys conducted in May 2012 indicate that the American burying beetle is present within the shoreline areas of the Carlton Landing site. Under Alternative 1, the development at Carlton

Landing would largely be the same as that described under the No Action Alternative; however, the Limited Development on the south side of Longtown Arm would be reallocated to Protected. While development of approximately 170 lots would still occur, construction of a marina and other public recreational facilities in the shoreline would not occur. Compared to the other action alternatives, Alternative 1 would result in the fewest potential impacts to local American burying beetle populations. Alternative 1 would be *not likely to adversely affect* the American burying beetle.

4.2.2.3 Alternative 2 Potential Effects on American Burying Beetle

Under Alternative 2, the future condition of American burying beetle populations would likely be similar to the condition described under Alternative 1. The establishment of extended shoreline buffers and the likely decrease in potential development on adjacent lands associated with the fewer areas of shoreline designated Limited Development. Under Alternative 2, the potential scope of future development at Carlton Landing would be the same as that described for the No Action Alternative. Potential impacts associated with this alternative would likely be similar to those described for the No Action Alternative, except that the implementation of extended shoreline buffers would protect American burying beetle habitat close to the shoreline. Alternative 2 would be *not likely to adversely affect* the American burying beetle.

4.2.2.4 Alternative 3 Potential Effects on American Burying Beetle

Under Alternative 3, the implementation of baseline vegetation management buffers would likely conserve some American burying beetle habitat not protected under the No Action Alternative. However, increased development and recreational opportunities within the study area would likely lead to decreases in beetle populations particularly on private lands in areas adjacent to areas where shoreline reallocation is proposed. In addition to direct land disturbance, development increases artificial night lighting, which has a negative indirect impact on populations of nocturnal insects such as the American burying beetle. Additionally, the potential for increased development and recreation would increase the potential for habitat fragmentation and degradation. Habitat alterations often result in increases in disturbed and edge habitats, which favor beetle predators and carrion competitors.

While artificial night lighting and habitat fragmentation can affect American burying beetle populations, the most significant adverse impacts generally result from ground disturbance. Potential direct impacts to these beetles during inactive and active periods may occur as a result of vegetation clearing, heavy equipment operation, fuel and chemical contamination of the soil, grading, soil excavation, and filling and reseeding of disturbed areas (FHWA 2009). Under Alternative 3, the probability of ground disturbance would increase compared to the No Action Alternative; therefore, American burying beetle populations within the study area would be more likely to be adversely affected as compared to the No Action Alternative by these indirect effects on adjacent private lands.

In comparison to the No Action Alternative, under Alternative 3, additional shoreline within the proposed Carlton Landing site would be designated Limited Development. While the increase in Limited Development would allow for more private dock construction, the scale and extent of the proposed Carlton Landing development would be similar to that described under the No Action Alternative. Therefore, combination of the potential for the development of some private docks at Carlton Landing and the greater degree of indirect effects on private lands adjacent to USACE-owned lands around the lake would potentially result in a *likely to adversely affect* determination for the American burying beetle. This determination requires Section 7 consultation with USFWS, which is explained in detail in Section 7.4.3.

4.2.2.5 Alternative 4 Potential Effects on American Burying Beetle

Alternative 4 is *likely to adversely affect* the American burying beetle. This determination requires Section 7 consultation with USFWS, which is explained in detail in Section 7.4.3. Alternative 4 would reallocate the shoreline along the Carlton Landing development and would grant a lease for construction of a marina and other public shoreline recreational facilities, which would enable full build-out including the development of approximately 2,570 home lots and associated community facilities. Full-build out would likely result in the development of approximately 1,650 acres of confirmed American burying beetle habitat. This level of land disturbance, especially if conducted during the underground, inactive period in the lifecycle of the species, would likely result in direct beetle mortality and the destruction of suitable beetle habitat. Planned recreation activities along the lake shoreline would also likely result in adverse impacts to beetle populations as vegetation management buffers that serve to protect shoreline vegetation would not be required in these areas. Increased recreational activity would also likely drive potential carrion species from the area, depriving American burying beetles of necessary food and reproductive sources.

Options to reduce the footprint of the proposed development on private lands at Carlton Landing would not be feasible. The proposal, which includes concepts of a walkable community with centrally located essential services to minimize residents' need to use cars, is dependent on achieving a critical density of development. That level of development would encompass virtually the entire proposed area of 1,650 acres.

Compared to the No Action Alternative, potential indirect impacts of Alternative 4 on American burying beetle populations would likely be greater and more widespread due to increased potential land disturbance associated with an increased number of shoreline miles reallocated from Protected to Limited Development and Public Recreation.

4.2.2.6 Potential Mitigation Measures for Effects on American Burying Beetle

Due to the confirmed presence of the American burying beetle within the survey area containing the proposed Carlton Landing development, Roundtree Landing, and adjacent private lands, consultation with USFWS under Section 7 of the ESA has been initiated as described in Section 7.4.3. No federal action would be authorized that is likely to jeopardize the continued existence of the American burying beetle unless ESA Section 7 consultation addressing the effects of the proposed action has been completed. According to the 2012 updated USFWS guidance, bait-away and trap-and-relocate procedures are no longer allowed as the primary means of avoiding impacts to the American burying beetle. Other potential mitigation measures are not known at this time as the USFWS is developing alternative approaches. Consultation with USFWS would generate appropriate conservation measures that would be implemented in association with any approvals for shoreline development on government lands.

4.2.3 No Action Alternative (Fish and Wildlife)

The No Action Alternative would reflect the existing condition in the study area and, except for additional development adjacent to already designated Limited Development areas, would leave the shoreline relatively unchanged. Therefore, current conditions or trends in fish and wildlife populations described in Section 3.2 would likely continue under the No Action Alternative.

4.2.3.1 Potential Impacts on USACE Lands

Fish

Protected Fish Species

Populations of paddlefish would likely continue to remain at low densities and would slowly increase primarily due to annual stocking efforts.

Fisheries

Potential impacts of the No Action Alternative on all common and popular game species would likely result in future conditions similar to the existing conditions.

Aquatic invasive and nuisance species threaten the diversity and stability of fish community structure within the Eufaula Lake study area. Asian carp are the invasive fish species most likely to cause significant impacts on native fish. Future conditions under the No Action Alternative would most likely follow existing trends with moderate to significant potential of Asian carp introduction and establishment.

Wildlife

Continued slow rates of development expected under the No Action Alternative on shorelines allocated as Limited Development would likely result in a small increase in habitat fragmentation as compared to the existing condition. For terrestrial wildlife, increased habitat fragmentation would likely sever travel corridors. Travel corridors are essential to maintaining connectivity between disparate populations; thereby, enabling gene flow and providing access to additional suitable habitat and food resources.

Reptiles and Amphibians

In general, potential impacts of the No Action Alternative would likely result in a future reptile community similar to that described under the existing condition. The likely future condition includes trends that favor reptile species adapted to low levels of development and seasonally-high levels of human recreation, especially during the summer breeding season.

Under the No Action Alternative, potential impacts would likely result in levels of amphibian diversity and population trends similar to those described for the existing condition. Some amphibian decline would likely continue due to potential conversion of wetland habitats and from altered water level fluctuation cycles.

Mammals

Recent status reports indicate that populations of both mammal species of special concern, the river otter and long-tailed weasel, are expanding into unoccupied areas of suitable habitat. Therefore, the No Action Alternative may result in higher otter and weasel populations than currently observed due to the existing trend toward range expansion and the presence of suitable habitat within the study area.

Land use changes and human disturbance within the Eufaula Lake study area can significantly impact the likelihood of invasive species introduction and establishment. Small, invasive rodents such as the house mouse and Old World rats are specifically adapted to human disturbance and often rely on urban sprawl to spread into new areas. Under the No Action Alternative, these species would likely experience little change, with significant populations present only in the most developed areas. The feral hog is a habitat generalist and can adapt to increases in human disturbance. However, feral hogs have been present within the study area for over four decades and continue to exist at moderate densities. Therefore, under the No

Action Alternative, feral hog populations would likely remain stable with the continuing trend of slow northward range expansion. Although documented in nearby areas, there is no evidence that the susceptibility of the study area to invasion by nutria would increase under the No Action Alternative.

Birds

The No Action Alternative would likely result in bald eagle populations and trends similar to those described under the existing condition. This future condition would be characterized by the presence of a small number of resident breeding pairs with a larger migrant population present during winter months. In the future, as bald eagle populations recover both statewide and nationwide, the likelihood exists that populations of both resident and migratory birds would increase.

Sprague's pipit is a non-breeding winter resident and passage migrant in Oklahoma and would most likely be observed in the study area during spring and fall migrations. While suitable prairie habitats, croplands, and pastures exist within the study area, they occupy a relatively small percentage of shoreline habitats and often exist in a degraded condition dominated by invasive species. These existing conditions are expected to persist under the No Action Alternative, and the future condition of the Sprague's pipit would likely be similar to the existing condition.

The potential future condition of the Bell's vireo within the Eufaula Lake Study area under the No Action Alternative would likely be similar to that described under the existing condition, characterized by small summer resident populations experiencing population decline due to habitat loss and degradation.

Bachman's sparrow, a summer resident of southeastern Oklahoma, has declined due to urban encroachment and fire suppression practices that have transformed oak-pine woodland habitat. Under the No Action Alternative, the future condition would likely see the decreasing trend continue, as described under the existing condition.

Similar to the Bachman's sparrow, the prothonotary warbler is a summer resident, and although a species of conservation concern, it has been routinely documented and observed throughout the study area. Since much of the shoreline would remain forested, the future condition under the No Action Alternative would likely contain warbler populations similar to those described under the existing condition.

Under the No Action Alternative, the birds of prey community would likely be similar to that described under the existing condition, characterized by a community dominated primarily by habitat generalists that can tolerate limited human disturbance.

Under the No Action Alternative, populations of songbirds, ground birds and other common species would remain similar to the existing condition, although ground bird species adapted to open habitats would likely experience a population decline.

The No Action Alternative would likely result in a future condition that maintains waterfowl and waterbird distributions and continue observed population trends as described under the existing condition.

Invertebrates

Under the No Action Alternative, future development would likely increase sediment and nutrient inputs, which would slowly shift aquatic invertebrate species composition to favor species that can tolerate poorer water quality in eutrophic systems.

Under the No Action Alternative, potential impacts would likely result in a future condition of invasive aquatic invertebrates similar to that described under the existing condition. However, the recent discovery of zebra mussels within the Eufaula Lake study area indicates that establishment has occurred and, under the No Action, future range expansion throughout the study area would be likely.

4.2.3.2 Potential Impacts on Adjacent Lands

The No Action Alternative may have slight negative impacts on species in the study area due to continued growth of residential development in areas adjacent to government-owned lands.

4.2.3.3 Significance of Impacts

The No Action Alternative is not likely to result in significant impacts that cannot be avoided or mitigated.

4.2.4 Alternative 1 (Fish and Wildlife)

4.2.4.1 Direct Impacts

Fish

Protected Fish Species

Under Alternative 1, paddlefish populations would likely increase as stocked populations mature and find protected spawning habitat and improved water quality resulting from the increase of protected lands and a decrease in potential development. In addition, nutrient inputs from lawn fertilizers and stormwater runoff would also likely decrease with an increase in Protected shoreline. The combination of reduced potential sediment and nutrient inputs compared to the No Action Alternative would likely result in increased water quality; therefore, benefiting paddlefish.

Common Species and Fisheries

Under Alternative 1, the reduction in areas designated Limited Development and the protection of forested shorelines would likely reduce sediment and nutrient input levels resulting in improved water quality and a reduction in anoxic conditions. While some species such as catfish and bullhead can thrive under poor water quality conditions, most fish are acutely sensitive to even a small decline in water quality. In addition, no new private boat dock construction would be allowed, which would reduce potential littoral zone shading and direct habitat alteration during construction, resulting in improved conditions for fry and small forage species compared to build out of the No Action Alternative. However, there could possibly be a negative impact on species such as bass that use docks as habitat structures.

Protection of shoreline areas and reduced development would reduce the potential for competing water uses, including water withdrawals needed to support large developments, and would reduce the likelihood of invasive species establishment and disease often associated with high levels of recreational activity. The conservation of shorelines would also likely improve littoral habitats on which many game species depend, thus improving food availability for bass and other game fish populations.

In comparison to the No Action Alternative, Alternative 1 would likely lower the introduction potential of Asian carp and other aquatic invasive species due to expected lower recreation rates associated with a decrease in areas designated Limited Development. Fewer recreationists lessen the probability of introduction from nearby infested rivers and reservoirs.

Wildlife

In comparison to the No Action Alternative, Alternative 1 would likely result in a decrease in levels of shoreline development due to more areas allocated as Protected and fewer areas allocated as Limited Development. Therefore, Alternative 1 would likely result in a decrease in habitat fragmentation as compared to the No Action Alternative. For terrestrial wildlife, a decrease in habitat fragmentation would likely preserve travel corridors. Travel corridors are essential to maintaining connectivity between disparate populations; thereby, enabling gene flow and providing access to additional suitable habitat and food resources.

Reptiles and Amphibians

In comparison to the No Action Alternative, Alternative 1 would likely increase populations of semi-aquatic and terrestrial reptiles. Terrestrial reptiles would benefit from the conservation of forests, woodlands, and prairies and would not be as impacted by conditions associated with development including road construction, herbicide use, and road traffic. The implementation of the extended vegetation management buffers adjacent to shorelines allocated as Limited Development would help filter out sediments, nutrients, and additional pollutants that could impair water quality. Finally, an increase in shoreline designated Protected would protect more hibernation habitat, including hollow logs and burrows, from disturbance and would protect fragile nesting areas, especially emergent wetlands and sandy shorelines.

For the imperiled alligator snapping turtle, which was observed along the sandy shoreline of Sycamore Bay, the new shoreline vegetation management policies under Alternative 1 would likely protect some habitat from disturbance.

In comparison to the No Action Alternative, under Alternative 1, amphibian diversity would be maintained and populations would be expected to increase and expand due to the protection of shoreline habitats and establishment of extended shoreline buffers. More than any other group of animals, amphibians are significantly impacted by the effects of water pollution. Shoreline vegetation buffers would be expected to reduce pollutant-laden runoff associated with adjacent developments and to benefit amphibian populations. In addition to improving water quality, Alternative 1 would likely protect areas of secure thermal refuge from shoreline disturbance.

Mammals

Alternative 1 would likely support increasing numbers of both the long-tailed weasel and river otter. Alternative 1, with its extended shoreline buffers, would likely improve water quality conditions in lake, stream, and wetland habitats; therefore, improving populations of amphibian and fish prey species and reducing turbidity resulting in improved hunting success. Wide buffers and an increase in Protected shoreline would conserve habitat utilized by both species. In particular, because otters exclusively use shoreline areas for denning, potential beneficial effects of Alternative 1 would likely include increased otter den site availability. On the other hand, the amount of slightly disturbed and edge habitat preferred by the weasel would likely be reduced somewhat.

Under Alternative 1, the size and structure of populations of most small- to medium-sized mammal species would likely be similar to that described under the No Action Alternative. Larger-bodied mammal species, especially carnivores like coyotes, and species requiring specialized or undisturbed habitats would likely see population increases due to the establishment of the shoreline vegetation buffers and a decrease in

development on lands adjacent to the shoreline. A greater proportion of bat roost sites would likely be preserved and larger predators would have larger areas of contiguous habitat in which to hunt. The establishment of wide buffers in riparian areas would particularly improve the quality of aquatic habitats; therefore, likely increasing local beaver and muskrat populations.

Under Alternative 1, the likelihood of introduction and establishment of invasive mammal species would be similar to that described under the No Action Alternative. Small, invasive rodent species would not be expected to spread outside of urban areas and the chances of nutria introduction would likely be low. Feral hog populations would likely remain stable at moderate densities with a continuing trend of slow, northward expansion.

Birds

With an emphasis on natural resource conservation, Alternative 1 would be likely to maintain or expand populations of rare bird species. Alternative 1 is likely to result in a small but stable population of bald eagles similar to the No Action Alternative, but with an increasing population trend due to the benefits of shoreline buffer implementation and land protection.

Under Alternative 1, the future condition of peregrine falcon, Sprague's pipit, and Bachman's sparrow populations in the Eufaula Lake study area would be similar to the condition described under the No Action Alternative. Due to the absence of peregrine falcon observations and the ability of this species to occupy both altered and un-altered habitats, it is unlikely that activities associated with Alternative 1 would have an adverse impact on this species.

Under Alternative 1, the future condition of Bell's vireo and prothonotary warbler populations in the Eufaula Lake study area would likely increase in comparison to the No Action Alternative. The establishment of extended vegetation management buffers under Alternative 1 would likely preserve forested wetland habitats and would contribute to the health and stability of vireo and warbler populations. Under this alternative, the increase in Protected shoreline and decrease in human disturbance would likely limit habitat degradation, conserve warbler nest cavities, and reduce edge habitats favored by nest parasites.

In comparison to the No Action Alternative, Alternative 1 is unlikely to impact birds of prey populations but may impact distributions. An increase in protected shoreline and the establishment of extended vegetation management policy buffers would likely increase the quantity of relatively undisturbed natural habitats. This would favor species such as the red-shouldered hawk and the barred owl, which prefer relatively dense forests. Alternative 1 would also likely limit development and the creation of edge habitats, which are exploited by species such as the red-tailed hawk. As habitats mature, especially forested habitats, it is likely that birds of prey would simply shift their distribution and occupy the most suitable areas for each species. Therefore, future changes to the birds of prey community would be unlikely under Alternative 1, but localized relative abundances could shift as a result of observed habitat conditions.

Similar to birds of prey, Alternative 1 is unlikely to impact songbird species richness by causing the disappearance of certain species, but would potentially impact species evenness by selecting for species best adapted to protected forest habitats, in comparison to the No Action Alternative.

Alternative 1 would likely benefit populations of ground birds such as the wild turkey and American woodcock that prefer forests and bottomland hardwoods. In addition, natural resource conservation through shoreline reallocation, land reclassification, and the establishment of extended buffers would likely preserve areas of mature forest and the snags contained within. Therefore, species composition of cavity-nesting birds would likely reflect the No Action Alternative but their distribution would likely expand and populations would likely increase.

Due to the magnitude of influence human disturbance has on aquatic habitats, Alternative 1, which establishes extended buffers to conserve shoreline habitat, would likely improve water quality resulting in an increase in the quantity of optimal habitat suitable for waterfowl and waterbirds. Alternative 1 also would greatly limit new dock construction and would increase the amount of shoreline designated as Protected which would limit the potential for development on adjacent lands.

In addition to limiting wetland losses, Protected shorelines would likely limit disturbances associated with people accessing the lake shore from adjacent developments including the potential for human-waterfowl interaction.

Invertebrates

The current benthic macroinvertebrate community is likely made up of tolerant species that are adapted to fine-sediment, eutrophic reservoir systems with significant organic inputs. While Alternative 1 would not likely change the existing condition in many parts of the lake, the implementation of extended shoreline buffers and an increase in Protected shoreline could reduce sediment and nutrient inputs resulting in localized improvements to water quality. An increase in water quality could shift the composition of the benthic macroinvertebrate community away from tolerant species to more sensitive species including beetles (Coleoptera), mayflies (Ephemeroptera), caddisflies (Trichoptera), and dragonflies and damselflies (Odonata). The macroinvertebrate mollusk community would also likely shift from fairly tolerant gastropods to more sensitive pelecypods.

While the species composition of the plankton community would be unlikely to change under Alternative 1, the expected water quality improvements would likely affect plankton populations. A reduction in suspended solids from lower rates of erosion would facilitate plankton growth, and reduced nutrient inputs from a decrease in development would likely reduce potential algal blooms. The reduced nutrient input would also decrease zooplankton impairment and mortality.

Increased water quality and protection of shoreline habitats under Alternative 1 would likely result in the expansion of localized freshwater mussel populations. Several species, which have been documented to exist within the study area, including the giant floater, are adapted to reservoir conditions. Therefore, if sedimentation rates and nutrient inputs associated with development are kept low, as they would be in Alternative 1, an expansion in the range of the resident freshwater mussel community would be likely.

Under Alternative 1, the probability of introduction, ease of establishment, and extent of expansion of the invasive zebra mussel and Asian clam would likely be similar to the future conditions described under the No Action Alternative. The designation of more shoreline as Protected with limits on dock construction could lower lake usage and lower the probability of additional zebra mussel or Asian clam introduction, but would do little to reduce the susceptibility of the Eufaula Lake study area to invasion.

4.2.4.2 Indirect Impacts

Of all the alternatives, Alternative 1 has the least potential to result in indirect impacts to fish and wildlife in the study area since it offers the most protection to existing habitats.

4.2.4.3 Significance of Impacts

Of all the alternatives, including No Action, Alternative 1 would provide the greatest amount of protection to fish and wildlife species in the study area. Therefore, it has the greatest potential to result in a significant beneficial impact to fish and wildlife.

4.2.5 Alternative 2 (Fish and Wildlife)

4.2.5.1 Direct Impacts

Fish

The future condition of all fish species under Alternative 2, including the paddlefish, and popular game species, would likely be similar to the condition described under Alternative 1. However, the extent of improvements to water quality, spawning habitat, and food availability would likely be less due to fewer shoreline miles being reallocated from Limited Development to Protected.

In comparison to the No Action Alternative, Alternative 2 would likely lower the introduction potential of Asian carp and other aquatic invasive species due to expected lower recreation rates associated with a decrease in areas designated Limited Development and a decrease in the potential number of private docks that could be constructed. Fewer recreationists lessen the probability of introduction from nearby infested rivers and reservoirs. However, the introduction potential would be higher than that expected under Alternative 1 because fewer shorelines are designated as Protected under Alternative 2.

Wildlife

In comparison to the No Action Alternative, Alternative 2 would likely result in a small decrease in levels of shoreline development due to more areas allocated as Protected and fewer areas allocated as Limited Development. Therefore, Alternative 2 would likely result in a small decrease in habitat fragmentation as compared to the No Action Alternative. For terrestrial wildlife, a decrease in habitat fragmentation would likely preserve travel corridors. Travel corridors are essential to maintaining connectivity between disparate populations; thereby, enabling gene flow and providing access to additional suitable habitat and food resources.

Reptiles and Amphibians

Although Alternative 2 designates less shoreline as Protected as compared to Alternative 1, it would likely have similar potential impacts on the future condition of reptile and amphibian communities due to the establishment of extended shoreline buffers and the likely decrease in potential development on adjacent lands associated with the fewer areas of shoreline designated Limited Development.

Mammals

Alternative 2 would likely have similar potential impacts on the future condition of the two mammal species of special concern, the river otter and long-tailed weasel, as described for Alternative 1. Under Alternative 2 there would be slight increases in preferred weasel habitat and slight decreases in preferred otter habitat compared to the changes expected under Alternative 1. Likewise, the future condition of common mammal species under Alternative 2 would likely be similar to that described under Alternative 1.

due to the establishment of extended shoreline buffers and the likely decrease in potential development on adjacent lands associated with the fewer areas of shoreline designated Limited Development.

Under Alternative 2, the likelihood of introduction and establishment of invasive mammal species would be similar to that described under the No Action Alternative. Small, invasive rodent species would not be expected to spread outside of urban areas and the chances of nutria introduction would likely be low. Feral hog populations would likely remain stable at moderate densities with a continuing trend of slow, northward expansion.

Birds

The future condition of bald eagle populations under Alternative 2 would likely be similar to the condition described under Alternative 1, but fewer positive impacts on water quality and nesting habitat would likely be realized due to fewer shoreline areas being designated as Protected.

Although Alternative 2 designates less shoreline as Protected than Alternative 1, it would likely have a similar potential impact on the future condition of all five bird species of conservation concern. The future condition under Alternative 2 would likely result in populations of peregrine falcon, Sprague's pipit, and Bachmann's sparrow similar to those described for Alternative 1, as well as for the No Action Alternative.

Although Alternative 2 designates less shoreline as Protected than Alternative 1, the future condition of the birds of prey, songbird, ground bird, woodpecker, waterfowl, and waterbird communities would likely be similar to that described under Alternative 1 due to the establishment of extended shoreline buffers and the likely decrease in potential development on adjacent lands associated with the fewer areas of shoreline designated Limited Development.

Invertebrates

Although Alternative 2 designates less shoreline as Protected as compared to Alternative 1, the future condition of the aquatic invertebrate community would likely be similar to that described under Alternative 1 due to the establishment of extended shoreline buffers and the likely decrease in potential development on adjacent lands associated with the fewer areas of shoreline designated Limited Development. The decrease in potential development would likely improve water quality, which is essential for the survival of many aquatic invertebrate species.

Under Alternative 2, the probability of introduction, ease of establishment, and extent of expansion of the invasive zebra mussel and Asian clam would likely be similar to the future conditions described under Alternative 1.

4.2.5.2 Indirect Impacts

Similar to Alternative 1, Alternative 2 would offer more protection to habitats within and adjacent to the study area than the No Action Alternative and would, therefore, be expected to have insignificant indirect impacts to fish and wildlife in the study area.

4.2.5.3 Significance of Impacts

Although the likelihood of negative impacts to fish and wildlife is greater under Alternative 2 than Alternative 1, it is less likely to have significant negative impacts than the No Action Alternative.

4.2.6 Alternative 3 (Fish and Wildlife)

4.2.6.1 Direct Impacts

Fish

Protected Fish Species

Alternative 3 would allow an increase in private dock construction, dock access, and vegetation clearing due to a change of 96 miles of Protected shoreline to Limited Development. Under Alternative 3, potential impacts on paddlefish would likely result in a future condition similar to that described under the No Action Alternative. As lands adjacent to Limited Development lands develop, the influx of sediment and nutrients associated with erosion, landscaping, and stormwater runoff could degrade water quality (Mims *et al.* 1999). The baseline shoreline buffers proposed under Alternative 3 may filter out fewer water pollutants in some cases than the extended buffers implemented in Alternatives 1 and 2, although they would still be effective in protecting water quality compared to the No Action Alternative. Finally, increased recreational opportunities could increase the number of paddlefish snagged by anglers.

Common Species and Fisheries

Alternative 3 would establish a baseline shoreline vegetation buffer that would protect more shoreline than under the No Action Alternative, but less than the extended buffers under Alternatives 1 and 2. The presence of the baseline buffers would provide essentially the same water quality and habitat benefits to common fish species as those in Alternatives 1 and 2. Despite increased shoreline conservation as compared to the No Action Alternative through the use of the vegetation buffers, proposed changes in shoreline allocations and land use classifications under Alternative 3 would likely encourage increased shoreline use and human disturbance. While additional private dock construction could provide overhead cover and habitat structure for some species, the benefits would likely be offset by potential degradation in water quality and littoral habitats that would be associated with increased levels of development and recreation. In addition, the probability of invasive species establishment would increase with the high levels of recreational activity expected under Alternative 3.

Under Alternative 3, increased development and recreational opportunities would likely have little potential impact on black bass and crappie populations overall. The primary impact to these fisheries would be increased angling pressure. Increased angling pressure often disrupts normal age structure and could result in a population dominated by small, young individuals if it is extreme. While increased sedimentation and nutrient inputs associated with human development could smother preferred spawning substrates and decrease water quality, black bass are remarkably adaptable to moderate habitat disturbance. The deposition of finer sediments would be beneficial to crappie as they prefer to spawn on silt, clay, or sand substrates. Although it would disturb natural littoral habits, increased boat dock construction under Alternative 3 would likely provide black bass with increased habitat structure and result in little potential net impact to bass populations. Therefore, the future condition of the black bass and crappie fisheries would likely resemble conditions described under the No Action Alternative.

The catfish fishery is the fishery least likely to be adversely impacted by increased shoreline development and recreation expected under Alternative 3. Within the Eufaula Lake study area, catfish take shelter near boat ramps, submerged roadways, and abandoned underwater culverts. Under Alternative 3, increased dock and infrastructure construction (*e.g.*, power lines and bridges) associated with increased residential development could provide underwater structure and increase available catfish habitat. A potential

adverse impact of Alternative 3 could be overharvesting. Noodling, allowed for flathead catfish, is growing in popularity throughout the study area, and specifically targets large and nesting catfish.

Alternative 3 would not create aquatic habitat conditions any more susceptible to Asian carp establishment. However, the expected increase in people utilizing the study area would likely increase the potential for accidental Asian carp introduction. Once introduced, eradication is difficult, if not impossible on a lake the size of Eufaula and could lead to a severe decline in managed fisheries and other native species.

Wildlife

An increase in the rate of shoreline development would be expected under Alternative 3 as more areas would be allocated as Limited Development and fewer areas would be allocated as Protected. Therefore, Alternative 3 would likely result in an increase in shoreline habitat fragmentation as compared to the No Action Alternative. For terrestrial wildlife, an increase in habitat fragmentation would likely sever travel corridors. Travel corridors are essential to maintaining connectivity between disparate populations; thereby, enabling gene flow and providing access to additional suitable habitat and food resources.

Reptiles and Amphibians

Generally speaking, Alternative 3 would likely result in localized adverse impacts to most reptile populations within the study area. Aquatic habitat and wetland degradation is likely to increase along with clearing and conversion of adjacent upland habitats to make room for residential development and associated infrastructure. Roads and construction activities could contribute directly to increased mortality and indirectly by fragmenting habitat and eliminating sources of thermal refuge. Finally, development also provides avenues for predators and makes habitats more susceptible to invasive species, which could replace native reptile food sources.

While the baseline vegetation management policy buffers proposed under Alternative 3 would improve amphibian condition over the No Action Alternative, the conversion of Protected shoreline to Limited Development would likely negatively impact amphibian diversity and amphibian populations overall. Studies have shown that increased habitat fragmentation due to development is directly correlated with a decrease in amphibian diversity (Beasley *et al.* 2002).

Mammals

In comparison to the No Action Alternative, Alternative 3 would likely have a positive impact on long-tailed weasel populations; whereas, it would likely reduce the amount of suitable river otter habitat. The implementation of baseline shoreline buffers would improve water and habitat quality, compared to the No Action Alternative. Potential impacts related to dock construction and development on adjacent lands would have additional negative impacts on the river otter, a species intricately tied to the health of aquatic and wetland systems. An influx of water pollutants near developments could make hunting unsuitable, decrease prey populations, and impact individual fitness. Increased recreation would likely increase human-otter interaction resulting in stress, decreased hunting success, and potentially more trappers during the winter season (ODWC 2011d). Unlike the river otter, the long-tailed weasel has been known to thrive in edge habitats and in areas with moderate human disturbance.

Under Alternative 3, populations of bats, larger predators like bobcats and coyotes, and habitat specialists like beaver and muskrat, would likely decrease due to removal or disturbance of roosting and denning sites, direct human conflict, and degraded habitats. For several of these species direct human conflict

means heightened animal control policies and an increase in recreational trapping that often result from increases in human populations in rural areas.

Despite the potential for adverse impacts on predators and habitat specialists, under Alternative 3, small rodents and medium-sized opportunists such as mice, squirrels, raccoons, and skunks would find increased amounts of low-level human disturbance advantageous due to increased food availability, decreased predation, or a preference for edge habitats.

Under Alternative 3, the likelihood of introduction and establishment of invasive mammal species would be similar to that described under the No Action Alternative. However, the creation of large residential communities that are likely to follow the increase in the amount of shoreline allocated as Limited Development could facilitate the spread of small, invasive rodent species. The potential for introduction and establishment of nutria in the study area would likely remain low under Alternative 3. Feral hog populations would likely remain stable at moderate densities with a continuing trend of slow, northward expansion.

Birds

Under Alternative 3, future population and distribution trends of bald eagles within the study area would be similar to those described under the No Action Alternative. The implementation of baseline vegetation management buffers would likely result in some water quality improvements benefiting eagle prey species, compared to the No Action Alternative. Increased shoreline length allocated as Limited Development would likely increase home and dock construction, making some areas of potential eagle habitat unsuitable. Localized effects may result in eagle relocation to more remote areas. However, 2012 surveys observed eagle activity in residential areas; therefore, development activity at rural densities similar to existing developments may not disrupt eagle behavior at Eufaula Lake to the extent reported elsewhere.

Under Alternative 3, the future condition of peregrine falcon, Sprague's pipit, and Bachman's sparrow populations in the Eufaula Lake study area would be similar to the condition described under the No Action Alternative.

The future condition of both the Bell's vireo and prothonotary warbler under Alternative 3 would likely be characterized by a slight population decrease in comparison to the No Action Alternative. The increase in Limited Development shorelines would be expected to increase habitat fragmentation and levels of human activity in the shoreline areas. As residential developments are constructed on lands adjacent to USACE-owned lands, existing forest cover would be reduced somewhat. Alternative 3 would likely increase the quantity of edge habitats. While the baseline vegetation buffers established under Alternative 3 would preserve some bottomland hardwood forest, shorelines under Alternative 3 would also likely be more susceptible to nest parasites, snag removal, and invasive species.

In comparison to the No Action Alternative, Alternative 3, would likely select for birds of prey species best suited to human disturbance. With a potential increase in development, edge habitats would increase resulting in higher populations of vultures and some hawk species that prefer more open habitats. This would also result in decreasing populations of species suited to dense forested habitats.

Alternative 3 would have a beneficial impact on the songbird communities that are tolerant of disturbed, edge habitats and would have an adverse impact on songbird communities that prefer core or closed-canopy forested habitats.

Another widespread potential impact of increased development on songbirds, and all native birds in general would be the potential increase in invasive competitors and nest predators. Invasive songbirds such as the European starling and house sparrow are aggressive, superb competitors that displace native cavity-nesting songbirds like the northern parula and brown creeper as well as most woodpeckers. While at home in most open habitats, starlings and house sparrows often use human development and disturbance to access new areas of core, interior habitat. Therefore, implementation of Alternative 3 would likely result in an expansion of invasive species distributions and an increase in starling and house sparrow populations in areas of development.

Under Alternative 3 the ground bird community would likely resemble the future condition described for the No Action Alternative. In addition to fire suppression and resulting forest encroachment, ground birds in open habitats, particularly bobwhite quail, would likely be impacted by invasive forage plant species introduction. An increase in development and recreational opportunities would likely increase the potential for the introduction of new invasive plants and the spread of established invasive species. As these plant species take over, the preferred foods of the ground bird community become scarcer.

Alternative 3, would likely result in a species composition of cavity-nesting birds similar to that described for the No Action Alternative but distributions and populations would likely decrease with the removal of mature forests. Even where mature forests are only thinned, as is often the case with rural residential development, selective management often prioritizes snag removal for safety and aesthetic reasons. In addition, because they play a role in the control of forest pests, a decline in insectivorous cavity-nesters could spark an overall decline in forest health.

Despite the likely decrease in woodpecker abundance, Alternative 3 would likely have beneficial impacts on several common bird species. Populations of crows and swallows generally increase with human disturbance, as swallows often nest on structures like bridges and barns, and crows, as generalists, take advantage of foraging opportunities associated with edge habitats.

In comparison to the No Action Alternative, Alternative 3 would reallocate approximately 96 miles of shoreline habitat from Protected to Limited Development. Potential development along these shoreline areas would likely have an adverse impact on the future condition of waterfowl and waterbird species. The establishment of baseline vegetation management buffers would likely improve water quality and protect wetland habitat, compared to the No Action Alternative. The potential increase in private dock construction, recreation, and development on adjacent lands as a result of Alternative 3 would likely impact certain waterfowl and waterbird species differently depending on each species preferred habitat type and the level of human disturbance and interaction each is willing to tolerate. While populations of wary species such as teal and pintail may decline, development could expand populations of generalist waterfowl species that adapt well to human disturbance such as mallard and Canada goose.

For the majority of waterfowl and waterbird species likely to be found within the study area, increased areas of development and associated human disturbances would likely lower forage quality, reproductive success, and available optimal habitat. Lowered reproductive success would include failed nest attempts and increased nestling mortality due to increases in nest predators adapted to human settlement like raccoons, red fox, and domestic cats. While sensitive species would likely shift their distribution to lesser developed portions of the study area, the concentration of waterfowl and waterbird populations into smaller areas of optimal habitat is likely to place additional stress on these areas. It would also increase

the probability that significant natural impacts, such as disease, could reduce large percentages of existing populations.

Invertebrates

The future condition of the aquatic invertebrate community under Alternative 3 would likely be similar to conditions described under the No Action Alternative. While a localized increase in water quality due to the implementation of the baseline vegetation buffers would be expected, this increase would likely be offset by increased sediment and nutrient inputs associated with increased levels of dock construction, recreation, impervious surfaces, and development on adjacent lands. An increase in suspended solids would likely inhibit plankton growth, and an increase in nutrients would likely result in algal blooms and significant zooplankton impairment.

In addition, the future condition under Alternative 3 would likely result in increased lake usage. Shoreline activities, including private dock construction and recreational boating and swimming, would likely result in direct take of mussels and could impact water quality to the extent that even tolerant species would be adversely impacted in very localized, heavily developed areas. However, the levels of development proposed under this alternative would be unlikely to degrade water quality of the entire Eufaula Lake study area to that point.

In comparison to the No Action Alternative, the increase in lake usage under Alternative 3 would likely lead to an increased probability of initial Asian clam introduction and subsequent zebra mussel introductions from nearby infested waters. Once introduced, an increase in the number of boat docks under Alternative 3 would likely provide attachment points for adult zebra mussels and could contribute to range expansion throughout the study area.

4.2.6.2 Indirect Impacts

Alternative 3 has a greater potential to result in indirect impacts to fish and wildlife than the No Action Alternative and Alternatives 1 and 2. Increased development under Alternative 3 in areas adjacent to government-owned land would likely disrupt natural hydrology and increase sediment and nutrient inputs through land disturbance activities including construction, increased impervious surfaces, and active vegetation management which, in turn would impact resident species.

4.2.6.3 Significance of Impacts

The likelihood of significant impacts to fish and wildlife under Alternative 3 is greater than under the No Action Alternative, as well as Alternatives 1 and 2.

4.2.7 Alternative 4 (Fish and Wildlife)

4.2.7.1 Direct Impacts

Fish

In comparison to all other alternatives, potential impacts of Alternative 4 to fish species would likely be the greatest and most widespread due to the potential increase in recreation and the increased number of shoreline miles that would be reallocated from Protected to Limited Development and Public Recreation. Also, the removal of standing dead timber to improve navigation for recreational activities would eliminate some of the underwater structure that makes Eufaula Lake a trophy crappie fishery. Under Alternative 4, the proposed Carlton Landing development would be allowed to remove up to 43 acres of standing dead

timber, which could result in additional removal requests. In areas where underwater structure would be removed, populations of crappie and other game species would likely be reduced in those areas.

Similarly, compared to other alternatives, the potential for introduction and establishment of Asian carp would likely be greater and more widespread. Under Alternative 4, there would be a potential increase in recreation levels within the study area, which would increase the chances that Asian carp could be transported and released into Eufaula Lake.

Wildlife

In comparison to Alternative 3, Alternative 4 would likely result in an even greater increase in the rate of shoreline development due to an increase in shoreline allocated Limited Development and a decrease in shoreline allocated as Protected. Therefore, Alternative 4 would likely result in an increase in shoreline habitat fragmentation as compared to Alternative 3. For terrestrial wildlife, a large increase in habitat fragmentation would likely sever travel corridors. Travel corridors are essential to maintaining connectivity between disparate populations; thereby, enabling gene flow and providing access to additional suitable habitat and food resources.

Reptiles and Amphibians

In comparison to Alternative 3, Alternative 4 would convert even more Protected shoreline to Limited Development and would increase the amount of Public Recreation shoreline. A significant portion of the reallocation to Public Recreation would take place at Carlton Landing, where fence lizards, eastern box turtles, and racers were observed. These reptiles, while adapted to edge habitats, would likely find little available suitable space under the full build-out of the proposed recreational facilities and parklands. Increased recreational use would lead to degraded shallow water habitats as this is where most recreational activity takes place and most semi-aquatic reptiles reside. Increased recreational activity would particularly affect the state imperiled alligator snapping turtle, as they require sandy beaches and sandbars for nesting habitat that are also popular with recreationists (Heck 1998). Finally, an increase in human population and lake access could result in increased reptile collection. Collection concerns contribute to the state imperiled designation of the Mississippi map turtle and collection is also a threat to eastern box turtles.

The increase in areas designated as Public Recreation would impact amphibian populations located along the six miles of converted shoreline at Carlton Landing. In this area, along the proposed Carlton Landing development, shoreline conversion would likely eliminate most shallow water habitat in favor of deepwater channels, revetments, and swimming beaches. Throughout the rest of the study area, increased recreational activity would degrade shallow water habitats due to high volumes of human traffic.

Mammals

Compared to the other alternatives, potential impacts to river otter populations under Alternative 4 would likely be greater and more widespread due to the potential increase in recreation and an increased number of shoreline miles reallocated from Protected to Limited Development and Public Recreation. In contrast to the negative impacts of shoreline conversion on river otters, increased development could have a positive impact on long-tailed weasel populations as any loss of forested habitats would likely be replaced by equally-preferred edge and slightly disturbed habitats. Low levels of human disturbance would also likely increase populations of small mammals, the favored prey of long-tailed weasels. While an increase in shoreline designated as Limited Development could potentially assist weasel populations, the increase in

shoreline designated as Public Recreation would likely lead to an increase in negative human-weasel interaction. As prolific raiders of chicken coops, weasels could be increasingly targeted during the trapping season (ODWC 2011d). The absence of a trapping limit on weasels could potentially have significant localized population impacts.

Under Alternative 4, the creation of large residential communities that are likely to follow the increase in the amount of shoreline allocated as Limited Development could facilitate the spread of small, invasive rodent species. The potential for introduction and establishment of nutria in the study area would likely remain low under Alternative 4. Feral hog populations would likely remain stable at moderate densities with a continuing trend of slow, northward expansion.

Birds

Potential habitat and water quality impacts under Alternative 4 could be more pronounced than under other alternatives due to higher potential levels of development and recreation. Therefore, the future condition of bald eagles would likely be characterized by some habitat loss. Full build-out of the Carlton Landing proposed development would likely displace any eagles that may frequent the area. While no eagle activity was observed during 2012 surveys, suitable habitat conditions exist, particularly on Roundtree Landing, and USACE staff report frequently observing eagle activity there. However, the lack of observed nests in the area makes it likely that displaced eagles would be migrants that would relocate to more suitable lake habitats.

Although Alternative 4 designates more shoreline as Limited Development and increases the amount of shoreline designated as Public Recreation as compared to Alternative 3, it would likely have similar potential impacts on all five bird species of conservation concern. The future condition of populations of the peregrine falcon, Sprague's pipit, and Bachmann's sparrow, would likely be similar to that described under the No Action Alternative. However, decreases in Bell's vireo and prothonotary warbler populations would likely be greater than those under other alternatives due to increased habitat degradation and other impacts associated with a potential increase in development on lands adjacent to the shoreline. Only the prothonotary warbler was observed within or adjacent to the proposed Carlton Landing development property. Therefore, activities associated with full build-out, including tree removal and increased human traffic, could impact local warbler populations.

Impacts to birds of prey and songbird populations under Alternative 4 would likely be greater and more widespread than under other alternatives due to an expected increase in recreation and the proposed increase in the number of shoreline miles reallocated from Protected to Limited Development. The increase in areas designated Public Recreation would likely impact those individuals located along the six miles of shoreline at Carlton Landing, resulting in displacement of some individuals to more suitable environments.

Under Alternative 4, especially under full build-out on the proposed Carlton Landing development, increased development of residential and recreational areas, and associated increased use of herbicide application, would be likely to alter songbird composition. For example, species such as the eastern bluebird, Bewick's wren, and indigo bunting may replace species that require dense forests such as the black-and-white warbler. Therefore, areas of intense residential development, such as that proposed at Carlton Landing, would result in the likely replacement of species adapted to dense forests or closed canopy systems with species at home in open park-like settings and maintained landscapes.

Most ground bird species do not tolerate high levels of human disturbance, and increased residential development often converts suitable habitat and decreases nesting success due to direct ground nest destruction and predation by raccoons and domestic cats. Therefore, under Alternative 4, full build-out of the proposed Carlton Landing development would likely displace many ground birds from the area.

Increased recreational activity and shoreline uses such as private docks under Alternative 4 would be likely to result in negative impacts to waterfowl and waterbirds. The potential increase in recreational activity on the lake would likely result in increased energy costs to waterfowl and waterbirds associated with fleeing response. Recreational activity also increases the likelihood of disturbance to aquatic habitats, including nest sites. Areas of significant development and shoreline conversion, such as would be allowed under the full build-out at the proposed Carlton Landing development, would likely eliminate those areas as habitat for sensitive species. However, some more adaptable species could potentially benefit through increased forage opportunities and decreased competition.

Another potential impact on waterfowl due to increased recreational use of the lake under Alternative 4 would be increased hunting pressure. Waterfowl hunting is extremely popular within the Eufaula Lake study area and an increase in the local human population as a result of increased development and recreational opportunities would likely increase the number of hunters. In addition, there would likely be fewer areas where hunting is allowed due to an increase in private development. Therefore, a greater number of hunters would be concentrated into fewer hunting areas. While waterfowl hunting is closely regulated and is not expected to reach high enough levels to cause a significant decline in waterfowl populations, hunting activity could potentially compound the impact to localized populations of species already stressed by habitat reduction.

Invertebrates

Compared to other alternatives, potential impacts of Alternative 4 on aquatic invertebrate populations and communities would likely be greater and more widespread due to a potential increase in recreational activity and an increased number of shoreline miles reallocated from Protected to Limited Development and Public Recreation. These potential impacts would be greatest at the Carlton Landing location, as planned shoreline disturbances and landscaping activities within the enclosed inlet at the proposed town center, known locally as Ski Cove, would likely provide the nutrient and environmental conditions conducive to algal population explosions.

The potential for additional boat dock construction would likely result in a faster and more complete expansion of the zebra mussel within the Eufaula Lake study area.

4.2.7.2 Indirect Impacts

Of all the alternatives, Alternative 4 has the greatest potential for indirect impacts to aquatic and terrestrial species because it would be likely to result in the greatest amount of development in areas adjacent to government-owned lands. Development would likely disrupt natural hydrology and increase sediment and nutrient inputs through land disturbance activities including construction, increased impervious surfaces, and active vegetation management, which in turn would impact habitats and their associated species.

4.2.7.3 Significance of Impacts

Alternative 4 has the greatest likelihood of all alternatives to result in significant negative impacts to fish and wildlife.

4.2.8 Potential Mitigation Measures (Fish and Wildlife)

Mitigation includes avoidance, minimization, rectification, reduction, and compensation for potential impacts associated with an action (40 CFR 1508.20). To mitigate for potential impacts of human disturbance on terrestrial and aquatic habitats and the natural resources that reside therein, USACE would implement the mitigation measures described in the following sections as appropriate.

The same mitigation measures that address impacts to vegetation, wetlands and aquatic habitats discussed in Section 4.1.7 also address impacts to the fish and wildlife species that reside in and rely on these habitats. The mitigation measures discussed in Section 4.1.7 would be applicable to this section as well, but are not repeated here. This section focuses on specific measures to address impacts to protected species in the study area.

4.2.8.1 Vegetation Management

Vegetation modification could affect the long-term viability of forest habitats by preventing recruitment of new trees in areas that are mowed continuously. In addition, mowing could have the effect of reducing the suitability of habitats for grass nesting birds. USACE could implement the following mitigation measures as conditions on vegetation modification permits to minimize potential impacts on wildlife species:

- Restrict tree cutting to only those 2.5 inches in diameter or less.
- Restrict mowing activities between April 1 and August 15 to no more than once per season.
- Limit mowing and vegetation management such that the minimum height of the remaining grass and vegetation must be at least 12 inches.
- USACE biologists would review mowed areas prior to vegetation modification permit renewal and require planting of trees and other woody species in areas where the understory has been impacted.

4.2.8.2 Protected Species

The bald eagle has also been documented in several areas of the Eufaula Lake study area, including areas near Brooken Cove, Mill Creek WMA, and Roberts Ridge. The seasonal and large geographic spread of these and other recent sightings suggest that the eagles comprise a low-density, widespread resident population supplemented by a larger number of winter residents. While USFWS has documented recent nesting activities, no nests, nest-building activities, or eagle courtship were observed during several winter, spring, and summer surveys.

Due to the documented presence of eagles during breeding and non-breeding seasons, construction activities within the Eufaula Lake study area may come into contact with bald eagles. Bald eagle nests would be avoided and nest trees would be preserved. Nesting bald eagles are most sensitive to disturbance during courtship, laying, and incubation. Thus, it would be prudent to complete large-scale shoreline construction projects in potential bald eagle nesting territories during the non-nesting periods from late-September until early-January. USFWS guidelines and recommendations would be followed for construction activities that must be completed during nesting and rearing months (USFWS 2006).

To avoid disturbing nesting eagles it is recommended that workers also maintain natural forest (vegetation) buffers around nest trees and minimize potential visual and auditory impacts associated with human activities.

Shoreline construction activities that take place during the non-breeding season would have little effect on bald eagles. However, construction activities would still need to be designed and scheduled to avoid established winter roost and feeding sites. Large shoreline trees would be preserved whenever possible to provide potential perching and nesting trees for bald eagles.

If any protected species are encountered during shoreline construction, all activities must cease and USFWS notification would be required. If listed species are encountered during recreational activities, any action that serves to harass or harm the individual(s) would be prohibited.

4.3 Water Quality

4.3.1 Assessment Methods (Water Quality)

Water quality in the study area is described in terms of the water quality monitoring points and from a watershed perspective (*e.g.*, documentation of land use and tributary water quality). This involves an evaluation of the water quality data relative to water quality standards (such as dissolved oxygen, turbidity, nutrients, coliforms, and biological integrity) and a qualitative determination of the contribution of point and nonpoint sources to the lake.

This information forms the basis of the evaluation of potential effects of each alternative on water quality and aquatic resources in Eufaula Lake. An evaluation of the 303(d) list of impaired waters for Oklahoma indicates that several portions of Eufaula Lake and tributaries to the lake do not meet water quality standards for the designated uses.

Water quality data were analyzed to determine trends in the data and evaluate how water quality may be affected by the alternatives. In addition, a basic model was used to quantitatively estimate runoff and pollutant loads into Eufaula Lake for each of the alternatives. The EPA Spreadsheet Tool for Estimating Pollutant Load (STEPL) Model employs simple algorithms to estimate annual runoff volume, and total nitrogen, phosphorus, biochemical oxygen demand (BOD), and sediment load from location and land use input information. For the purposes of the STEPL analysis, two scenarios were explored to determine direct and indirect impacts to water quality in Eufaula Lake: pollutant loads contributed from USACE-owned lands only, which represent direct impacts, and pollutant loads contributed from USACE-owned and adjacent private lands, which represents direct and indirect impacts. The contributing watershed was assumed to be the USACE-owned lands around the lake, and private land area was calculated based on a ½ mile buffer around USACE-owned lands.

A summary of total pollutant loads entering Eufaula Lake are presented in **Table 4.3-1** and **Table 4.3-2**. Based on the pollutant loads for each alternative, percent changes were calculated compared to the No Action Alternative for each pollutant. These values are presented in **Table 4.3-3** and **Table 4.3-4**.

The total pollutant loads presented in **Table 4.3-1** and **Table 4.3-2** only account for inputs around the lakeshore and do not include pollutant loadings from the rivers that contribute to Eufaula Lake. Model results represent potential conditions under each alternative and do not estimate pollutant concentrations with any BMPs or mitigation measures installed. More detail on the modeling method and results are provided in Appendix D.

Table 4.3-1. Total Pollutant Loads Entering Eufaula Lake from USACE-owned Land

Alternatives	Runoff Volume (AF)	Phosphorus (lb/yr)	Nitrogen (lb/yr)	BOD (lb/yr)	Sediment (tons/yr)
No Action	41,783	26,999	183,579	552,489	4,691
Alternative 1	38,907	22,771	158,805	483,444	3,941
Alternative 2	40,095	24,517	169,039	511,966	4,251
Alternative 3	43,683	29,793	199,950	598,113	5,186
Alternative 4	45,855	32,986	218,659	650,252	5,753

Table 4.3-2. Total Pollutant Loads Entering Eufaula Lake from USACE-owned and Private Land

Alternatives	Runoff Volume (AF)	Phosphorus (lb/yr)	Nitrogen (lb/yr)	BOD (lb/yr)	Sediment (tons/yr)
No Action	196,840	142,981	1,099,811	3,363,701	22,134
Alternative 1	155,989	103,141	921,627	2,893,814	13,972
Alternative 2	180,725	127,208	1,028,504	3,174,993	18,906
Alternative 3	214,993	160,748	1,180,136	3,576,276	25,770
Alternative 4	235,738	181,053	1,271,927	3,819,191	29,925

Table 4.3-3. Percent Change in Pollutants Entering Eufaula Lake from USACE-owned Land Compared to the No Action Alternative

Alternatives	Runoff Volume (AF)	Phosphorus (lb/yr)	Nitrogen (lb/yr)	BOD (lb/yr)	Sediment (tons/yr)
Alternative 1	-7%	-16%	-13%	-12%	-16%
Alternative 2	-4%	-9%	-8%	-7%	-9%
Alternative 3	5%	10%	9%	8%	11%
Alternative 4	10%	22%	19%	18%	23%

Table 4.3-4. Percent Change in Pollutants Entering Eufaula Lake from USACE-owned and Private Land Compared to the No Action Alternative

Alternatives	Runoff Volume (AF)	Phosphorus (lb/yr)	Nitrogen (lb/yr)	BOD (lb/yr)	Sediment (tons/yr)
Alternative 1	-21%	-28%	-16%	-14%	-37%
Alternative 2	-8%	-11%	-6%	-6%	-15%
Alternative 3	9%	12%	7%	6%	16%
Alternative 4	20%	27%	16%	14%	35%

4.3.2 Significance Criteria (Water Quality)

An impact on water quality may be considered significant if it results in a decline in water quality so that water quality standards are not met or water quality is degraded as described in national policy. If the potential direct or indirect impacts would exceed existing water quality standards, a significant effect would occur. In addition, if the potential direct or indirect impacts will contribute to continued impairment of water quality standards, this would constitute a significant effect.

4.3.3 No Action Alternative (Water Quality)

The No Action Alternative represents no change from current management direction or level of management intensity. There would be no change to the existing shoreline allocations, land use classifications under the MP, or vegetation management policies. No action would be taken on any of the individual zoning requests as described in Section 2.4.2. With respect to the proposed development at Carlton Landing, the grant of a lease would not be approved and proposed public shoreline recreational facilities on government land would not be permitted.

4.3.3.1 Potential Impacts

Shoreline Allocations and Land Use

Under this alternative, the existing distribution of shoreline allocations would remain unchanged. The areas allocated for Limited Development would be the areas where the greatest potential for shoreline effects would occur. Limited Development areas allow private boat docks and modification of shoreline vegetation. Under this alternative, a total of 271 miles of Limited Development would remain unchanged, which would have a maximum build-out potential of 8,746 docks. Currently 1,673 private and community docks are located along Limited Development shorelines.

Existing Limited Development areas would allow additional dock construction and water quality impacts associated with dock construction (*e.g.* sedimentation and erosion) could result in impacts to water quality. Construction of private boat docks would result in an increase in recreational boating activity on the water. Dock construction, and subsequent boating activity, would have the potential to cause an increase in shoreline erosion from wave action. Potential water quality impacts may include oil, gas, bacteria, and nutrients from boating activities (*e.g.*, cleaning, fueling, sewage disposal), as well as an increase in turbidity caused by shoreline erosion. Wake zones can mitigate some erosion associated with waves caused by boats. Water quality impacts related to boating access may result in unavoidable and significant (in terms of turbidity) water quality impacts.

Vegetation Modification

Vegetation modification and mowing can alter the natural vegetation along the shoreline. Vegetation modification often includes fertilization, which can lead to nutrient loading of aquatic systems. Vegetation modification can also increase the velocity of stormwater runoff, which would otherwise be slowed by natural vegetation and infiltration. Increased stormwater runoff has the potential to cause erosion and an increase in turbidity.

Carlton Landing Development

The requested lease for use of government land to construct and operate a proposed public marina and other shoreline recreational facilities would not be granted under the No Action Alternative. Development on the adjacent private lands would include approximately 170 residential lots, a conference and retreat facility, community parks and green spaces, and commercial/multi-use family areas under the No Action

Alternative. Development associated with these activities could result in increased turbidity, shoreline erosion, and increased nutrient loading, particularly as they would be located close to the lakeshore.

The STEPL Model was run for the proposed Carlton Landing development area for both USACE-owned lands only and for the combination of USACE-owned and adjacent private lands (**Table 4.3-5**). The estimated runoff and pollutant loads under the No Action alternative in the proposed Carlton Landing area are shown in **Table 4.3-5**.

Table 4.3-5. Proposed Carlton Landing Development under the No Action Alternative

	Runoff Volume (AF)	Total Phosphorus Load (lb/year)	Total Nitrogen Load (lb/year)	Total Sediment Load (tons/year)
USACE-owned Lands	158	117	634	42
USACE-owned and Adjacent Private Lands	740	588	3,808	192

Residential Development Adjacent to Government Lands

Under the No Action Alternative there would be the potential for considerable new development around the lake on private lands adjacent to Limited Development shorelines. Construction of new residential development would increase the amount of impervious surfaces near the lake, which is associated with an increased quantity of stormwater, and therefore, with an increased pollutant load (*e.g.*, sediment, oil, grease, pesticides and nutrients from lawns, bacteria and nutrients from pet waste, heavy metals from roof shingles, motor vehicles and other sources). Potential water quality impacts associated with stormwater pollution include higher turbidity, increased nutrient and bacteria loading, and decreased dissolved oxygen.

Construction of new developments on private lands adjacent to Limited Development shorelines would also be expected to result in an increase in the number of new septic systems. Septic systems, if improperly managed and/or maintained, may contribute to surface water pollution and result in elevated nutrient or bacteria loads. Common causes of water quality impacts from these systems include aging, inappropriate design, overloading with too much wastewater in too short a period of time, and poor maintenance. Aging septic systems accompanied by poor soils and lack of wastewater disposal alternatives may be contributing factors to water quality degradation in Eufaula Lake.

4.3.3.2 Summary of Potential Water Quality Impacts

Overall, the No Action Alternative would be expected to remain fairly consistent with current trends (*e.g.*, increasing phosphorus, nitrogen, turbidity and chlorophyll-*a*). Selection of this alternative would likely result in an increase in land-based effects (*e.g.*, shoreline erosion from residential clearing, impacts from failing septic systems, increased stormwater pollution) and an increase in water-based effects (*e.g.*, boating). Water quality modeling indicates that under the No Action Alternative, average phosphorus, nitrogen, and sediment concentrations entering Eufaula Lake could increase compared to existing conditions (**Table 4.3-6**).

Table 4.3-6. Average Phosphorus, Nitrogen, and Sediment Concentrations in Eufaula Lake

	Phosphorus (ppm)	Nitrogen (ppm)	Sediment Inflow (AF/yr) ¹
Existing Conditions	0.070	0.410	7,249
No Action Alternative	0.0729	0.4226	7,257

¹ODWC 2008

Nutrients are an existing water quality issue in Eufaula Lake. Under this alternative, nutrient transport has the potential to increase as Limited Development shorelines are developed with docks and adjacent lands are built up. Water quality modeling indicates that under the No Action Alternative, Eufaula Lake could see a four percent increase in average phosphorus concentrations, and a three percent increase in average nitrogen concentrations compared to existing conditions. Increased levels of nitrogen and phosphorus can lead to blooms of blue-green algae, impede recreational activities, harm wildlife habitats, and decrease the amount of oxygen that fish and aquatic life need to survive.

The potential for significant water quality impacts from increased turbidity, which already exceeds water quality standards, is of particular concern. There could be the potential for significant water quality impacts related to dissolved oxygen, which also exceeds water quality standards in some samples. In addition, potential impacts related to recreation would be present and may be caused by a variety of water quality impacts (*e.g.* nutrients, turbidity) and other factors (*e.g.* water clarity).

USACE water quality monitoring has identified high levels of blue-green algae near Belle Starr, Brooken Cove, Highway 9 Landing, and Porum Landing at various times during the 2012 recreation season. Due to elevated blue-green algae cell counts, water contact activities in the affected areas are discouraged until toxicity tests can be completed (OTRD 2012). Algal blooms are caused by an increase in nutrients that causes an overgrowth of algae. The risk associated with high algae counts is their ability to produce and release toxins into the water. People that come in contact with water high in blue-green algae may experience a wide range of symptoms, most commonly upper respiratory problems, eye irritation, vomiting, and diarrhea. Water quality impacts of algal blooms may affect public health, and the ecological and economic resources in Eufaula Lake. Continued increases in recreational use and lakeshore development under the No Action Alternative could result in additional blue-green algal blooms during the summer months in many parts of the lake.

4.3.4 Alternative 1 (Water Quality)

Under Alternative 1, the shoreline allocation for Limited Development is reduced to the area as it existed under the 1981 SMP. This alternative would implement the extended buffer vegetation management policy, which includes the widest buffers proposed to protect shoreline habitats. The requested lease for a public marina and other public recreational facilities at Carlton Landing would not be granted and individual zoning requests received during scoping would be addressed as described in Section 2.4.3.

4.3.4.1 Direct Impacts

Shoreline Allocations and Land Use

Alternative 1 would decrease Limited Development shoreline allocation by 85 percent and Protected shoreline would increase by 53 percent. This alternative would reduce Limited Development allocated shoreline to 42 miles, with a potential maximum of 2,278 private boat docks. Since the current number of

docks is 1,673, only 605 new docks would be permitted under Alternative 1. Therefore, potential water quality impacts related to dock construction would be minimal.

Water quality modeling results indicate that Alternative 1 could result in a reduction in phosphorus, nitrogen, and sediment compared to the No Action Alternative. The model results estimate that direct potential impacts under Alternative 1 could result in a load reduction of 16 percent for phosphorus, 13 percent for nitrogen, and 16 percent for sediment as compared to the No Action Alternative (**Table 4.3-3**).

Boating activities could have a potential water quality impact, although it would not increase from the existing condition. Future potential impacts from boating activities could be substantially less than with the maximum build out under the No Action Alternative.

Vegetation Management

Alternative 1 would implement the extended buffer vegetation management policy, which includes the widest buffers proposed to protect shoreline habitats. Extended buffers would protect 55 to 95 feet of vegetation along the water's edge forming a buffer between the water and upland activities. In order to limit effects on water quality, vegetation management activities on government land would be limited to the areas upland of these buffer zones. Clearing or mowing activities would not be allowed within the buffer zone. Vegetated buffers can be very effective in filtering stormwater runoff and removing pollutant loads of nutrients and sediment. The overall increase in vegetative buffers could result in improved water quality.

USACE generally honors past written commitments, such as permits related to vegetation modification practices. Any changes to vegetation management policies included within any proposed alternative would apply only to the issuance of new permits.

Carlton Landing Development

The development at Carlton Landing would largely be the same as that described under the No Action Alternative. Under Alternative 1, the Limited Development areas on the south side of Longtown Arm would be reallocated to Protected areas.

The request for Public Recreation shoreline designated at the proposed Carlton Landing development would not be approved, and the land would be reclassified to Future/Inactive Recreation. The lease for a public marina and other public recreational facilities would not be granted. The maintenance of the Protected shoreline allocation would limit potential public recreational use of the shoreline for Carlton Landing residents and the limited access would protect shoreline vegetation and water quality. Potential build out under Alternative 1 of the adjacent private lands would be the same as under the No Action Alternative. The transition of Limited Development to Protected shoreline allocation on the south side of Longtown Arm would further limit potential residential development on adjacent private lands in that area.

The STEPL Model was run for the proposed Carlton Landing development area for both USACE-owned lands only and USACE-owned and adjacent private lands (**Table 4.3-5**). The potential water quality impacts from the proposed Carlton Landing development under Alternative 2 would be the same as those under the No Action Alternative.

4.3.4.2 Indirect Impacts

Shoreline Allocations and Land Use

Indirect impacts resulting from shoreline allocations and corresponding land use under Alternative 1 would be minimal compared to the No Action Alternative. Under this alternative, there is the potential for the rate of new residential development to slow compared to historic trends because less land along the lake would be available to provide the amenities of lake access and private boat dock ownership. Potential water quality impacts related to construction and development could be minimal compared to the No Action Alternative.

Model results for both USACE and adjacent private lands combined indicate that Alternative 1 could result in a load reduction of 28 percent for phosphorus, 16 percent for nitrogen, and 37 percent for sediment as compared to the No Action Alternative (**Table 4.3-4**). The results from both private and government lands are combined because stormwater runoff that carries the pollutant loads to aquatic systems needs to cross the government lands before reaching the lake.

4.3.4.3 Summary of Potential Water Quality Impacts

Overall, Alternative 1 would result in few new docks, less potential development on adjacent private lands, and larger vegetative buffers compared to the No Action Alternative, which could have a beneficial effect on water quality. Under this alternative, water quality at Eufaula Lake could be expected to improve somewhat. Less activity around and on the lake could increase dissolved oxygen, decrease turbidity, and decrease nitrogen and phosphorus loading.

Water quality modeling results indicate that Alternative 1 could result in a reduction in phosphorus, nitrogen, and sediment compared to the No Action Alternative. The model results estimate that direct potential impacts under Alternative 1 could result in a load reduction of 16 percent for phosphorus, 13 percent for nitrogen, and 16 percent for sediment as compared to the No Action Alternative (**Table 4.3-3**). When indirect and direct impacts are combined, Alternative 1 could result in a load reduction of 28 percent for phosphorus, 16 percent for nitrogen, and 37 percent for sediment as compared to the No Action Alternative (**Table 4.3-4**). The water quality impacts estimated with the STEPL model do not take into account any mitigating effects of the shoreline buffer vegetation management policy or potential BMP installation, which would further reduce these potential pollutant loads.

Implementation of the extended shoreline buffer vegetation management policy and the establishment of buffers along the shoreline could reduce shoreline erosion, decrease turbidity, and reduce runoff from activities near the shoreline that may degrade water quality. The extended vegetation buffers proposed under this alternative would be the widest buffers proposed and would be most protective of water quality. Extended buffers could minimize water quality degradation related to runoff, vegetation clearing, and mowing. This alternative would result in a decrease in both land-based and water-based water quality effects.

4.3.5 Alternative 2 (Water Quality)

Alternative 2 would reduce the length of Limited Development shoreline compared to the No Action Alternative by converting existing Limited Development shorelines that are unsuitable for docks and do not have existing developments adjacent to the government lands to Protected shoreline allocations. This alternative represents a mid-range alternative balancing natural resource conservation with recreation and private exclusive uses. The requested lease for a public marina and other public recreational facilities at

Carlton Landing would not be granted. Individual zoning requests received during scoping would be addressed as described in Section 2.4.4.

4.3.5.1 Direct Impacts

Shoreline Allocations and Land Use

This alternative would decrease the amount of Limited Development shoreline miles by 33 percent and increase Protected allocated shoreline by miles by 20 percent. Under this alternative, there would be a maximum build-out potential of 5,873 docks. Dock construction and recreational activity associated with boating could have the potential for similar impacts to those described under the No Action Alternative. However, there would be a 32 percent decrease in the potential number of boat docks with corresponding decreases in potential impacts from construction and use as compared to the No Action Alternative.

Water quality modeling results indicate that Alternative 2 could result in a reduction in phosphorus, nitrogen, and sediment compared to the No Action Alternative. The model results estimate that, compared to the No Action Alternative, direct potential impacts under Alternative 2 could result in load reductions of nine percent for phosphorus, eight percent for nitrogen, and nine percent for sediment (**Table 4.3-3**).

Vegetation Management

Under this alternative, the extended buffer vegetation management policy would be implemented, which includes the widest buffers proposed. Extended buffers would protect 55 to 95 feet of vegetation along the water's edge forming a buffer between the water and upland activities. In order to limit effects on water quality, vegetation management activities on government land would be limited to the areas upland of these buffer zones. Clearing or mowing activities would not be allowed within the buffer zone. Vegetated buffers can be very effective in filtering stormwater runoff and removing pollutant loads of nutrients and sediment. The overall increase in vegetative buffers could result in improved water quality.

USACE generally honors past written commitments, such as permits related to vegetation modification practices. Any changes to vegetation management policies included within any proposed alternative would apply only to the issuance of new permits.

Carlton Landing Development

Similar to the No Action Alternative, the requested lease required for construction and operation of a proposed public marina and other public recreational facilities at Carlton Landing would not be granted. Under this alternative, the potential scope of future development at Carlton Landing would be the same as that described for the No Action Alternative. The continued presence of the Limited Development area on the south side of Longtown Arm would allow for some additional private docks and floating facilities to be developed. However, this potential impact would likely be minimal.

The STEPL Model was run for the proposed Carlton Landing development area for both USACE-owned lands only and USACE-owned and adjacent private lands (**Table 4.3-5**). The potential water quality impacts from the proposed Carlton Landing development under Alternative 2 would be the same as those under the No Action Alternative.

4.3.5.2 Indirect Impacts

Shoreline Allocations and Land Use

Under Alternative 2, there would be the potential for some new development around the lake on private lands adjacent to Limited Development shorelines. Approximately 65 miles of additional shoreline would be available to accommodate new boat dock construction which is about 39 percent less than is currently available under the No Action Alternative. New residential development would increase the amount of impervious surfaces near the lake, which is associated with an increased quantity of stormwater, and therefore, with an increased pollutant load. Construction of new developments adjacent to Limited Development shorelines could also be expected to result in an increase in the number of new of septic systems with potential water quality impacts as they age.

Indirect impacts resulting from shoreline allocations and corresponding land use under Alternative 2 would be less than those expected under the No Action Alternative.

Model results for both USACE and adjacent private lands combined indicate that Alternative 2 could result in load reductions of 11 percent for phosphorus, six percent for nitrogen, and 15 percent for sediment as compared to the No Action Alternative (**Table 4.3-4**). The results from both private and government lands are combined because stormwater runoff that carries the pollutant loads to aquatic systems needs to cross the government lands before reaching the lake.

4.3.5.3 Summary of Potential Water Quality Impacts

Overall, water quality at Eufaula Lake could improve under Alternative 2, but not as significantly as under Alternative 1. A reduction in the length of the shoreline allocated to Limited Development would result in less activity on the lake and less potential for new residential development adjacent to the lakeshore. Reduced activity on and around the lake would result in reduced pollutant loads and could increase dissolved oxygen, decrease turbidity, and decrease nitrogen and phosphorus loading.

Water quality modeling results indicate that Alternative 2 could result in a reduction in phosphorus, nitrogen, and sediment compared to the No Action Alternative. The model results estimate that, compared to the No Action Alternative, direct potential impacts under Alternative 2 could result in load reductions of nine percent for phosphorus, eight percent for nitrogen, and nine percent for sediment (**Table 4.3-3**). When indirect and direct impacts are combined, Alternative 2 could result in load reductions of 11 percent for phosphorus, six percent for nitrogen, and 15 percent for sediment as compared to the No Action Alternative (**Table 4.3-4**). The water quality impacts estimated with the STEPL model do not take into account any mitigating effects of the shoreline buffer vegetation management policy or potential BMP installation, which would further reduce these potential pollutant loads.

Implementation of the extended buffer vegetation management policy and the establishment of vegetation buffers along the shoreline could reduce shoreline erosion and decrease turbidity as well as reduce runoff from activities near the shoreline that may degrade water quality, such as fertilizing lawns. The extended buffers proposed under this alternative are the widest proposed and would be the most protective of water quality, minimizing water quality degradation related to runoff, vegetation clearing, and mowing. This alternative could result in a decrease in both land-based and water-based effects.

4.3.6 Alternative 3 (Water Quality)

Alternative 3 would increase the amount of Limited Development shoreline compared to the No Action Alternative by reallocating Protected shorelines that are suitable for docks and which do not have an

existing lease agreement for use of the USACE-owned lands to Limited Development. Alternative 3 represents a mid-range option for balancing natural resource conservation with private recreational development opportunities. Under Alternative 3, the lease request for a public marina and public shoreline recreational facilities at Carlton Landing would not be granted. Individual zoning requests received during scoping would be addressed as described in Section 2.4.5.

4.3.6.1 Direct Impacts

Shoreline Allocations and Land Use

Under Alternative 3, Limited Development shoreline miles would increase by 35 percent and Protected shoreline miles would decrease by 23 percent compared to the No Action Alternative. Under this alternative, there could be a maximum of 11,844 docks.

Similar to the No Action Alternative, development and dock construction have the potential to cause an increase in shoreline erosion, increased turbidity, and potential impacts due to boating activities (*e.g.*, oil, gas, bacteria, and nutrients). Potential water quality impacts related to boating may result in unavoidable and significant (in terms of turbidity) water quality impacts.

Water quality modeling results indicate that Alternative 3 could result in an increase in phosphorus, nitrogen, and sediment compared to the No Action Alternative. The model results estimate that potential direct impacts under Alternative 3 could result in load increases of ten percent for phosphorus, nine percent for nitrogen, and 11 percent for sediment as compared to the No Action Alternative (**Table 4.3-3**).

Vegetation Management Policies

Alternative 3 would implement the baseline buffer vegetation management policy. The baseline buffers would be 25 feet smaller than the extended buffers applied under Alternatives 1 and 2. Based on the criteria in this policy, the baseline vegetation management buffers would extend from 30 to 70 feet from the shoreline. In order to limit effects on water quality, vegetation, and wildlife habitat, vegetation management activities would only be allowed on USACE-owned land upland of these buffer zones. Vegetated buffers can be very effective in filtering stormwater runoff and removing pollutant loads of nutrients and sediment. Although the buffers proposed under this alternative are smaller than under Alternatives 1 and 2, they could be very effective in protecting water quality from the effects of residential development upland from the lakeshore.

USACE generally honors past written commitments, such as permits related to vegetation modification practices. Any changes to vegetation management policies included within any proposed alternative would apply only to the issuance of new permits.

Carlton Landing Development

Under Alternative 3, the designation of Protected shorelines along the Carlton Landing shoreline would change to Limited Development. The lease request for a marina and other public recreational facilities along the shoreline would not be granted. Access to lake-based recreation would be largely limited to private home sites immediately adjacent to USACE-owned lands along the shoreline and in the town center area of the Carlton Landing development. Overall, the scale and extent of the proposed Carlton Landing development would be similar to that described for the No Action Alternative.

The increase in Limited Development area on the north side of Longtown Arm would allow for additional private dock construction and boating access as compared to the No Action Alternative. However, the

number of docks that could be accommodated would be limited. Potential water quality impacts could result from the construction of boat docks at individual residences and there could be an increase in activity along the shoreline compared to the No Action Alternative.

At Carlton Landing, about 1.4 miles of the 5.8 miles of shoreline along the proposed lease actually abuts the private land boundary. This could allow for a theoretical maximum of about 87 new docks at Carlton Landing, mostly along the shoreline to the west of Roundtree Landing. However, much of the shoreline is very steep and the presence of standing timber in Longtown Arm could reduce the attractiveness of this area for boat dock construction. However, while the construction of 87 docks as a component of the total number of docks that could potentially be constructed under Alternative 3 may represent a minimal effect, the concentration of this many new docks along the short span of the Carlton Landing shoreline and within the narrow confines of Longtown Arm could result in acute localized erosion and turbidity.

The proposed Carlton Landing development wastewater system would consist of a private sewage treatment system composed of three sewage treatment lagoons that would be sufficient to serve the amount of development expected under Alternative 3. All of the lagoons would be zero-output, total retention lagoons with a synthetic liner and under-liner collection system. A lagoon sewage treatment system operated and maintained per Title 252 Chapter 641 of the Oklahoma Administrative Code should have minimal to no impact on water quality.

The STEPL Model was run for the proposed Carlton Landing development area for both USACE-owned lands only and USACE-owned and adjacent private lands (**Table 4.3-5**). The potential water quality impacts from the proposed Carlton Landing development under Alternative 3 would be the same as those under the No Action Alternative.

4.3.6.2 Indirect Impacts

Under Alternative 3, there would be the potential for new development around the lake on private lands adjacent to Limited Development shorelines. There would be approximately 157 miles of additional shoreline that could accommodate new boat dock construction which is about 45 percent more than is currently available under the No Action Alternative. These shorelines allocated to Limited Development would be likely to attract new residential developments on adjacent private lands because of the amenities of lake access and the potential for private dock ownership. New residential development could increase the quantity of stormwater runoff, and therefore, increase pollutant loads. Development on private lands adjacent to Limited Development areas could result in increased nutrients associated with fertilizer application and increased turbidity associated with impervious surfaces and construction.

Construction of new developments adjacent to Limited Development shorelines could also be expected to result in an increase in the number of new septic systems which may not have an immediate water quality impact but may result in an increase in nutrients and bacteria over the long-term as they age.

Indirect water quality impacts resulting from shoreline allocations and corresponding adjacent land development under Alternative 3 could increase compared to the No Action Alternative. Model results for both USACE and adjacent private lands combined indicate that Alternative 3 could result in load increases of 12 percent for phosphorus, seven percent for nitrogen, and 16 percent for sediment as compared to the No Action Alternative (**Table 4.3-4**). The results from both private and government lands are combined because stormwater runoff that carries the pollutant loads to aquatic systems needs to cross the government lands before reaching the lake.

4.3.6.3 Summary of Potential Water Quality Impacts

Under Alternative 3, water quality in Eufaula Lake could be negatively impacted and there could be an increase in both land-based and water-based effects. Increased activity around and on the lake could result in increased erosion, lower dissolved oxygen, higher turbidity and larger phosphorus and nitrogen loads.

Water quality standards for turbidity are exceeded under current conditions; therefore, any impact on turbidity would be significant. Dissolved oxygen levels in Eufaula Lake have exceeded water quality standards under some conditions; therefore, water quality impacts on dissolved oxygen have the potential to be significant under Alternative 3.

Nutrients are an existing water quality concern in Eufaula Lake, and under Alternative 3 nutrient transport could have the potential to increase. An increase in nutrients could contribute to blue-green algae blooms around the lake, which could compromise recreational opportunities, public health, and wildlife habitat.

Water quality modeling results indicate that Alternative 3 could result in an increase in phosphorus, nitrogen, and sediment compared to the No Action Alternative. The model results estimate that potential direct impacts under Alternative 3 could result in load increases compared to the No Action Alternative of ten percent for phosphorus, nine percent for nitrogen, and 11 percent for sediment (**Table 4.3-3**). When indirect and direct impacts are combined, Alternative 3 could result in a load increases compared to the No Action Alternative of 12 percent for phosphorus, seven percent for nitrogen, and 16 percent for sediment (**Table 4.3-4**). The water quality impacts estimated with the STEPL model do not include the mitigating effects of the shoreline buffer vegetation management policy or BMPs, which would reduce these predicted pollutant loads.

Existing water quality conditions in Eufaula Lake would not affect the proposed actions in Alternative 3. Turbidity is quite high in some areas of the lake, which may be undesirable from an aesthetic perspective for swimming and recreational activities such as water skiing. The Carlton Landing development is proposed on the eastern portion of the lake which tends to have better water clarity in general. Other areas that would be changed to Limited Development include areas where turbidity and water quality may not be suitable for certain types of recreational activities and may be less attractive for new residential development.

4.3.7 Alternative 4 (Water Quality)

Alternative 4 would increase the amount of Limited Development shoreline compared to the No Action Alternative by converting all Protected areas that do not have an existing lease agreement for use of the USACE-owned shoreline to Limited Development. Under Alternative 4, the lease request for a public marina and other public recreational facilities at Carlton Landing would be granted. Individual zoning requests received during scoping would be addressed as described in Section 2.4.6.

4.3.7.1 Direct Impacts

Shoreline Allocations and Land Use

Under Alternative 4, Limited Development shoreline would increase by 77 percent and Protected shoreline miles would decrease by 50 percent. This alternative would result in the largest increase in Limited Development shoreline allocation of all of the alternatives. High Density Recreation land use allocations would increase by 43 acres along the shoreline to the west of Roundtree Landing at the Carlton Landing area. Alternative 4 would allow a potential maximum of 15,459 docks to be constructed. While the actual

number of docks could be considerably less, this number represents the maximum potential for growth in docks and boating activity under Alternative 4.

Similar to the No Action Alternative, development and dock construction would have the potential to cause an increase in shoreline erosion, increased turbidity, and potential impacts related to boating (*e.g.*, oil, gas, bacteria, and nutrients). Water quality impacts related to boating access may result in unavoidable and significant (in terms of turbidity) water quality impacts.

Water quality modeling results indicate that among all the alternatives, Alternative 4 could result in the largest increase in phosphorus, nitrogen, and sediment compared to the No Action Alternative. The model results estimate that potential direct impacts under Alternative 4 could result in load increases of 22 percent for phosphorus, 19 percent for nitrogen, and 23 percent for sediment as compared to the No Action Alternative (**Table 4.3-3**).

Vegetation Management

Under Alternative 4, the baseline buffer vegetation management policy would be implemented. The baseline buffers would be 25 feet smaller than the extended buffers applied under Alternatives 1 and 2. Based on the criteria in this policy, the baseline vegetation management buffers would extend from 30 to 70 feet from the shoreline. In order to limit effects on water quality, vegetation, and wildlife habitat, vegetation management activities would only be allowed on USACE-owned land upland of these buffer zones. Vegetated buffers can be very effective in filtering stormwater runoff and removing pollutant loads of nutrients and sediment. Although the buffers proposed under this alternative are smaller than under Alternatives 1 and 2, they could still likely be very effective in protecting water quality from the effects of residential development upland from the lakeshore.

USACE generally honors past written commitments, such as permits related to vegetation modification practices. Any changes to vegetation management policies included within any proposed alternative would apply only to the issuance of new permits.

Carlton Landing Development

Under this alternative, the shoreline allocation along Carlton Landing would be changed from Protected to Public Recreation and the lease necessary for the construction and operation of a public marina and other public recreational facilities (*e.g.*, horseback riding trails, campsites, a nature center, and parking) would be granted. Following approval of a rezone and issuance of a lease, the full build out proposed for Carlton Landing would likely be implemented. Full build out of the 1,600 acres of privately-owned land is proposed to include approximately 2,570 home lots, a K-12 school, an organic farm, a town center, community pools, public open spaces, a conference center, and a 275-300 boat slip marina.

Development of Carlton Landing under Alternative 4 would include planned actions that would occur within the lake such as clearing of standing timber, dredging and silt removal, protected public swimming area, no wake area, kayaking and paddle boarding area, kids play zone, community boat docks (marina), boat fueling facilities, and boat storage. Planned shoreline recreational development would include structures, bike trails and horse riding trails, improved walkways, parking areas, vehicular access roads, utilities, golf cart access, a dog park, vegetation modification, and rights typical for a mowing permit.

With implementation of this development, animal waste could be expected to increase as a result of the proposed equestrian facilities and dog park. The proposed equestrian amenities would include a trail

system, stables, paddocks, pens, and barns located on USACE-owned land and sized to accommodate up to 100 horses. Animal waste contains several types of pollutants that contribute to water quality problems: nutrients, pathogens, and ammonia. Animal waste can be picked up by stormwater runoff and washed into Eufaula Lake where it would decompose, leading to a decrease in dissolved oxygen. During summer months when the water is warm, low oxygen levels can kill fish and other aquatic organisms.

Potential water quality impacts associated with the proposed horseback riding trails and dog park could include increased sediment, phosphorus, nutrients, and bacteria loadings to the lake. Activities such as heavy grazing and horse traffic on trails would remove the vegetative cover and can expose the soil surface. Exposed soil could be easily transported by runoff into the lake. Chemicals used during horse grooming and shelter and living area maintenance may cause adverse health effects to humans and can be toxic to aquatic life. Runoff from areas containing manure, bedding, or feed debris could represent the most significant potential source of pollutants from proposed equestrian facilities (South Orange County Permittees 2004).

Planned shoreline recreational development could increase impervious surfaces (*e.g.*, roads, parking lots, roof tops) along the shoreline and contribute to increased erosion and turbidity, which already exceeds water quality standards.

The construction of a public marina at Carlton Landing could increase the number of boats potentially on the water in the vicinity of the proposed development. A marina's location, flushing times, and circulation patterns can affect sewage releases to surface waters. Proper siting of marina basins and adequate planning for boat sewage disposal are important factors in regards to mitigating potential water quality impacts.

The proposed Carlton Landing development wastewater system would consist of a private sewage treatment system. All of the proposed lagoons would be zero-output, total retention lagoons with a synthetic liner and under liner collection drain system. It is anticipated that this system would accommodate Carlton Landing for at least the first five years of the proposed development. When the community's sanitary sewer needs exceed the capacity of the first five lagoons, a new approach would be developed to meet this infrastructure need. A lagoon sewage treatment system operated and maintained properly per Title 252 Chapter 641 of the Oklahoma Administrative Code should have minimal to no impact on water quality.

The STEPL Model was run for the proposed Carlton Landing development area for both USACE-owned lands only (**Table 4.3-7**) and USACE-owned and adjacent private lands (**Table 4.3-8**). The results presented here estimate runoff and pollutant loads under Alternative 4 and compare these values to those under the No Action Alternative. These impacts may result in increased erosion and impact recreation in the area immediately surrounding the proposed Carlton Landing development.

Table 4.3-7. Direct Impacts Associated with Carlton Landing Development under Alternative 4 Compared with the No Action Alternative

	Runoff Volume (AF)	Total P ¹ Load (lb/year)	Total N ¹ Load (lb/year)	Total Sediment Load (tons/year)
No Action Alternative	158	117	634	42
Alternative 4	430	888	7,172	86
Percent Change	173%	659%	1,031%	105%

Note: This analysis addresses impacts originating from USACE-owned lands only (i.e. direct impacts)

1 - P = Phosphorus. N = Nitrogen

Table 4.3-8. Direct and Indirect Impacts Associated with Carlton Landing Development under Alternative 4 Compared with the No Action Alternative

	Runoff Volume (AF)	Total P ¹ Load (lb/year)	Total N ¹ Load (lb/year)	Total Sediment Load (tons/year)
No Action Alternative	740	588	3,805	192
Alternative 4	1,991	1,934	13,764	247
Percent Change	169%	229%	262%	28%

Note: This analysis addresses impacts originating from USACE-owned lands and adjacent private lands (i.e. direct and indirect impacts, respectively)

1 - P = Phosphorus. N = Nitrogen

4.3.7.2 Indirect Impacts

Under Alternative 4, there could be the potential for new development around the lake on private lands adjacent to Limited Development shorelines. There would be approximately 213 miles of additional shoreline that could accommodate new boat dock construction which is about 96 percent more than is currently available under the No Action Alternative. New residential development could increase the quantity of stormwater runoff, and therefore, increase pollutant loads. Construction of new developments adjacent to Limited Development shorelines could also be expected to result in an increase in the number of new of septic systems which may not have an immediate water quality impact but may result in an increase in nutrients and bacteria over the long-term as they age.

Indirect water quality impacts resulting from shoreline allocations and corresponding adjacent land development under Alternative 4 could increase compared to the No Action Alternative. Model results for both USACE and adjacent private lands combined indicate that Alternative 4 could result in load increases of 27 percent for phosphorus, 16 percent for nitrogen, and 35 percent for sediment as compared to the No Action Alternative (**Table 4.3-4**). The results from both private and government lands are combined because stormwater runoff that carries the pollutant loads to aquatic systems needs to cross the government lands before reaching the lake.

4.3.7.3 Summary of Potential Water Quality Impacts

Overall, it is anticipated that water quality in Eufaula Lake could worsen under Alternative 4. Of all the proposed alternatives, Alternative 4 could have the greatest potential for negative impacts on water quality in Eufaula Lake because of the potential water quality degradation associated with increased development of both new docks on the lake and new residential developments adjacent to the lakeshore. Selection of this alternative could result in an increase in both land-based and water-based effects.

The potential for significant water quality impacts from increased turbidity, which is already in excess of water quality standards, is of particular concern. There is the potential for significant water quality impacts related to dissolved oxygen, which exceeds water quality standards in some samples. These potential water quality impacts could lead to general degradation of water quality and may result in a degradation of aesthetic and recreational amenities. Increased nutrients may impact blue-green algae blooms; however, the mechanisms for these blooms on Eufaula Lake are complex and adequate water quality data are not present to determine the likelihood or the magnitude of this impact.

Water quality modeling results indicate that among all the alternatives, Alternative 4 could result in the largest increase in phosphorus, nitrogen, and sediment compared to the No Action Alternative. The model results estimate that potential direct impacts under Alternative 4 could result in load increases of 22 percent for phosphorus, 19 percent for nitrogen, and 23 percent for sediment as compared to the No Action Alternative (**Table 4.3-3**). When indirect and direct impacts are combined, Alternative 4 could result in load increases of 27 percent for phosphorus, 16 percent for nitrogen, and 35 percent for sediment as compared to the No Action Alternative (**Table 4.3-4**). The water quality impacts estimated with the STEPL model do not take into account any mitigating effects of the shoreline buffer vegetation management policy or potential BMP installation, which would reduce these predicted pollutant loads.

Existing water quality conditions in Eufaula Lake would not affect the proposed actions in Alternative 4. Turbidity is quite high in some areas of the lake and exceeds water quality standards, which may be undesirable from an aesthetic perspective for swimming and recreational activities such as water skiing. The Carlton Landing development is proposed on the eastern portion of the lake which tends to have better water clarity in general. Other areas that would be changed to Limited Development may be in areas where turbidity and water quality may not be suitable for certain types of recreational activities and may be less attractive for new residential development.

4.3.8 Potential Mitigation Measures (Water Quality)

To mitigate potential water quality impacts associated with the alternatives, the following mitigation measures are proposed. Mitigation measures are intended to lessen potential water quality impacts. The mitigation measures presented below can be implemented individually or as part of a watershed approach. Most of the mitigation measures presented here address potential water quality impacts associated with all of the alternatives, including the No Action Alternative. Water quality impacts may originate from nonpoint source pollution associated with activity along the lake shoreline, development activities, and existing nonpoint source pollution that could be exacerbated under Alternatives 3 and 4 and lessened in Alternatives 1 and 2.

4.3.8.1 Nutrient Management Strategies

To mitigate potential impacts from nutrient inputs, USACE would ensure adequate vegetative buffers between residential development and the shoreline of Lake Eufaula are maintained to filter out nutrients from stormwater runoff. USACE may influence the amount of adjacent residential development that occurs by minimizing the amount of Limited Development shoreline allocated.

USACE may incorporate into the lease for the proposed Carlton Landing development, terms ensuring the trails, picnic sites, campsites, and other public recreation facilities are constructed and maintained to ensure access to the water is limited to controlled locations. In addition, the development of and adherence to a Water Quality Management Plan (WQMP) could reduce potential nutrient loading associated with the equestrian trails proposed under Alternative 4.

The shoreline vegetation management buffer policies proposed in the alternatives address the potential water quality impacts of vegetation modification; therefore additional mitigation measures would not be needed for the alternatives.

4.3.8.2 Preserving Natural Vegetation

Preserving natural vegetation along the shoreline can mitigate potential water quality impacts associated with nutrients as well as erosion that leads to increased turbidity. The principal advantage to preserving natural vegetation along Eufaula Lake is for providing erosion control and reducing stormwater runoff. Natural vegetation can mitigate water quality impacts by intercepting rainfall, filtering stormwater runoff, and preventing sediments and other pollutants from entering the lake.

Under the action alternatives, a buffer vegetation management policy would be implemented and would reasonably mitigate potential water quality impacts related to vegetation modification. Under Alternatives 3 and 4, baseline buffers (30 to 70 feet) would be implemented, and would likely be protective of potential water quality impacts, such as erosion, increased turbidity, increased nutrient and bacteria loading, and decreased dissolved oxygen. The extended buffers (55 to 95 feet) proposed under Alternatives 1 and 2 could provide greater water quality protection.

4.3.8.3 Stormwater Best Management Practices

To mitigate potential water quality impacts from construction associated with proposed access trails to private docks along Limited Development shorelines as well as development on government lands associated with the Carlton Landing development under Alternative 4, USACE would incorporate mitigation measures into shoreline permit approvals and into the lease terms for Carlton Landing to ensure stormwater BMPs are implemented.

EPA has developed a National Menu of BMPs for Stormwater that provides a wide array of BMPs for all types of water quality impacts related to stormwater runoff. Mitigation measures that could be implemented are summarized in **Table 4.3-9**.

Table 4.3-9. Stormwater BMPs

Activity	BMP(s)
Construction on government lands at Carlton Landing	Maintain vegetated buffers and berms along trails and around structures to reduce erosion and pollutant transport into Eufaula Lake
	Construct wetlands or biofiltration swales around parking lots and other pervious pavements that have the potential to contribute nonpoint source pollution to Eufaula Lake
	Land grading to direct and control surface runoff, soil erosion, and sedimentation during and after construction
Construction of access trails to private docks along Limited Development shorelines	Use of pervious pavement where practical
	Maintain vegetated buffers and berms to reduce erosion and pollutant transport

4.3.8.4 Recreational Best Management Practices

Recreational water quality impacts would be most severe under Alternative 4 in which the proposed Carlton Landing development would construct a marina and equestrian trails on government lands along the lakeshore. To mitigate potential water quality impacts from recreational activities, USACE would

implement BMPs related to the construction and operation of the equestrian trails and marina, both of which would be located on leased USACE lands. USACE could incorporate these mitigation measures into the lease terms to ensure adequate construction and operation of these facilities. If Alternative 4 were selected, mitigation measures may include the implementation of BMPs to address recreational facilities in general, as well as specific mitigation measures to address potential impacts related to equestrian trails, and the marina. Mitigation measures that could be implemented are summarized in **Table 4.3-10**.

Table 4.3-10. General Mitigation Measures and BMPs for Recreation Facilities on Government Lands

Mitigation Measure Category	BMP	Performance Measure(s)
Building and Site Design	Site design conducted with USACE input and approval to incorporate mitigation measures	Develop and implement site design plan with coordination/approval of USACE
	Site layout should ensure that structures are placed where adverse effects are minimized and the natural topography, drainage patterns, and vegetation remain undisturbed	Develop and implement site design plan with coordination/approval of USACE
	Design diversion terraces that drain into areas with sufficient vegetation to filter the flow	Develop and implement site design plan with coordination/approval of USACE
Erosion Control	Maintain vegetation and replant bare areas to reduce erosion	Area of land re-vegetated each year, frequency of vegetation maintenance
	Maintain culverts and ditches, keep ditches vegetated with grass to help maintain stability and capture sediments	Number of culverts and ditches cleaned and/or re-vegetated each year
	Watch for accelerated erosion on steep slopes, trails, and gullies, and stabilize slopes with vegetation or other applicable erosion control measures, such as erosion control blankets	Area of land/trails inspected for erosion, and area repaired
Construction and Maintenance of Trails	Provide a vegetated buffer area between trails and waterways	Area of land covered by vegetated buffers, size of vegetated buffers
	The grade on any new trail should not exceed 10 percent and trails should be avoided at all costs on slopes steeper than 20 percent. If a trail must be built on a steep slope, the trail should switch back and forth down the slope	Number of trails with slopes less than 20 percent, number of switch-back trails with slopes of greater than 20 percent Develop and implement approved WQMP ¹
	Consider drainage patterns when building new trails. To reduce potential erosion on the trail, trails should be built so that water sheet flows across the trail	Develop and implement approved WQMP ¹ Assessment of trail drainage patterns, and type and number erosion mitigation measures taken

Mitigation Measure Category	BMP	Performance Measure(s)
	Maintenance of trails to address erosion	Number of miles of trails maintained, annual trail assessment
	Berms should be constructed as appropriate to direct stormwater away from the trail	Number and location of berms installed

4.3.8.5 Equestrian-Related Best Management Practices

To mitigate potential water quality impacts from the proposed equestrian trails and facilities associated with the Carlton Landing development under Alternative 4, USACE would incorporate mitigation measures into the lease terms to ensure appropriate construction and operation of equestrian facilities. If Alternative 4 were selected, mitigation measures may include the implementation of individual BMPs, a Water Quality Management Plan (WQMP), and implementation of mitigation measures for site design prior to construction of the equestrian facilities.

USACE would require the development and implementation of a WQMP, or similar document, for their review and approval prior to construction of the equestrian trails and facilities. A WQMP would describe commitments related to installation and maintenance of site design, source control, and treatment control BMPs that have been demonstrated to mitigate potential water quality impacts. A WQMP would also include a water quality monitoring program to monitor the effectiveness of mitigation measures and BMPs and ensure water quality protection. The WQMP would include a mechanism for periodic assessment of the effectiveness of the WQMP, and a process to update of the WQMP if necessary. The water quality monitoring program would be important to assess the success of the WQMP and identify additional mitigation measures needed to protect water quality. In addition to a WQMP, additional BMPs may be implemented.

The BMPs presented in **Table 4.3-11** are the most commonly recognized effective BMPs for mitigating potential water quality impacts associated with equestrian trails and facilities, and should be implemented in conjunction with the mitigation measures recommended for general recreational facilities (**Table 4.3-10**). The equine-related BMPs focus primarily on maintaining adequate vegetation, separating contaminated water and manure, and mitigating erosion and nutrient transport.

Success of these BMPs would be determined by a set of performance measures. Performance measures ensure consistent implementation of the mitigation measures, and would serve as a mechanism for requiring improvements if water quality protection is not achieved. Performance measures for equestrian facility mitigation measures are included in **Table 4.3-11**.

Table 4.3-11. Equestrian-Related Mitigation Measures and BMPs

Mitigation Measure Category	BMP	Performance Measure(s)
Building and Site Design	Install gutters that divert runoff from livestock area	Develop and implement site design plan with coordination/approval of USACE
	Place gravel below the sand in corrals and paddocks to percolate wastes and extra water, and these facilities not be built in areas with a greater than 10 percent slope	Develop and implement site design plan with coordination/approval of USACE
Waste Management	Remove manure regularly, daily is best, and provide temporary storage for manure that cannot be disposed of daily (about 15 cubic feet of storage per horse per week)	Frequency of manure removal, capacity of temporary waste storage facility (if present)
	Protect manure storage facilities from rainfall and surface runoff, grade the area surrounding the storage facility to prevent surface water reaching the storage area	Develop and implement approved WQMP
	Store horse waste on an impervious surface and under cover during rains to prevent leaching or runoff, and locate manure storage areas away from waterways so that floods or runoff will not wash away waste	Develop and implement approved WQMP
	Divert surface water runoff around areas with pollutants by constructing berms, ditches, underground pipes, or other methods	Develop and implement approved WQMP
	Collect soiled bedding and manure daily from stalls and paddocks and place in temporary or long-term storage units. Store in sturdy, insect resistant and seepage free units such as plastic garbage cans with lids, composters, or pits lined with an impermeable layer	Frequency of manure and soiled bedding removal, capacity of temporary or long-term storage units Storage units designed according to WQMP
	Compost soiled bedding and manure or transport manure to topsoil companies or composting facilities, if possible	Develop and implement approved WQMP
	Confine animals in properly fenced areas except during exercise and grazing periods	Develop and implement approved WQMP
Erosion Control	Establish healthy pastures with at least three inches of leafy material, and subdivide grazing areas into three or more units of equal size and rotate horses to ensure adequate vegetative cover	Develop and implement approved WQMP
	If no pastures are on site, filter strips should be used to separate trails and manure collection from waterways	Area of land covered by filter strips, size of filter strips

Mitigation Measure Category	BMP	Performance Measure(s)
Wash Rack Design	Do not allow water from horse wash areas to flow into Eufaula Lake	Develop and implement approved WQMP
	Connect wash racks to the sanitary sewer system or septic system, if possible. Infiltration of wash rack water, if possible, is an acceptable means of disposal. Verify that soil conditions allow percolation prior to construction	Develop and implement approved WQMP
	Elevate the wash area from the surrounding ground	Develop and implement approved WQMP
	Wash water should drain to a filter strip or other vegetated area	Area of land covered by vegetated buffers, size of vegetated buffers
	Use horse grooming and health products properly, and clean up spills, avoid using soap as much as possible	Develop and implement approved WQMP
Trails and Access to Waterbodies	Utilize fencing to keep horses away from environmentally sensitive areas and protect the lakeshore from contamination	Develop and implement approved WQMP
	Restrict horse access in creeks, on the lakeshore, and along steep hillsides	Develop and implement approved WQMP
	If water access is determined acceptable, designate access points by using a designated crossing/entry point to reduce and control contaminants and to prevent shoreline erosion	Develop and implement approved WQMP

4.3.8.6 Boating Best Management Practices

To mitigate potential water quality impacts from the proposed marina associated with the Carlton Landing development under Alternative 4, USACE could incorporate mitigation measures into the lease terms to ensure adequate construction and operation of the marina. USACE would require the Carlton Landing development to develop a Marina Management Plan that would ensure compliance with lease terms, and outline required mitigation measures and BMPs set forth by USACE to satisfy those terms. Lease terms may include that Carlton Landing incorporate mitigation measures into the marina slip user contract. General mitigation measures that may be included in lease terms and/or marina contract are listed in **Table 4.3-12**.

Depending on the capacity of the fuel station at the proposed marina at Carlton Landing, and the potential of the site to impact waters of the U.S., the site may be subject to the EPA's Spill Prevention, Control, and Countermeasure (SPCC) Rule. The SPCC Rule requires SPCC plans for exterior storage of petroleum products and waste in tanks or containers in excess of 660 gallons in any one tank or in excess of 1,320 gallons cumulatively. SPCC Plans require secondary containment of 110 percent of the volume of the largest container and written spill prevention and response measures approved as adequate by a professional engineer. These rules apply to aboveground tanks (40 CFR 112).

To mitigate potential water quality impacts caused by boating activities, USACE would implement no wake zones (5 mph or less) around boating recreational areas. Because hull shape strongly influence wake formation, no wake zones are more effective than speed limits in shallow surface waters for reducing turbidity and erosion caused by boat passage. No wake zones are typically required within 150 to 200 feet of the shoreline.

Table 4.3-12. Boating Mitigation Measures

Mitigation Measure	BMPs	Performance Measure
Education, Training, and Notification	Post informational signs regarding proper practices on cleaning, fueling, and waste management	Number and location of advisory signs in appropriate locations
	Communicate proper practices to marina users	Incorporation of proper practices into user contracts
Marina Rules and Regulations	Designate activities prohibited at the marina	Number and location of advisory signs in appropriate locations, incorporation into user contracts
	Clearly designate areas for restricted activities (<i>e.g.</i> , painting and scraping, waste handling)	Number and location of advisory signs in appropriate locations
	Designate activities restricted to performance by authorized personnel	Number and location of advisory signs in appropriate locations
	Marina rules should be incorporated into user contracts, where approved methods and means of enforcement are clearly described	Incorporation into user contracts
	Establish no wake zones in and around the marina	Post signs for no wake zones, include in user contracts
Fuel Storage	Regularly inspect above ground fuel storage tanks (ASTs) and associated piping for leaks	Frequency of inspections
	ASTs should have a secondary containment area that contains spills and allows leaks to be more easily detected. Secondary ASTs should be impermeable to the materials being stored	Construction and maintenance of secondary containment
	Develop a Spill Contingency Plan for all fuel storage and dispensing areas	Development and implementation of a Spill Contingency Plan
Fuel Station Operation	Locate fuel docks in protected areas to reduce potential for accidents due to passing boat traffic	Location and siting of fuel docks
	Design station so that spill containment equipment can be easily deployed to surround a spill and any boats that may be tied to the fuel dock	Fuel station design incorporates spill containment measures
	Keep oil absorbent pads and pillows available at the fuel dock for staff and customers to mop up drips and small spills	Adequate number of oil absorbent pads, and periodic inspection and maintenance of these materials

Mitigation Measure	BMPs	Performance Measure
	Routinely inspect and repair fuel transfer equipment, such as hoses and pipes	Frequency of inspection
	Place plastic or nonferrous drip trays lined with oil absorbent materials beneath fuel connections	Adequate drip trays, frequency of inspection and maintenance of these materials
	Post emergency phone numbers in a conspicuous location at the fuel station	Presence of signs displaying emergency contact information
Solid Waste Handling	Construction and maintenance of adequate pump-out facilities for boats with holding tanks	Adequate number of pump-out stations ¹ , frequency of inspection and maintenance of facilities
	Covered recycling and trash receptacles should be placed in convenient locations away from the water for use by marina patrons	Number and location of recycling and trash receptacles, schedule and frequency of pick up
	Provide designated fish cleaning areas	Number and location of fish cleaning areas
Stormwater Runoff Management	All areas of the marina should be cleaned on a regular basis to prevent oil, paint, dust, and other wastes from washing into surface waters	Frequency of cleaning, incorporate into Marina Management Plan
	Runoff and rinse water from boat maintenance and repair areas should be directed into a dedicated oil/water separator and sediment trap	Incorporate into site design, develop and implement Marina Management Plan
	Sediment traps and oil/water separators in the storm water drainage system should be inspected on a monthly basis and after each storm event	Develop and implement Marina Management Plan

1- EPA suggests one pump-out facility for every 200 – 250 boats with holding tanks. The State of Michigan mandates one pump-out facility for every 100 boats with holding tanks. Based on these numbers, USACE would require Carlton Landing to construct two to four pump-out facilities to accommodate sewage disposal at the proposed marina.

4.3.8.7 Summary of Mitigation Measures

In summary, a wide range of mitigation measures are available to address potential water quality impacts associated with the alternatives. The approach to selecting and implementing mitigation measures should be strategic and consider the potential for water quality improvement.

If Alternative 1, Alternative 2, or Alternative 3 is selected, USACE and the Oklahoma Marine Enforcement Division would assess existing no-wake zones and speed limit zones to determine if additional zones should be implemented to minimize shoreline erosion resulting from boating activities. Many of the potential water quality impacts associated with the alternatives would be largely the result of activities on private lands and could not be mitigated directly by USACE. The vegetation buffer policies proposed under these alternatives would provide some mitigation of potential water quality impacts with respect to sedimentation and nutrient inputs. Vegetative buffers may be very effective at filtering out these potential pollutants; however, the application of the vegetation management buffers alone may not be sufficient to bring the lake into compliance with WQS because the sources of potential pollutants are not only along

shorelines where these buffers would be applied. For example, the Canadian River and other major creeks that enter Eufaula Lake are significant contributors to turbidity in the lake and these sources would not be affected by this mitigation measure.

If Alternative 4 is selected, USACE would address activities located on government land by implementing mitigation measures to address equestrian and boating activities as well as stormwater BMPs to mitigate potential construction impacts. Specific mitigation measures are described in more detail above. For boating-related impacts, USACE would implement measures such as no wake zones, marina rules and regulations, and a waste management plan including pump-out stations and waste receptacles. For construction-related impacts, USACE would require the Carlton Landing development to implement stormwater BMPs such as vegetative buffers, silt fences, and pervious pavement. To address equine-related impacts, USACE would require a Water Quality Management Plan that addresses waste management, trail construction and maintenance, and animal access to the shoreline. These mitigation measures would be required as part of the lease granted for use of government lands.

EPA has an extensive database of BMPs which can serve as a valuable resource during consideration and selection of mitigation measures. The mitigation measures included in this section are not an exhaustive list of all available mitigation measures, but represent a strategic selection of relevant measures that have been proven effective.

4.4 Geology, Soils, and Mineral Resources

This section describes potential impacts related to geology, soils, and mineral resources for each of the alternatives. Alternatives 1 through 4 include revisions to the Eufaula Lake SMP. Since the MP would be supplemented to be consistent with the SMP, impacts would be the same as those described for the proposed SMP revisions under Alternatives 1 through 4.

4.4.1 Assessment Methods (Geology, Soils, and Mineral Resources)

The method for assessing potential impacts involved reviewing available information describing the existing conditions related to geology, soils, and mineral resources and then identifying potential direct and indirect impacts in consideration of the regulatory setting and the significance criteria presented in the next section.

Direct impacts could occur through soil erosion in areas disturbed by construction activities or if changes in vegetation management policies result in less vegetative buffer to stabilize the soil along the shoreline. Changes in shoreline allocations could also result in indirect impacts if there is increased use of shoreline areas by the public that causes soil disturbance from foot traffic or vehicular traffic without adequate policies or management to prevent soil erosion.

4.4.2 Significance Criteria (Geology, Soils, and Mineral Resources)

Impacts on geology, soils, or mineral resources would be significant if they would result in the following:

- Alteration or destruction of unique geologic features;
- Substantial soil erosion or the loss of topsoil; or
- Loss of access to mineral resources.

4.4.3 No Action Alternative (Geology, Soils, and Mineral Resources)

The No Action Alternative would not change existing shoreline allocations or land use classifications. Under existing shoreline allocations, there would be Limited Development shoreline available that could accommodate additional private dock development. These areas would be expected to attract additional residential developments on the adjacent private lands where homeowners could take advantage of the lake access and opportunity for private docks. Potential development at Carlton Landing would likely entail development of 170 residential lots, but there would be no public marina or other public recreational facilities on the shoreline. No action would be taken on any of the individual zoning requests as described in Section 2.4.2.

4.4.3.1 Potential Impacts

Under the No Action Alternative, 8,746 new docks could be constructed along the shoreline in areas allocated to Limited Development. Dock construction and boat operation close to the shoreline can result in shoreline erosion. Under the No Action Alternative the number of new docks could increase by 81 percent over the current number of docks on the lake. These new docks would be constructed along the remaining 13 percent of the shoreline that would be available for new dock construction. This increase in docks and boat operation would have the potential to result in a significant increase in shoreline erosion.

Existing policies regarding vegetation management, land-based shoreline uses, and erosion control activities under the No Action Alternative would remain the same as those outlined in the 1998 SMP. Mowing and vegetation clearing would be allowed with a shoreline permit to the water's edge. This practice may lead to erosion of shoreline areas through loss of vegetative cover in localized areas. Generally, vegetation management is requested in association with residential development on adjacent private lands, which limits these practices largely to areas associated with Limited Development shorelines. This would suggest that most of the requests would likely be associated with the 13 percent of the shoreline where new docks could be constructed, but requests might be submitted in other areas where views are desired. Existing vegetation management practices may lead to soil erosion and result in adverse impacts in localized areas. Lakewide, such practices could be expected to be applied to up to 13 percent of the shoreline which could result in a significant impact related to erosion.

Under the No Action Alternative, there would be no change in the existing processes through which one can access minerals under USACE-owned lands. With improvements in directional drilling technology, even if there are sensitive surface resources, it may still be possible to access mineral resources from outside of USACE shorelines without disturbing the surface features. There would be no effect on potential access to mineral resources under the No Action Alternative.

Under the No Action Alternative, 170 residential lots could be developed at Carlton Landing. This construction could result in direct impacts through the loss of soils from disturbed areas. An increase in

impervious surfaces such as roads, buildings, and driveways for the Carlton Landing development, would increase surface runoff and thereby also increase the potential for erosion. An increase in soil erosion would be a significant impact, and mitigation would be required to reduce this impact to less than significant.

There would be no direct impact on unique geologic features from either proposed development at Carlton Landing or from dock construction or other permitted shoreline activities.

Construction of new residential developments on lands adjacent to USACE-owned lands could result in soil erosion during construction. Common construction practices such as the use of silt fencing to contain sediment on-site and watering to control dust would be used to control effects. Landscaping and paved surfaces would control erosion following construction. The potential for stormwater runoff or access across USACE lands to result in erosion is discussed under direct effects. Indirect effects would be localized and temporary. While the total area that could potentially be developed is large, it would not be developed at the same time and so the impacts would be spread out over many years and would not be significant with the use of normal construction BMPs.

4.4.4 Alternative 1 (Geology, Soils, and Mineral Resources)

Under Alternative 1, the length of the shoreline allocated to Limited Development would be reduced. Under Alternative 1, only 605 new private docks would be allowed and thus the lake would likely be much less attractive for new residential development. Potential development at Carlton Landing would be the same as under the No Action Alternative. Individual zoning requests received during scoping would be addressed as described in Section 2.4.3.

Alternative 1 would establish the extended vegetation management buffer zones between the water's edge and the nearest allowed vegetation clearing or mowing. The extended buffer zones are the widest of the proposed shoreline buffer zones among the four action alternatives, requiring a minimum of 55 feet of vegetative buffer between the water's edge and any mowing, trimming or other modification of vegetation.

4.4.4.1 Direct Impacts

Under Alternative 1, only 605 new docks would be allowed to be constructed. Therefore, there would be minimal potential impact on shoreline erosion from dock construction and there would be no change in the existing soil erosion conditions related to boat operation.

The extended vegetation management buffers would provide a natural vegetation filter that can be very effective preventing erosion of soils. Vegetation intercepts rainwater and lessens the impact on the soil surface, which reduces erosion. Leaves and roots capture and hold stormwater, preventing and slowing runoff volumes and velocities which also reduce erosion. Vegetation also filters out and holds soil particles that may be washing through from uphill locations and prevents sediments from reaching the lake. The implementation of vegetative buffers would likely result in reduced shoreline erosion which would be a beneficial effect. The vegetation buffers would have an effect on potential soil erosion that could result from water running downhill towards the lake. They would not affect the erosive action of waves on the shoreline.

Under Alternative 1, development at Carlton Landing would be the same as under the No Action Alternative. There is a segment of lakeshore at Carlton Landing that is privately owned. This area is

located along the Town Center area and represents a significant portion of the shoreline that would be accessible by residents of the development that would be constructed under Alternative 1. The vegetation management buffers would not apply to this area of privately held lakeshore. Therefore, construction and subsequent lake access by residents could result in direct impacts through the loss of soils from disturbed areas. An increase in impervious surfaces such as roads, buildings, and driveways for the Carlton Landing development, would increase surface runoff and thereby also increase the potential for erosion through this area of privately held lakeshore. An increase in soil erosion would be a significant, if localized impact.

Under Alternative 1, there would be no change in the existing processes through which one can access minerals under USACE-owned lands. There would be no effect on potential access to mineral resources under Alternative 1.

There would be no direct impact on unique geologic features from either proposed development at Carlton Landing or from other permitted shoreline activities.

4.4.4.2 Indirect Impacts

Under Alternative 1, few new private docks would be allowed and thus the lake would likely be much less attractive for new residential development. Less residential development around the lakeshore would result in less impervious surface and clearing of natural vegetation. The potential for soil erosion would be significantly reduced under Alternative 1 largely as a result of the predicted reduction in demand for lakeshore residential development.

4.4.5 Alternative 2 (Geology, Soils, and Mineral Resources)

Under Alternative 2, shoreline allocations would change to reduce the length of the shoreline allocated to Limited Development. Over the long-term, there would likely be less residential development around the lake. Potential development at Carlton Landing would be the same as under the No Action Alternative. Individual zoning requests received during scoping would be addressed as described in Section 2.4.4.

Alternative 2 would also establish the extended vegetation management buffer zones between the water's edge and the nearest allowed vegetation clearing or mowing. The extended buffer zones are the widest of the proposed shoreline buffer zones.

4.4.5.1 Direct Impacts

Under Alternative 2, up to 5,873 new docks would be allowed to be constructed. Therefore, there would be the potential for shoreline erosion from dock construction and from increases in boat operation compared to the existing condition. However, Alternative 2 would result in fewer boat docks and boats than under the No Action Alternative and therefore, there would be less potential for soil erosion to occur as compared to the No Action Alternative.

The extended vegetation management buffers would likely result in reduced shoreline erosion which would be a beneficial effect.

Under Alternative 2, development at Carlton Landing would have the same potential to result in localized soil erosion as under the No Action Alternative. This impact could be significant if construction BMPs are not employed.

Under Alternative 2, there would be no effect on potential access to mineral resources or on unique geologic features.

4.4.5.2 Indirect Impacts

Under Alternative 2, less shoreline would be allocated as Limited Development which would reduce the number of potential new private docks as compared to the No Action Alternative. Therefore, there would likely be less residential development around the lakeshore which would reduce the potential for soil erosion. As with the No Action Alternative, some erosion could occur from the use of shoreline footpaths to access new private boat docks. However, under the existing SMP rules regarding access paths, this would be a minor impact. Therefore, potential indirect impacts would not be significant.

4.4.6 Alternative 3 (Geology, Soils, and Mineral Resources)

Under Alternative 3, shoreline allocations would change to increase the length of the shoreline allocated to Limited Development. Over the long-term, at full build out, there would likely be more residential development around the lake. Potential development at Carlton Landing would be the same as under the No Action Alternative although there may be some additional private dock construction. Individual zoning requests received during scoping would be addressed as described in Section 2.4.5.

4.4.6.1 Direct Impacts

Under Alternative 3, up to 11,844 new docks would be allowed to be constructed. Therefore, there would be the potential for more shoreline erosion from dock construction and from increases in boat operation compared to the No Action Alternative. This increase in the number of docks would be a 35 percent increase over the potential number of docks that could be built under the No Action Alternative. Under Alternative 3, docks could be built along 23 percent of the shoreline at Eufaula Lake, and this could result in a significant impact on shoreline erosion.

Under Alternative 3, the baseline buffer vegetation management policy would be implemented. The baseline buffers would be 25 feet smaller than the extended buffers applied under Alternatives 1 and 2. Based on the criteria in this policy, the baseline vegetation management buffers would extend from 30 to 70 feet from the shoreline. Although the buffers proposed under this alternative are smaller than under Alternatives 1 and 2, they would still likely be very effective in reducing soil erosion. As described above for the extended buffers, the vegetation buffers would have a beneficial effect on potential soil erosion that could result from water running downhill towards the lake. They would not affect the erosive action of waves on the shoreline.

Under Alternative 3, development at Carlton Landing would have the same potential to result in localized soil erosion as under the No Action Alternative. This impact could be significant if construction BMPs are not employed.

Under Alternative 3, there would be no effect on potential access to mineral resources or on unique geologic features.

4.4.6.2 Indirect Impacts

Under Alternative 3, more shoreline would be designated as Limited Development than under the No Action Alternative. Therefore, there would be more areas adjacent to USACE-owned lands that would be attractive for new residential development. Increased residential development would have the potential to increase soil erosion relative to the No Action Alternative. As with the No Action Alternative, some erosion could occur from the use of shoreline footpaths to access new private boat docks. However, under the existing SMP rules regarding access paths, this would be a minor impact. Therefore, potential indirect impacts would not be significant.

4.4.7 Alternative 4 (Geology, Soils, and Mineral Resources)

Under Alternative 4, shoreline allocations would change to increase the length of the shoreline allocated to Limited Development. Over the long-term, at full build out, there would likely be more residential development around the lake. Individual zoning requests received during scoping would be addressed as described in Section 2.4.6.

Under Alternative 4, full build-out at Carlton Landing would occur, including construction of approximately 2,570 home lots, a K-12 school, an organic farm, a town center, community pools, public open spaces, and a conference center. The shoreline area at Carlton Landing would be extensively developed with a public marina and other public recreational facilities and trails along the shoreline.

4.4.7.1 Direct Impacts

Under Alternative 4, up to 15,459 new docks would be allowed to be constructed. Therefore, there would be the potential for more shoreline erosion from dock construction and from increases in boat operation compared to the No Action Alternative. This increase in the number of docks would be a 77 percent increase over the potential number of docks that could be built under the No Action Alternative. Under Alternative 4, docks could be built along 30 percent of the shoreline at Eufaula Lake, and this could result in a significant impact on shoreline erosion.

Under Alternative 4, the baseline buffer vegetation management policy would be implemented. Although the buffers proposed under this alternative are smaller than under Alternatives 1 and 2, they would still likely be very effective in reducing soil erosion. As described above for the extended buffers, the vegetation buffers would have a beneficial effect on potential soil erosion that could result from water running downhill towards the lake. They would not affect the erosive action of waves on the shoreline.

The proposed development at Carlton Landing would create large amounts of impervious surfaces both on the government lands adjacent to the lake and on the adjacent private lands that extend up onto the ridge above the lake. This would have the potential to result in significant erosion of soils if construction BMPs are not implemented properly. The increased public access to the lake shore that would be provided by the proposed public recreation facilities and trails along the shoreline would have the potential to result in increased soil erosion. Mitigation measures related to trail design and operation would need to be implemented to avoid significant impacts to soils.

Under Alternative 4, there would be no effect on potential access to mineral resources or on unique geologic features.

4.4.7.2 Indirect Impacts

Under Alternative 4, more shoreline would be designated as Limited Development than under any of the other alternatives. Therefore, this alternative would present the greatest potential for new residential development close to the shoreline and for soil erosion related to residential development and the use of shoreline access paths. Typical construction BMPs would reduce potential erosion during construction activities. Existing SMP rules regarding access path construction and operation would avoid potentially significant impacts from shoreline access paths created to provide access between new residential areas and new boat docks.

4.4.8 Potential Mitigation Measures (Geology, Soils, and Mineral Resources)

Appropriate erosion and sediment control techniques, such as silt fences and sediment retention ponds, would be required during construction, including development at Carlton Landing, to reduce impacts from soil erosion to a less than significant level. Development along the shoreline, including construction of a public marina, would require a lease or license from USACE, and may also require permits under Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act. Mitigation measures to reduce soil erosion would be specified in these permits and required during construction. With implementation of mitigation to reduce soil erosion, direct impacts from construction would be reduced to a less than significant level.

In accordance with the existing SMP (USACE 1998), all improved pathways providing access across government lands would require a Shoreline Use Permit and would follow a route as to avoid steep slopes that may increase erosion. Walkway routes are subject to designation and/or approval of the Lake Manager. Compliance with this process would reduce potential impacts from increased use of footpaths along the shoreline to a less than significant level.

4.5 Aesthetics and Visual Resources

4.5.1 Assessment Methods and Significance Criteria (Aesthetics and Visual Resources)

The visual analysis was conducted using the methodology in the Visual Resources Assessment Procedure (VRAP) for USACE as developed by Smardon *et al.* (1988). This procedure provides a method to evaluate visual resources affected by USACE water resources projects. The procedure uses the Visual Management Classification System (MCS) to identify Landscape Similarity Zones (LSZ), inventory visual resources, and establish an assessment framework based on local aesthetic values. This information is then used in a Visual Impact Assessment (VIA), where scenarios under the different alternatives from representative viewpoints are compared. The principal steps required to assess visual impacts include:

- Management Classification System: The Regional Landscape (visual setting and character of the Eufaula Lake in general) was defined, and LSZs and visual resources of the study area were identified. Each LSZ is assigned a Management Class.
- Visual Sensitivity and Key Views: Key viewpoints for visual assessment were identified where potential land use changes resulting from the SMP update will be most visible to viewers.
- Visual Impact Assessment (VIA): The visual appearance of the landscape from the key viewpoints was assessed, and forecasts were performed to predict what the landscape might look like in 25 years under the different alternatives. These forecasts were compared to a forecast of the No Action Alternative.

Within the Regional Landscape, ten Landscape Similarity Zones (LSZs) were identified that represent areas of land that share common characteristics of landform, water resources, vegetation/ecosystems, land use, and land use intensity. The LSZs established within the study area were: Forest, Grassland/Prairie/Pasture, Farmland, Wetland, Recreation Area, Residential-Medium Density, Urban-Commercial/Industrial, Transportation, Marinas, and High Density Docks.

To create an assessment framework, judgments were made about the existing visual quality of each zone by identifying examples of resource categories that exhibit each of three levels of visual quality: Distinct, Average, and Minimal. A Management Class (Preservation, Retention, Partial Retention, Modification, or Rehabilitation) was then assigned to each LSZ based on these overall ratings. The potential impact of each alternative was assessed by predicting the future characteristics of nine selected viewpoints. Potential viewpoints were selected during field reviews in early February, late February, and April, 2012, and were photographed under both leaf-on and leaf-off conditions. The visual qualities of each alternative were weighted according to VRAP procedures and compared to those that would occur under the No Action Alternative to determine a VIA quotient for each resource category. These quotients were then compared to ranges established by the VRAP as acceptable thresholds for the management classifications of the different LSZs.

Public input was used to help determine visual priorities and preferences for views in the Eufaula Lake study area. Lake users noted that undeveloped wetlands and forested areas are of particular value to them. Park users noted that they value the undeveloped shoreline views from park areas, as well as the surrounding undeveloped forest. Some written public comments complained about litter near docks and the visual quality of areas with dense docks. However, many public comments also were critical of the moratorium on new dock construction, and many requested that their particular properties be allowed to have docks. Scenic vistas from bridges and causeways have been identified by USACE as being of particular importance. These vistas offer views of varying terrain, geologic formations, and vegetative cover that are unique as compared to the surrounding plains. These scenic vistas are considered to be priority visual elements for Eufaula Lake.

4.5.2 Significance Criteria (Aesthetics and Visual Resources)

Significance criteria are based on the intensity of the potential direct and indirect effects, defined below.

4.5.2.1 Direct Effects

The federal action under consideration is primarily a planning and zoning action. The potential direct effects are that the shoreline allocation (which is like zoning) would change and allow more docks to be built. Docks have direct effects on visual resources. The proposed revisions to the SMP would also include different types of vegetation modification along Limited Development allocated shorelines. The alternatives would each have different buffer width ranges so there would be the potential for differential impact. USACE generally honors past written commitments, such as permits related to vegetation modification practices. Any changes to vegetation management policies included within any proposed alternative would apply only to the issuance of new permits.

4.5.2.2 Indirect Effects

Limited Development allocations, which allow for private docks, would also have the indirect effect of attracting residential development to the private lands adjacent to the government lands – *i.e.*, if you are going to build a house at the lake you will tend to select a lot adjacent to shorelines allocated as Limited Development because of the potential to have a dock rather than next to another shoreline allocation that does not allow docks. So the amount of Limited Development would have an indirect effect on visual resources outside of the government lands through the influence on the location of residential development.

Changes to the different LSZs would occur mostly due to development pressures. These pressures would vary greatly between the different alternatives and would be related to the amount of shoreline allocated to Limited Development. Private property adjacent to these government-owned lands is popular for development due to the ability to have docks and clear views to the lake. As such, private land adjacent to government-owned land in other allocations is likely to be less preferred for development. For comparison between alternatives, miles of shoreline under the SMP is used for discussion rather than acres under the MP, as shoreline length would be a determining factor in how many docks could be built. **Table 4.5-1** details the miles of shoreline that would fall under each shoreline designation for each alternative.

Table 4.5-1. Shoreline Allocations (Miles) by Alternative for Eufaula Lake

Shoreline Allocation (Zoning)	Miles of Shoreline				
	No Action	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Limited Development	271	42	182	367	479
Protected	430	657	517	332	214
Public Recreation	106	108	108	108	114
Prohibited	1	1	1	1	1

4.5.3 No Action Alternative (Aesthetics and Visual Resources)

4.5.3.1 Potential Impacts to LSZs

LSZ 1 – Forest: Under the No Action Alternative, the amount of forested land would be reduced in the future. As development continues on private lands around the lake, some areas would be cleared. In addition, some new homeowners would request issuance of permits to mow the adjacent government-owned property to improve their views of the lake. It is expected that permitted mowed areas adjacent to new homes would look similar to areas that currently have mowing permits. These areas reduce the amount of forest overall, and can have an even larger impact on the visual impression of forested area.

LSZ 2 – Grassland/Prairie/Pasture: The amount of land in that is grassland, pasture, or prairie within the study area would be expected to be somewhat reduced. These lands are likely to be preferred by developers over forested lands, but impacts would be less noticeable, as this LSZ is much less visible from the lake and shorelines.

LSZ 3 – Farmland: The amount of land that is farmed within the study area could be expected to decrease slightly due to development. However, conversion of lands from this LSZ would likely not be noticeable from the lake and shoreline.

LSZ 4 – Wetland: Impacts to this LSZ would likely be relatively small. Although wetlands that form along the narrow shallow fringe of the lake would likely be affected by any new development, these wetlands do not play as large of a role in the viewscape.

LSZ 5 – Recreation Area: Recreation areas are expected to experience higher usership in the future. These lands would not decrease or increase in acreage, but their visual quality could be slightly reduced due increased use and possible conversion of undeveloped land within recreation areas for high-demand amenities.

LSZ 6 – Residential – Medium Density: The area of land in this LSZ would likely increase, especially in areas adjacent to government-owned lands that are zoned Limited Development. This land would be highly visible from the lake and shorelines.

LSZ 7 – Urban – Commercial/Industrial: Under the No Action Alternative, slight increases of land used for urban and commercial/industrial purposes would likely occur to support new development that would occur around the lake.

LSZ 8 – Transportation: Views from bridges and causeways would be slightly different, as some new development, land clearing, and docks would be expected, resulting in the loss of the natural and wild aesthetic in some places.

LSZ 9 – Marinas: No new marinas would be built. The existing marinas would likely be operated as they are today, and would retain similar visual qualities.

LSZ 10 – High Density Docks: The amount of area of the lake that has a high density of docks would be expected to increase. There were a total of 1,673 docks on Eufaula Lake in 2011. Under the existing SMP, an estimated maximum of 8,746 docks could eventually be built. Using historical dock construction rates, it can be reasonably expected that there would be 2,800 docks on Eufaula Lake in the near future of 20 years.

4.5.3.2 Potential Impacts to Viewpoints

Viewpoint 1 - Near Duchess Creek Island: The viewer would notice slightly more houses and docks under the No Action Alternative than are currently present. The aesthetic would therefore be more rural-residential than rural.

Viewpoint 2 - Standing Rock Cut – East: The viewer would notice a slight increase in the density of docks; however, this would have a minor effect due to the large docks that are already visible.

Viewpoint 3 – Roundtree Landing: No development would be permitted, and the viewscape would remain serene with a sense of mystery due to the curvature of the cove.

Viewpoint 4 – Carlton Landing: The area behind the planned waterfront park would consist of multi-family residential buildings that would be visible through the mature park trees. The government-owned lands would remain protected but would be slightly less serene due to increased activity in the Carlton Landing waterfront park area.

Viewpoint 5 - Daisy Hallum Cove, Near Gaines Creek Park: Some of the existing undeveloped and untamed feeling of the cove would be lost due to the development of houses and especially of more visible docks, and especially during the winter. The viewscape would continue to have an enclosed feeling due to the surrounding tall hills. Although a number of residences would be added, there would likely be limited clearing of lots.

Viewpoint 6 – I-40 Bridge and Causeway: The development of additional homes and docks in this viewshed would eliminate the unspoiled and untamed aesthetic of this landscape. The new construction would visually compete with and detract from the boulders, bluffs, and mature forest that currently dominate the view. The view would still be a significant departure from other features along the I-40 corridor, but it would not have the same dramatic effect that it currently exhibits.

Viewpoint 7 – US 69 Bridge at Bridgeport: The visual character of the viewscape under the No Action Alternative would be similar to current conditions. The wide panorama of Eufaula Lake and the nearby shore would continue to convey a sense of enormity to the lake and of relatively unspoiled sandy shore.

Viewpoint 8 – Arrowhead State Park: The character of the viewscape under the No Action Alternative would be that of a relatively quiet cove and the opposite shore. It would be peaceful with the aesthetic of domesticated nature within the park; however, noise from other park users would at times decrease the overall tranquility of the location, as would people driving and parking on the dirt road next to the shore. The opposite shore and hill slope would appear relatively undeveloped and natural.

Viewpoint 9 – Highway 31 Bridge North of Elm Point Park: The visual character of the viewscape under the No Action Alternative would be slightly more developed than current conditions. The additional houses and docks on the opposite shore would eliminate some of the natural aesthetic of the view.

4.5.3.3 Potential Impacts to LSZs and Viewpoints from Adjacent Lands

Because the No Action Alternative would be likely to result in increased development in areas adjacent to government-owned land, it would have an indirect negative visual impact.

4.5.4 Alternative 1 (Aesthetics and Visual Resources)

4.5.4.1 Direct Impacts to LSZs

LSZ 1 – Forest: Alternative 1, the amount of shoreline designated as Limited Development would be reduced from 271 miles (under the No Action Alternative) to 42 miles. This alternative would result in dramatically less conversion of natural forested land to mowed areas, and the extended shoreline vegetation buffer would be implemented whereby the majority of shoreline would be required to have a 70-foot non-mowed buffer adjacent to the lake.

LSZ 2 – Grassland/Prairie/Pasture: There would likely be fewer developments built on lands adjacent to government property due to the reduced amount of shoreline where docks could be built. This would result in considerably less conversion from this LSZ than the No Action Alternative.

LSZ 3 – Farmland: Impacts to this LSZ would likely be similar to those of the No Action Alternative.

LSZ 4 – Wetland: Impacts to this LSZ would likely be similar to those under the No Action Alternative.

LSZ 5 – Recreation Area: Impacts to this LSZ would likely be similar to those under the No Action Alternative.

LSZ 6 – Residential – Medium Density: There would likely be considerably less land adjacent to government-owned lands converted to medium-density residential uses than under the No Action Alternative due to the reduced amount of shoreline where docks could be built. In addition, the extended vegetation buffers that would be established under this alternative would effectively screen many of the new developments from view from the lake and shoreline.

LSZ 7 – Urban – Commercial/Industrial: Less conversion of land into urban and commercial/industrial uses would be expected as compared to the No Action Alternative due to lower demand from reduced development potential.

LSZ 8 – Transportation: Views from bridges and causeways would have a more natural and wild aesthetic as compared to the No Action Alternative due to lower development potential of surrounding lands.

LSZ 9 – Marinas: Impacts to this LSZ would likely be similar to those of the No Action Alternative.

LSZ 10 – High Density Docks: The amount of area of the lake that has a high density of docks would be expected to be much less than would occur under the No Action Alternative. Under the existing regulations, an estimated maximum of 2,278 docks could be built under this alternative, compared with 8,746 docks that could be built under the No Action Alternative. Given that there are currently 1,673 docks permitted on the lake, only 605 additional docks would be allowed to be built under Alternative 1.

4.5.4.2 Direct Impacts to Viewpoints

Viewpoint 1 – Near Duchess Creek Island: The viewscape is expected to remain as it is currently. The viewer would see a much more rural landscape than under the No Action Alternative.

Viewpoint 2 – Standing Rock Cut – East: Since no additional docks would be permitted, development potential for lakeshore residences is expected to be low. As a result, the viewscape is expected to remain similar to current conditions, with fewer homes and docks than would be likely under the No Action Alternative.

Viewpoint 3 – Roundtree Landing: No development would be permitted, and the viewscape would remain serene with a sense of mystery due to the curvature of the cove. This alternative would have the same visual impact as the No Action Alternative.

Viewpoint 4 – Carlton Landing: The overall aesthetic effect would be extremely similar to that of the No Action Alternative.

Viewpoint 5 – Daisy Hallum Cove, Near Gaines Creek Park: More of the existing undeveloped and untamed feeling of the cove would be retained than under the No Action Alternative, and it would appear mostly as it is today.

Viewpoint 6 – I-40 Bridge and Causeway: The visual character of the viewscape would be in sharp contrast to the dry plains and forested bottomlands that are seen along the nearby stretches of the highway. The boulder-strewn shoreline and rocky, rugged bluffs would be much more of a focal point than under the No Action Alternative, and this view would illustrate the special qualities of the Eufaula Lake landscape.

Viewpoint 7 – US 69 Bridge at Bridgeport: The visual character of the viewscape would be the same as under the No Action Alternative. The wide panorama of Eufaula Lake and the nearby shore would continue to convey a sense of enormity to the lake and of relatively unspoiled sandy shore. This alternative would also result in the same visual quality as Alternative 2.

Viewpoint 8 – Arrowhead State Park: The character of the viewscape would be the same as under the No Action Alternative with a relatively quiet cove and the opposite shore. It would be peaceful with the aesthetic of domesticated nature within the park; however, noise from other park users would at times decrease the overall tranquility of the location, as would people driving and parking on the dirt road next to the shore. The opposite shore and hill slope would appear relatively undeveloped and natural. This alternative would also result in the same visual quality as Alternative 2.

Viewpoint 9 – Highway 31 Bridge North of Elm Point Park: The visual character of the viewscape under Alternative 1 would be slightly less developed than under the No Action Alternative due to fewer houses visible on the right side of the view as well as the absence of docks in this area.

4.5.4.3 Indirect Impacts to LSZs and Viewpoints

Compared to the No Action Alternative, Alternative 1 would have fewer indirect visual impacts since more areas are protected and less development would occur in areas adjacent to government-owned lands.

4.5.5 Alternative 2 (Aesthetics and Visual Resources)

4.5.5.1 Direct Impacts to LSZs

LSZ 1 – Forest: Under Alternative 2, the amount of shoreline designated as Limited Development would be reduced from 271 miles (under the No Action Alternative) to 182 miles. In addition, an extended shoreline vegetation buffer would be implemented whereby the majority of shoreline would be required to have a 70-foot non-mowed buffer adjacent to the lake. As a result, although the amount of land that is forested would likely increase only slightly as compared to the No Action Alternative, the visual effect from the lake would give the impression that there is much more forested area.

LSZ 2 – Grassland/Prairie/Pasture: Impacts to this LSZ would likely be similar to the No Action Alternative.

LSZ 3 – Farmland: There would likely be slightly less conversion of land from farmland as compared to the No Action Alternative.

LSZ 4 – Wetland: Impacts to this LSZ would likely be similar to those under the No Action Alternative.

LSZ 5 – Recreation Area: Impacts to this LSZ would likely be similar to those under the No Action Alternative.

LSZ 6 – Residential – Medium Density: Impacts to this LSZ would likely be similar to those under the No Action Alternative. However, the 70-foot buffer that would be established in most locations would effectively screen much of the potential new development from view from the lake and shoreline.

LSZ 7 – Urban – Commercial/Industrial: Impacts to this LSZ would likely be similar to those under the No Action Alternative.

LSZ 8 – Transportation: Impacts to this LSZ would likely be similar to those under the No Action Alternative. However, the 70-foot vegetation buffer that would be established in most locations would effectively screen much of the potential new development from view from bridges and causeways.

LSZ 9 – Marinas: Impacts to this LSZ would likely be similar to those of the No Action Alternative.

LSZ 10 – High Density Docks: The amount of area of the lake that has a high density of docks would be expected to be slightly less than would occur under the No Action Alternative. Under the existing regulations, an estimated maximum of 5,873 docks could eventually be built under this alternative, compared with 8,746 docks that could be built under the No Action Alternative. Using historical dock construction rates, it can be reasonably expected that there would be 2,800 docks on Eufaula Lake in the near future of 20 years.

4.5.5.2 Direct Impacts to Viewpoints

Viewpoint 1 – Near Duchess Creek Island: The viewscape at this location is expected to be the same as under the No Action Alternative. The aesthetic would be somewhat rural-residential.

Viewpoint 2 – Standing Rock Cut – East: The viewer would notice a slight increase in the density of docks; however, this would have a minor effect due to the large docks that are already visible. This alternative would have the same visual effect as the No Action Alternative.

Viewpoint 3 – Roundtree Landing: No development would be permitted, and the viewscape would remain serene with a sense of mystery due to the curvature of the cove. This alternative would have the same visual impact as the No Action Alternative.

Viewpoint 4 – Carlton Landing: The overall aesthetic effect would be extremely similar to that of the No Action Alternative.

Viewpoint 5 – Daisy Hallum Cove, Near Gaines Creek Park: The existing undeveloped and untamed feeling of the cove would be slightly decreased, but not nearly as much as under the No Action Alternative.

Viewpoint 6 – I-40 Bridge and Causeway: The visual character of the viewscape would be the same as the No Action Alternative. It would also be the same as Alternatives 3 and 4. The development of additional homes and docks in this viewshed would eliminate the unspoiled and untamed aesthetic of this landscape. They would visually compete with and detract from the boulders, bluffs, and mature forest that currently dominate the view. The view would still be a significant departure from other features along the I-40 corridor, but it would not have the same dramatic effect that it currently exhibits.

Viewpoint 7 – US 69 Bridge at Bridgeport: The visual character of the viewscape would be the same as under the No Action Alternative. The wide panorama of Eufaula Lake and the nearby shore would continue to convey a sense of enormity to the lake and of relatively unspoiled sandy shore. This alternative would also result in the same visual quality as Alternative 1.

Viewpoint 8 – Arrowhead State Park: The character of the viewscape would be the same as under the No Action Alternative with a relatively quiet cove and the opposite shore. It would be peaceful with the aesthetic of domesticated nature within the park; however, noise from other park users would at times decrease the overall tranquility of the location, as would people driving and parking on the dirt road next to the shore. The opposite shore and hill slope would appear relatively undeveloped and natural. This alternative would also result in the same visual quality as Alternative 1.

Viewpoint 9 – Highway 31 Bridge North of Elm Point Park: The visual character of the viewscape would be almost the same as under the No Action Alternative. The 70-foot extended vegetation buffer required in the Limited Development area would somewhat screen the houses there, but the docks would still be very visible.

4.5.5.3 Indirect Impacts to LSZs and Viewpoints

Because there would be less area designated as Limited Development under Alternative 2 than under the No Action Alternative, indirect visual impacts from induced development in adjacent areas would be less likely compared to the No Action Alternative (but more likely than under Alternative 1).

4.5.6 Alternative 3 (Aesthetics and Visual Resources)

4.5.6.1 Direct Impacts to LSZs

LSZ 1 – Forest: Under Alternative 3, the amount of shoreline designated as Limited Development would be increased from 271 miles (under the No Action Alternative) to 367 miles. A shoreline buffer would be implemented whereby the majority of shoreline (312 miles) would be required to have a 45-foot non-mowed buffer adjacent to the lake. This buffer would help screen development somewhat, especially in areas with less steep slopes, but would likely not be an effective screen where slopes are steeper. As a result, there would be less forestland than under the No Action Alternative.

LSZ 2 – Grassland/Prairie/Pasture: Development potential would likely be increased as compared to the No Action Alternative and would result in more conversion of land from this LSZ. However, the impact of this conversion would not be very noticeable as this LSZ is much less visible from the lake and shoreline.

LSZ 3 – Farmland: There would likely be slightly more conversion of land from farmland as compared to the No Action Alternative. However, the difference may not be noticeable from the lake and shoreline.

LSZ 4 – Wetland: Impacts to this LSZ would likely be similar to those under the No Action Alternative. However, for wetlands where there is adjacent new development, they would likely appear less wild and unspoiled due to the discontinuity with adjacent undeveloped lands.

LSZ 5 – Recreation Area: Impacts to this LSZ would likely be similar to those under the No Action Alternative.

LSZ 6 – Residential – Medium Density: There would be larger amounts of land converted to medium-density residential uses as under the No Action Alternative due to increased development potential. However, the 45-foot buffer that would be established in most locations would somewhat screen much of this development from view from the lake and shoreline.

LSZ 7 – Urban – Commercial/Industrial: There would likely be an increase of land converted into urban and commercial/industrial uses as compared to the No Action Alternative to support increased development potential.

LSZ 8 – Transportation: Views from bridges and causeways would be considerably different than they would be under the No Action Alternative, due to the construction of new housing developments, land clearing, and new docks. As a result, the view of the lake from bridges and causeways would appear less wild and natural than under the No Action Alternative.

LSZ 9 – Marinas: Impacts to this LSZ would likely be similar to those of the No Action Alternative.

LSZ 10 – High Density Docks: The amount of area of the lake that has a high density of docks would be expected to be more than would occur under the No Action Alternative. Under the existing regulations, an estimated maximum of 11,844 docks could eventually be built under this alternative, compared with 8,746 docks that could be built under the No Action Alternative. Using historical dock construction rates, it can be reasonably expected that there would be 2,800 docks on Eufaula Lake in the near future of 20 years.

4.5.6.2 Direct Impacts to Viewpoints

Viewpoint 1 – Near Duchess Creek Island: Since docks would be permitted in areas previously zoned Protected, development potential would be expected to increase in this location and residences with docks

would likely be constructed. As such, the viewscape at this location would be expected to be much more residential than under the No Action Alternative.

Viewpoint 2 – Standing Rock Cut – East: Development potential would be expected to increase in this newly available area and the viewer would notice a considerable increase in residences and docks as compared to the No Action Alternative. This alternative would have the same visual effect as Alternative 4.

Viewpoint 3 – Roundtree Landing: No development would be permitted, and the viewscape would remain serene with a sense of mystery due to the curvature of the cove. This alternative would have the same visual impact as the No Action Alternative.

Viewpoint 4 – Carlton Landing: The overall aesthetic effect would be the similar to the No Action Alternative, but with slightly reduced scenic qualities to the government-owned land on the west side of the cove due to increased activity from the building of docks further down that shoreline.

Viewpoint 5 – Daisy Hallum Cove, Near Gaines Creek Park: A few more houses and docks would likely be built as compared to the No Action Alternative due to additional development pressure created by the nearby Falcon Tree subdivision. The overall aesthetic of the cove would tip towards appearing somewhat densely developed with a high dock density, especially in winter when the trees would not provide as much screening as they do in summer. The viewscape would continue to have an enclosed feeling due to the surrounding tall hills. This alternative would result in the same visual qualities as Alternative 4.

Viewpoint 6 – I-40 Bridge and Causeway: The visual character of the viewscape would be the same as the No Action Alternative. It would also be the same as Alternatives 2 and 4. The development of additional homes and docks in this viewshed would eliminate the unspoiled and untamed aesthetic of this landscape. They would visually compete with and detract from the boulders, bluffs, and mature forest that currently dominate the view. The view would still be a significant departure from other features along the I-40 corridor, but it would not have the same dramatic effect that it currently exhibits.

Viewpoint 7 – US 69 Bridge at Bridgeport: The visual character of the viewscape would be very different than under the No Action Alternative. The wide panorama of Eufaula Lake and the nearby shore would continue to convey a sense of enormity to the lake, but the high dock density would eliminate the sense of relatively unspoiled sandy shore. Although few homes would likely be visible, it would be clear to the viewer that this is a densely developed area. This alternative would also result in the same visual quality as Alternative 4.

Viewpoint 8 – Arrowhead State Park: The character of the viewscape under Alternative 3 would be more developed than it would under the No Action Alternative. The cove and opposite shore would be slightly more active. The user experience in the park would still be relatively peaceful at most times, with the aesthetic of domesticated nature. Noise from other park users would be expected to be the same as under the No Action Alternative, and would at times decrease the overall tranquility of the location, as would people driving and parking on the dirt road next to the shore. Opportunities for viewing wildlife would remain excellent.

Viewpoint 9 – Highway 31 Bridge North of Elm Point Park: The visual character of the viewscape would be more developed than it would under the No Action Alternative. The 45-foot baseline vegetation buffer required in the Limited Development area would somewhat screen the potential houses, but the docks would still be very visible. This alternative would also result in the same visual quality as Alternative 4.

4.5.6.3 Indirect Impacts to LSZs and Viewpoints

Because development would be expected to increase in areas adjacent to government-owned lands, there would be an increase in indirect negative visual impacts under Alternative 3 compared to the No Action Alternative.

4.5.7 Alternative 4 (Aesthetics and Visual Resources)

4.5.7.1 Direct Impacts to LSZs

LSZ 1 – Forest: Under Alternative 4, the amount of shoreline designated as Limited Development would be increased from 271 miles (under the No Action Alternative) to 479 miles. A shoreline vegetation buffer would be implemented whereby the majority of shoreline would be required to have a 45-foot non-mowed buffer adjacent to the lake. This buffer would help screen development somewhat, especially in areas with less steep slopes, but would likely not be an effective screen where slopes are steeper. As a result, there would be considerably less forestland than under the No Action Alternative.

LSZ 2 – Grassland/Prairie/Pasture: Development acreage would likely be greatly increased as compared to the No Action Alternative because of the considerably increased area where docks would be permitted, resulting in considerably more conversion of land from this LSZ. However, the impact of this conversion would not be as noticeable as this LSZ is much less visible from the lake and shorelines.

LSZ 3 – Farmland: There would likely be slightly more conversion of land from farmland as compared to the No Action Alternative. However, the difference may not be noticeable from the lake and shoreline.

LSZ 4 – Wetland: Impacts to this LSZ would likely be similar to those under the No Action Alternative. However, for wetlands where there is adjacent new development, they would likely appear less wild and unspoiled due to the discontinuity with adjacent undeveloped lands.

LSZ 5 – Recreation Area: A total of 43 acres would change from Low Density Recreation to High Density Recreation and another 258 acres would change from being managed as Future/Inactive Recreation to High Density Recreation and the shoreline allocations would change from Protected to Public Recreation at Carlton Landing and Roundtree Landing. Proposed recreational facilities would include both passive and active recreation and a public beach. The addition of these recreational areas would likely reduce some of the pressure that other recreational areas around Eufaula Lake would experience under the No Action Alternative. The new recreational areas on government-owned land would be highly visible from the lake and nearby shoreline.

LSZ 6 – Residential – Medium Density: There would be much larger amounts of land converted to medium-density residential uses than under the No Action Alternative due to increased development potential. The 45-foot vegetation buffer that would be established in most locations would somewhat screen some of this development from view from the lake and shoreline, but the overall visual effect would likely still be that of much more medium-density residential land, due to the acreage that would likely be converted.

LSZ 7 – Urban – Commercial/Industrial: There would likely be an increase of land conversion into urban and commercial/industrial uses as compared to the No Action Alternative to support greatly increased residential development potential.

LSZ 8 – Transportation: Views from bridges and causeways would be considerably different than they would be under the No Action Alternative, due to the construction of new housing developments, land

clearing, and new docks. As a result, the view of the lake from bridges and causeways would appear much less wild and natural than under the No Action Alternative.

LSZ 9 – Marinas: A new marina with approximately 275 to 300 slips would be built on the north side of Roundtree Landing. It and other marinas around Eufaula Lake would likely be operated as they would be under the No Action Alternative, and would have similar visual qualities.

LSZ 10 – High Density Docks: The amount of area of the lake that would have a high density of docks would be expected to be more than would occur under the No Action Alternative. Under the existing regulations, an estimated maximum of 15,459 docks could eventually be built under this alternative, compared with 8,746 docks that could be built under the No Action Alternative. Using historical dock construction rates, it can be reasonably expected that there would be 2,800 docks on Eufaula Lake in the near future of 20 years.

4.5.7.2 Direct Impacts to Viewpoints

Viewpoint 1 – Near Duchess Creek Island: Since docks would be permitted in areas previously zoned Protected, development potential is expected to increase and residences with docks are likely to be constructed (**Figure 4.5-1**). As such, the viewscape at this location is expected to be much more residential than under the No Action Alternative.

Viewpoint 2 – Standing Rock Cut – East: Development potential would be expected to increase in this newly available area and the viewer would notice a considerable increase in residences and docks as compared to the No Action Alternative. This alternative would have the same visual effect as Alternative 3.

Viewpoint 3 – Roundtree Landing: The overall aesthetic of this location would be dramatically different than under the No Action alternative. The view would be dominated by the marina (**Figure 4.5-2**). It would likely have a somewhat industrial quality due to the materials the docks are typically constructed of as well as the general upkeep of the marina landscape. Litter may accumulate. The viewer would experience unpleasant noise and odor (typical of marinas) that would not be experienced under the No Action alternative. Spilled fuel and oil would likely occasionally occur and would create an occasional sheen on the water. The serene aesthetic of the cove would be lost and wildlife would likely be disturbed due to the activity in the area. Fishing from boats would most likely not often occur at this location, as users would motor to more remote locations to fish due to the increased noise, water disturbance, and in-lake timber clearing.

Viewpoint 4 – Carlton Landing: The overall aesthetic effect would be dramatically different than the No Action Alternative. The serene natural aesthetic of the cove would be greatly reduced and the user experience would be more typical of an active waterfront area with beach recreation, sporting activities, and other public amenities.

Viewpoint 5 – Daisy Hallum Cove, Near Gaines Creek Park: A few more houses and docks would likely be built as compared to the No Action Alternative due to additional development pressure created by the nearby Falcon Tree subdivision. The overall aesthetic of the cove would tip towards appearing somewhat densely developed with a high dock density, especially in winter when the trees would not provide as much screening as they do in summer. The viewscape would continue to have an enclosed feeling due to the surrounding tall hills. Opportunities for viewing wildlife would begin to decline due to habitat fragmentation. This alternative would result in the same visual qualities as Alternative 3.



LEAF-ON



LEAF-OFF

Figure 4.5-1. Viewpoint 1 – Near Duchess Creek Island Under Alternative 4



LEAF-ON



LEAF-OFF

Figure 4.5-2. Viewpoint 3 - Roundtree Landing Under Alternative 4

Viewpoint 6 – I-40 Bridge and Causeway: The visual character of the viewscape would be the same as under the No Action Alternative. It would also be the same as Alternatives 2 and 3. The development of additional homes and docks in this viewshed would eliminate the unspoiled and untamed aesthetic of this landscape. They would visually compete with and detract from the boulders, bluffs, and mature forest that currently dominate the view. The view would still be a significant departure from other features along the I-40 corridor, but it would not have the same dramatic effect that it currently exhibits.

Viewpoint 7 – US 69 Bridge at Bridgeport: The visual character of the viewscape would be very different than under the No Action Alternative. The wide panorama of Eufaula Lake and the nearby shore would continue to convey a sense of enormity to the lake, but the high dock density would eliminate the sense of relatively unspoiled sandy shore. Although few homes would likely be visible, it would be clear to the viewer that this is a densely developed area. This alternative would also result in the same visual quality as Alternative 3.

Viewpoint 8 – Arrowhead State Park: The character of the viewscape would be more developed than it would be under the No Action Alternative. The cove and opposite shore would be slightly more active. The user experience in the park would still be relatively peaceful at most times, with the aesthetic of domesticated nature. Noise from other park users would be expected to be the same as under the No Action Alternative, and would at times decrease the overall tranquility of the location, as would people driving and parking on the dirt road next to the shore.

Viewpoint 9 – Highway 31 Bridge North of Elm Point Park: The visual character of the viewscape would be more developed than it would be under the No Action Alternative. The 45-foot baseline vegetation buffer required in the Limited Development area would somewhat screen the houses, but the docks would still be very visible. This alternative would also result in the same visual quality as Alternative 3.

4.5.7.3 Indirect Impacts to LSZs and Viewpoints

Of all the alternatives, Alternative 4 is most likely to have indirect visual effects due to the increase in development in areas adjacent to government-owned lands surrounding the lake.

4.5.8 Visual Impact Assessment Ratings

VIA ratings were calculated based on comparing each alternative to the No Action Alternative by averaging across viewpoints and comparing to impact thresholds established in the VRAP for each MCS classification.

4.5.8.1 Alternative 1

The VIA quotient for Alternative 1 of +0.89 represents an improvement in the overall visual quality of Eufaula Lake as compared to the No Action Alternative. The quotient for this alternative is also higher than the quotients for Alternatives 2, 3, and 4. This alternative preserves much of the existing character of Eufaula Lake, especially aspects of the lake that are considered visually desirable.

10.4.8.2 Alternative 2

The VIA quotient for Alternative 2 of +0.22 represents a small improvement in the overall visual quality of Eufaula Lake as compared to the No Action Alternative. The quotient for this alternative is also higher than the quotients for Alternatives 3, and 4, but lower than Alternative 1. Alternative 2 preserves some of the existing character of Eufaula Lake, but would generally have a similar visual effect as the No Action Alternative.

4.5.8.3 Alternative 3

The VIA quotient for Alternative 3 of -1.67 represents an decrease in the overall visual quality of Eufaula Lake as compared to the No Action Alternative. The quotient for this alternative is lower than that of Alternatives 1 and 2, but higher than that of Alternative 4. Alternative 3 would result in a change of visual character of Eufaula Lake, to one that would be less wild and natural, with less of an emphasis on the unique geologic formations of the region, than the No Action Alternative. Residential development and docks would be much more dominant features than they would be under the No Action Alternative.

4.5.8.4 Alternative 4

The VIA quotient for Alternative 4 of -2.89 represents a considerable decrease in the overall visual quality of Eufaula Lake as compared to the No Action Alternative. The quotient for this alternative is lower than that of Alternatives 1, 2, and 3. Alternative 4 would result in a change of visual character of Eufaula Lake, to one that would be considerably less wild and natural, with less of an emphasis on the unique geologic formations of the region, than the No Action Alternative. Residential development and docks would be considerably more dominant features than they would be under the No Action Alternative.

4.5.9 LSZ Threshold VIA Values

Each MCS classification has a threshold for acceptable VIA values. These thresholds represent the lowest VIA value each alternative should have within that zone. All zones have the potential to have a VIA of +10, although this is unlikely in any alternative. The threshold values for the LSZs for the various alternatives under consideration are shown in **Table 4.5-2**.

Table 4.5-2. Threshold Visual Impact Analysis Values for each LSZ

Landscape Similarity Zone		MCS Classification	Threshold VIA	Alt. 1 VIA +0.89	Alt. 2 VIA +0.22	Alt. 3 VIA -1.67	Alt. 4 VIA -2.89
1	Forest	Preservation	+10 to 0	Acceptable	Acceptable	Adverse	Adverse
2	Grassland/ Pasture/ Prairie	Partial Retention	+10 to -5	Acceptable	Acceptable	Acceptable	Acceptable
3	Farmland	Retention	+10 to -2	Acceptable	Acceptable	Acceptable	Acceptable
4	Wetland	Preservation	+10 to 0	Acceptable	Acceptable	Acceptable	Acceptable
5	Recreation Area	Preservation	+10 to 0	Acceptable	Acceptable	Acceptable	Acceptable
6	Residential - medium density	Partial Retention	+10 to -5	Acceptable	Acceptable	Acceptable	Acceptable
7	Urban - Commercial/ Industrial	Modification	+10 to -7	Acceptable	Acceptable	Acceptable	Acceptable
8	Transportation	Retention	+10 to -2	Acceptable	Acceptable	Acceptable	Acceptable
9	Marinas	Rehabilitation	+10 to -10	Acceptable	Acceptable	Acceptable	Acceptable
10	High Density Docks	Modification	+10 to -7	Acceptable	Acceptable	Acceptable	Acceptable

The VIA values of +0.98 for Alternative 1 and +0.22 for Alternative 2 are within the threshold values for all LCZs and as such are considered acceptable. The VIA values of -1.67 for Alternative 3 and -2.89 for Alternative 4 are considered adverse for the Forest LSZ, but acceptable for all others. It should be noted that almost half of the land in the study area is within the Forest LSZ (approximately 91,712 acres). As such, threshold ratings for this LSZ could be considered to be of greater magnitude than similar ratings for other LSZs.

4.5.10 Potential Mitigation Measures (Aesthetics and Visual Resources)

USACE can only control aspects of land use that occurs on government-owned property. Potential additional mitigation measures for areas receiving mowing permits are not considered, since the amount of clearing is determined by each alternative. However, considerable mitigation of visual and aesthetic impacts could be accomplished by focusing on higher-intensity land uses. USACE could implement the following measures for activities on government-owned property in all LSZs:

Docks: There are currently no restrictions on the size of docks that may be built, so long as they are in keeping with USACE policies for distance from adjacent docks, from shore, and the amount of open cove remaining. Some docks have a very high number of boat slips. In addition, some docks with many slips are built with the intention of selling slips to others. Shoreline management regulations prohibit building a boat dock with the intention of selling the individual slips but it is known to occur from time to time. The practice of building roofs over docks makes them much more dominant to the viewer and blocks the view of the adjacent landscape. The aesthetic impact of additional docks under any of the alternatives could be reduced by the following measures:

- Limit the number of slips per dock.
- Prohibit permit holders from selling slips to anyone other than a purchaser of the permit holder's adjacent property.
- Prohibit or limit the size of dock roofs.
- Limit acceptable colors for dock roofs to ones that may be less visually intrusive.

Encasing dock floats in plastic as they are repaired or replaced is also an effective way to reduce potential visual impacts and is already required by USACE regulations on Eufaula Lake.

Marinas: Marinas can have an industrial and unattractive quality due to the nature of boat storage and maintenance activities, storage of miscellaneous material, and accumulation of litter. The negative aesthetic impact of marinas on the lake and adjacent shorelines could be reduced by the following measures:

- Prohibit the accumulation of miscellaneous materials and/or junk piles.
- Prohibit driving on unimproved surfaces.
- Prohibit the storage of boats and trailers on unimproved surfaces.
- Plant vegetation to screen upland marina areas from the lake.
- Prohibit mowing of land not used for marina amenities.
- Require dock floats to be encased in plastic as they are repaired or replaced.

- Prohibit the use of tires or other waste materials as breakwaters.
- Require the removal of litter from adjacent shoreline and wetland areas.

Recreation Areas: Although recreational areas are generally attractive and consistent with the natural character of Eufaula Lake, some heavily used areas can experience wear and deterioration. The aesthetic impact of such areas on the lake, adjacent shorelines, and other spaces within recreational areas could be reduced by the following measures:

- Prohibit driving on unimproved surfaces.
- Strategic screening of play areas, restrooms, dumpsters, and other facilities with vegetation from adjacent areas with less compatible uses, such as nature trails and fishing areas.

4.6 Cultural and Historic Resources

4.6.1 Assessment Methods (Cultural and Historic Resources)

The federal action under consideration is a revision of the SMP and a supplement to the MP. The alternatives to this action would result in varying amounts of Limited Development, Protected, and Public Recreation shoreline allocations. These shoreline allocations differ in the intensity of use that may be permitted and thus the relative amounts of each would result in differing levels of potential development around the lake. A specific request for Public Recreation shoreline allocation and the grant of a lease for a public marina and other shoreline recreational facilities for the proposed Carlton Landing development is also evaluated.

Area and point data for cultural and historic resources known to be present around the Lake was provided by USACE, Tulsa District. Over time, approximately 490 archeological sites and 13 historic properties have been cataloged around the lake. Many of these known sites are now under the lake waters and would not be affected by changes in shoreline allocations or land use classifications. The term “historic properties” refers to both archeological and historic sites. Historic properties may or may not be eligible for listing on the National Register.

The potential impact on these sites was assessed for each of the four alternatives considered. The greatest potential for effects would occur where cultural resources are located along Limited Development shorelines. Limited Development shorelines would be where the greatest potential for ground disturbing activities could take place. Boat dock construction and trail construction would be the activities with the greatest potential to disturb historic properties. Vegetation management activities that cause ground disturbance would also have the potential to adversely affect known and unknown cultural resources, both directly and indirectly, depending on the specific activity undertaken and the methods used to conduct the work. Impacts could be either direct or indirect. Direct impacts would result from specific actions, such as the use of machines and vehicles during dock construction or vegetation management activities, by felling trees on certain types of cultural resources, by skidding of logs and trees, or by erosion caused by vegetation removal or damage. Some direct impacts may be avoided by selectively choosing when to conduct vegetation management activities. For example, conducting management activities only during the wintertime when the ground is frozen and snow-covered would reduce or eliminate potential damage.

Indirect impacts generally occur after an action, and are a result of changes in the condition of the landscape (such as loss of vegetation and subsequent erosion). Indirect effects can result from changed visitor use patterns and improved access and visibility that bring more visitors, resulting in the deterioration or loss of the resource. Mitigation of indirect impacts could be done through enhanced signage and trail guide features.

The locations of known cultural and historic resources were evaluated against the potential changes in shoreline allocations for each alternative to provide an assessment of the magnitude of the potential effect. It is recognized that there may be other unknown historic properties on USACE-owned lands around the lake. The known sites are used in this analysis as a proxy for all potential sites and for evaluating the relative magnitude of potential effects between alternatives.

To address potential effects at the proposed Carlton Landing development, a phase I archeological survey was conducted as described in Section 3.6. Within the area of potential effect at the Carlton Landing development area, previously recorded sites were re-examined and a systematic survey was conducted to identify additional sites. The eligibility of each site for listing on the National Register under the NHPA was assessed. Potential effects of each alternative with respect to the findings of this site specific survey are described.

If National Register eligible historic properties are present where there may be construction or increased public access, a potential effect could occur. The USACE Historic Properties Management Plan would be implemented to avoid or to mitigate for unavoidable impacts.

4.6.2 Significance Criteria (Cultural and Historic Resources)

The National Historic Preservation Act (NHPA) promotes historic preservation by ensuring that federal agencies consider historic properties when planning and making decisions on projects. Section 106 requires federal agencies to take into account the effects of their undertakings on historic properties.

The NHPA provides the following criteria for determining the significance for historic properties, including:

- A - Associated with events that have made a significant contribution to the broad patterns of our history.
- B - Associated with the lives of persons significant in our past.
- C - Embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic value, or that represent a significant and distinguishable entity whose components may lack individual distinction.
- D - Have yielded, or may be likely to yield, information important in prehistory or history.

Once a property is determined to meet one or more of the above criteria, it must also be examined for integrity of location, design, setting, materials, workmanship, feeling, and association. These determinations would be made by a qualified archeologist or historian.

4.6.3 No Action Alternative (Cultural and Historic Resources)

Under the No Action Alternative there would be no change in the current shoreline allocations as designated under the 1998 SMP. In addition, the MP would not be revised to be consistent with the current SMP; however, where there are discrepancies, the lands would be managed as though they were

consistent with the SMP. The rezone request related to proposed shoreline development at Carlton Landing would also not be approved and a lease for a new marina and shoreline recreational facilities would not be granted.

Under the No Action Alternative, the areas allocated as Limited Development would be where the greatest potential for shoreline effects to cultural and historic resources would occur. There are approximately 145 known historic properties along Limited Development shorelines. Under the No Action Alternative all of these sites would be at risk of disturbance. Ground disturbing activities on USACE lands would require a shoreline use permit issued prior to commencement of the activity. Through the site review process prior to issuance of a shoreline use permit, known sites would be evaluated for their significance and eligibility for the National Register. USACE would implement the Tulsa District Historic Properties Management Plan to recognize and protect historic properties and to protect significant resources.

While known sites would be re-evaluated and protected as appropriate, unknown sites might be disturbed and affected. The number of known sites potentially affected is used as a proxy for the magnitude of potential effects under the No Action Alternative.

Boat dock construction and trail construction would be the activities with the greatest potential to disturb historic properties. Vegetation management activities that cause ground disturbance would also have the potential to adversely affect known and unknown cultural resources, both directly and indirectly, depending on the specific activity undertaken and the methods used to conduct the work. Impacts could be either direct or indirect.

Direct impacts would result from specific actions, such as the use of machines and vehicles during dock construction or vegetation management activities, by felling trees on certain types of cultural resources, by skidding of logs and trees, or by erosion caused by vegetation removal or damage. Some direct impacts may be avoided by selectively choosing when to conduct vegetation management activities. For example, conducting management activities only during the wintertime when the ground is frozen and snow-covered would reduce or eliminate potential damage. In addition, the restriction on clearing of trees greater than 4 inches in diameter would mean that most vegetation modification would likely be conducted with hand tools that would have minimal potential effects on historic properties.

Under the No Action Alternative, 145 sites are associated with Limited Development shorelines and could potentially be affected by future ground disturbing activities. There would be no shoreline development at Carlton Landing; and therefore, there would be no effect on historic properties at that location under the No Action Alternative. Under the No Action Alternative, approximately 170 lots would be developed on private lands adjacent to the government lands. It is possible that there are unknown cultural resources on these private lands that would be affected by the development that would occur under the No Action Alternative.

Indirect impacts generally occur after an action, and are a result of changes in the condition of the landscape (such as loss of vegetation and subsequent erosion). Indirect effects can result from changed visitor use patterns and improved access and visibility that bring more visitors, resulting in the deterioration or loss of the resource. Mitigation of indirect impacts could be done through enhanced signage and trail guide features.

In addition, indirect impacts could occur as private lands adjacent to USACE-owned lands are developed near shorelines allocated to Limited Development. It is possible that unknown historic properties are

present on these adjacent private lands and they may be disturbed by residential development. While this residential development may occur partly as a result of the shoreline zoning that would allow private dock development, residential development may also occur because of other lakeshore amenities such as views of the water and the proximity to water-based recreational opportunities whether or not one has a private dock. Private residential development typically does not include surveys or mitigation for effects on historic properties. Therefore, there would be potential indirect effects on historic properties that would not be mitigated.

4.6.4 Alternative 1 (Cultural and Historic Resources)

Alternative 1 reduces the Limited Development shoreline allocations to those areas mapped as Limited Development in the 1981 SMP. Limited Development shorelines that are not Limited Development under the 1981 SMP would be converted to Protected shorelines. This alternative would revise the MP land classification maps to be consistent with the SMP.

Under Alternative 1, potential effects on historic properties would be greatly reduced compared to the No Action Alternative. The shoreline allocation around approximately 139 known sites would change from Limited Development to Protected; only 6 known sites would occur along shorelines that remain designated as Limited Development. This would have the effect of greatly reducing potential impacts on historic properties because ground disturbing activities such as construction of private docks and improved access paths is generally not allowed on Protected shorelines.

Vegetation management activities that cause ground disturbance have the potential to adversely affect known and unknown cultural resources, both directly and indirectly, depending on the specific activity undertaken. These potential impacts would be the same as described under the No Action Alternative. Under Alternative 1, the area on which vegetation modification activities would be allowed would be substantially less than under the No Action Alternative. The area of USACE lands adjacent to Limited Development shorelines, which is where vegetation modification could be permitted, would be substantially less under Alternative 1. In addition, the implementation of the extended vegetation management buffer policy would further limit the area subject to vegetation modification. Therefore, potential effects from vegetation management would be substantially less under Alternative 1 as compared to the No Action Alternative.

Under Alternative 1, the request for Public Recreation shoreline allocation at Carlton Landing would not be approved. The lease request for a public marina and other recreational amenities at Carlton Landing also would not be granted. Therefore, there would be no effect on historic properties under Alternative 1 on USACE-owned shorelines at Carlton Landing. The potential for residential development on private lands at Carlton Landing to affect unknown sites would be the same as under the No Action Alternative.

4.6.5 Alternative 2 (Cultural and Historic Resources)

Under Alternative 2, the amount of Limited Development shoreline would be reduced from 271 miles under the No Action Alternative, to 182 miles. Limited Development shorelines that are unsuitable for docks and which do not have existing developments adjacent to the government lands would be converted to Protected. The MP land use classification maps would be revised to be consistent with the SMP shoreline allocations.

Under Alternative 2, the shoreline allocation around approximately 39 known historic properties would change from Limited Development to Protected. This would reduce potential impacts on historic

properties compared to the No Action Alternative, but not as much as under Alternative 1, as 106 sites would remain associated with Limited Development shorelines.

Vegetation management activities would have the potential to result in impacts similar to those described under the No Action Alternative. Under Alternative 2, the amount of Limited Development shorelines where vegetation modification activities would be allowed would be somewhat less than under the No Action Alternative. In addition, the implementation of the extended vegetation management buffer policy would further limit the area subject to vegetation modification. Therefore, potential effects from vegetation management would be less under Alternative 2 as compared to the No Action Alternative.

The request for Public Recreation shoreline allocation at Carlton Landing would not be approved. The lease request for a public marina and other public shoreline recreational facilities at Carlton Landing would also not be granted. Therefore, there would be no effect on historic properties under Alternative 2 on USACE-owned shorelines at Carlton Landing. The potential for residential development on private lands at Carlton Landing to affect unknown sites would be the same as under the No Action Alternative.

4.6.6 Alternative 3 (Cultural and Historic Resources)

Under Alternative 3, the amount of Limited Development shoreline would increase to 367 miles compared to the No Action Alternative by converting Protected shorelines that are suitable for docks and which do not have an existing license agreement for use of the government land to Limited Development. MP land use classification maps would be revised to be consistent with the SMP shoreline allocations.

Under Alternative 3, the shoreline allocation around approximately 51 known historic properties would change from Protected to Limited Development. This would increase potential impacts on historic properties compared to the No Action Alternative (from 145 to 196), but not as much as under Alternative 4.

Vegetation management activities would have the potential to result in impacts similar to those described under the No Action Alternative. Under Alternative 3, the amount of Limited Development shorelines where vegetation modification activities would be allowed would be somewhat greater than under the No Action Alternative. Implementation of the baseline vegetation management buffer policy would limit the area subject to vegetation modification compared to the No Action Alternative and would partially offset the increased area. Potential effects from vegetation management on historic properties would be greater under Alternative 3 as compared to the No Action Alternative.

The Carlton Landing shoreline allocations would be changed from Protected to Limited Development, which could result in some private dock construction although potential would be limited by steep slopes, shallow waters, and an irregular shoreline that provides little frontage for private lots to abut. The lease request for a public marina and other public shoreline recreational facilities at Carlton Landing would not be granted.

A Phase I archaeological survey (see Appendix G) over the 301 acres of shoreline at Carlton Landing re-examined or identified seven sites. None of these prehistoric and historic sites was determined to be eligible for listing in the National Register of Historic Places. Therefore, there would be no effect on cultural and historic resources from shoreline development on USACE-owned lands at the Carlton Landing development. The potential for residential development on private lands at Carlton Landing to affect unknown sites would be the same as under the No Action Alternative.

4.6.7 Alternative 4 (Cultural and Historic Resources)

Under Alternative 4, the amount of Limited Development area would increase to 479 miles compared to the No Action Alternative by converting all Protected areas that do not have an existing license agreement for use of the government land to Limited Development. MP land use classification maps would be revised to be consistent with the SMP shoreline allocations.

Under Alternative 4, the shoreline allocation around approximately 98 known historic properties would change from Protected to Limited Development or Public Recreation. This alternative would have the greatest increase in potential impacts on historic properties compared to all of the alternatives (from 145 under the No Action Alternative to 243 under Alternative 4).

Vegetation management activities would have the potential to result in impacts similar to those described under the No Action Alternative. Under Alternative 4, the amount of Limited Development shorelines where vegetation modification activities would be allowed would be substantially greater than under the No Action Alternative. Implementation of the baseline vegetation management buffer policy would limit the area subject to vegetation modification compared to the No Action Alternative and would partially offset the increased area. Potential effects from vegetation management on historic properties would be greater under Alternative 4 as compared to the No Action Alternative.

The shoreline allocation at Carlton Landing would be changed from Protected to Public Recreation and the lease request for a public marina and other public shoreline recreational facilities would be granted. Of the 98 known sites where the shoreline allocation would change under Alternative 4, seven of them are located at Carlton Landing.

A Phase I archaeological survey (see Appendix G) over the 301 acres of shoreline at Carlton Landing re-examined or identified seven sites. None of these prehistoric and historic sites was determined to be eligible for listing in the National Register of Historic Places. Therefore, there would be no effect on cultural and historic resources from shoreline development on USACE-owned lands at the Carlton Landing development. The proposed development on adjacent private lands would be much more extensive than under the No Action Alternative or the other action alternatives, potentially resulting in development on approximately 1,650 acres. This would have the potential to affect unknown cultural resources.

4.6.8 Potential Mitigation Measures (Cultural and Historic Resources)

The USACE Historic Properties Management Plan would be implemented to avoid or to mitigate for unavoidable impacts. This plan outlines a series of actions that would result in protection of historic properties at Eufaula Lake. These actions include:

- Protection of known sites.
- Determination of eligibility of previously recorded sites.
- Survey uninvestigated areas.
- Train USACE personnel on the requirements of historic property protection.
- Provide opportunities for public involvement.
- Continue ongoing consultation and coordination with the SHPO and tribes.
- Maintain a GIS database of known cultural resources.

Prior to issuing shoreline use permits in Limited Development shoreline areas, USACE would 1) check for known sites to avoid affecting known eligible cultural resource sites, and 2) conduct site reviews to ensure that significant unknown cultural resource sites are not affected without proper consultation.

Vegetation modification permits, if they permit the removal of large trees greater than 4 inches in diameter could require that work be conducted during the wintertime when the ground is frozen or snow-covered in order to reduce or eliminate potential damage.

4.7 Recreation

4.7.1 Assessment Methods and Significance Criteria (Recreation)

This section describes the potential impacts associated with each of the types of recreational uses described in 3.7 and how those recreational uses might be affected under each of the alternatives. Both direct and indirect impacts are described. The No Action Alternative and four action alternatives have been analyzed, including:

- No Action Alternative.
- Alternative 1: Limited Development shoreline allocations as they existed under the 1981 SMP.
- Alternative 2: Limited Development shoreline allocations somewhat reduced from the No Action Alternative based on dock suitability criteria.
- Alternative 3: Shoreline allocation for Limited Development somewhat increased compared to the No Action Alternative but constrained by dock suitability criteria.
- Alternative 4: Shoreline allocation for Limited Development greatly increased compared to the No Action Alternative and approval of a lease of government land in support of the Carlton Landing development proposal.

One of the key components in determining impacts is the number and density of boat docks. Private boat docks may only be permitted along shorelines allocated as Limited Development. Potential boat dock density is calculated based on existing USACE regulations and the current Eufaula Lake SMP. The shoreline management regulations limit the amount of shoreline that can be developed to 50 percent of the area allocated as Limited Development (36 CFR 327.30). Therefore, the number of shoreline miles is first divided in half before calculating the maximum number of docks that could potentially be constructed.

USACE regulations further require boat docks to be placed a minimum of 50 feet from other docks. Although in reality, the average distance between docks tends to be greater than 50 feet because of factors such as irregular shorelines or shallow water depths, this 50-foot spacing provides a maximum density. The average boat dock width at Eufaula Lake is 31.8 feet. If the docks are spaced 50 feet apart, then there would be a minimum of 81.8 feet of shoreline length per boat dock.

Currently, there are a total of 1,673 private and community boat docks authorized and in place under the existing SMP. There are 5,523 boats located at these docks, which indicates that the average number of boats per dock is 3.3 boats per dock. The boat dock development potential for each of the alternatives is summarized in **Table 4.7-1**.

Table 4.7-1. Maximum Potential Number of Private Boat Docks under each Alternative

Alternative	Limited Development Shoreline (miles)	Miles Available for Dock Construction	Limited Development Shoreline (feet)	Maximum Number of Docks ¹
No Action	271	135.5	715,440	8,746
Alternative 1	42	21	110,880	1,355 ²
Alternative 2	182	91	480,480	5,873
Alternative 3	367	183.5	968,880	11,844
Alternative 4	479	239.5	1,264,560	15,459

¹ - The maximum potential number of docks that could be built under each alternative is based on an average width of 31.8 feet and a minimum dock spacing of 50 feet. Currently there are 1,673 existing docks on the lake.

² - Although this value is less than the total number of existing docks, over half of the existing docks (908) are located outside of areas that would be designated as Limited Development under Alternative 1. A closer analysis of the individual segments that would be allocated as Limited Development under Alternative 1 reveals that an additional 605 docks could be constructed along the Limited Development shorelines under Alternative 1 for a total potential number of 2,278 docks.

A number of factors were determined in assessing potential impacts. The first factor is the determination of the Boats At One Time (BAOT) for the lake. This is the total number of boats on the water surface, actively being used for recreational purposes, at any given time. As described in Section 3.7.4.2, the existing BAOT for Eufaula Lake is 2,174.

The second factor is the Boating Density (BD). This is the measure of use that is calculated by dividing the number of unrestricted water surface acres (52,218) by the total number of boats at one time (2,174). The existing BD for Eufaula Lake is 24 acres per boat.

The third factor is the total boat capacity (TBC). This is the total number of boats that can be moored or stored at an approved moorage facility, such as a marina or boat dock, plus the total number of boats that can be placed on the water surface using an approved boat ramp or launch facility. This number is obtained by adding the number of car/trailer spaces at boat ramps in public recreation areas (1,096), the number of marina wet slips (1,097), the number of boats from private boat docks (5,523), and the number of boats from subdivision boat ramps (1,218). The existing TBC for Eufaula Lake is 8,934.

Using these factors, the recommended BAOT capacity is determined by dividing the amount of unrestricted water surface acres (52,218) by the optimal number of acres per boat (15), which is obtained from studies at similar lakes. This calculation results in a recommended BAOT capacity of 3,481 (rounded to 3,500 for this assessment).

Using the current Lake Use Rate of 24 percent (see Section 3.7.4.2), the maximum number of boats that can be safely accommodated at mooring facilities, such as private/community boat docks and marinas, and from boat ramps, should not exceed a combined total of approximately 14,200 boats. Therefore, the recommended TBC is 14,200.

To complete the impact assessment for the No Action Alternative as well as each of the four alternatives, the BAOT capacity for each alternative was computed and compared to the recommended BAOT capacity of 3,500, the recommended BD of 15 acres per boat, and the recommended TBC capacity of 14,200.

If an alternative exceeds the existing carrying capacity (either land-based or water-based), there would be a significant effect. Proposed actions that would not be in compliance with adopted laws, regulations, or policies (described in Section 3.7.2) may also be considered to have a significant impact.

4.7.2 No Action Alternative (Recreation)

The No Action Alternative would not revise the SMP and the MP land use classification maps would not be revised to be consistent with 1998 SMP shoreline allocations. In addition, the lease request for a public marina and other public recreation facilities at Carlton Landing would not be approved.

While there would be no change to the existing shoreline allocations under the No Action Alternative, there are currently many miles of undeveloped shoreline that are allocated as Limited Development that could be developed at some time in the future. This future potential development could reasonably be expected to include additional dock construction and alteration of the existing shoreline vegetation. The “future condition” under the No Action Alternative would be expected to be different from the current existing condition.

Under the No Action alternative, there are 271 miles of shoreline designated as Limited Development. Therefore, the maximum potential number of docks that could be permitted under the No Action Alternative is 8,746 boat docks. Applying the current number of boats per dock (3.3 boats/dock), approximately 28,862 boats could be at the lake under a maximum build out scenario of full build out of the No Action Alternative.

4.7.2.1 Land-based Recreation

The No Action Alternative would not include in any changes to land-based recreational facilities at Eufaula Lake. Studies conducted by USACE indicate that persons who boat also participate in the following land-based recreation activities at the following rates (*e.g.*, 50 percent of boaters also picnic):

- Picnicking – 50 percent
- Camping – 44 percent
- Hiking/Walking/Biking – 33 percent
- Hunting – 3 percent
- Sightseeing – 1 percent

Using these crossover activity participation rates, land-based recreation visits would be expected to increase as the number of boat docks, and thus boaters, increase. Because the number of boat docks would substantially increase over time under the No Action Alternative, there would be impacts to land-based recreational facilities and experiences. **Table 4.7-2** shows the potential impact to land-based recreational uses that would occur upon reaching the maximum potential build-out of docks under this alternative. Data from the USACE Recreation Economic Assessment System (REAS) provides the basis for the formula used in calculating this visitation increase: (# of boats) x (3) average boating party size) x (crossover participation percentage rate) = (land-based crossover visits from boaters).

The number of annual visits for picnicking is currently about 167,000. There are 79 developed picnic sites at Eufaula Lake which could provide approximately 230,680 picnicking opportunities per year (79 sites

times 2 (the number of parties that can use a site per day) times 4 (the average size of a picnic party) times 365 days per year). The predicted visits for picnicking under the No Action Alternative would not exceed the existing capacity, but the limited number of picnic facilities and opportunities would become noticeably apparent.

As discussed in Section 3.7, campgrounds are currently at about 28 percent capacity, although the summer and weekend rates are higher. Therefore, the maximum camping opportunity available would be 173,439 annual visits. Under the No Action Alternative, the availability of campsites would likely be impacted during peak use periods, particularly in the month of July.

In addition to increases in the potential number of boaters, the potential for residential development adjacent to Limited Development shorelines that are currently undeveloped could result in an increase in the population within one-quarter mile of the shoreline, and thus, an increase in the number of people who may participate in land-based recreational activities.

Table 4.7-2. Potential Long-Term Impacts to Land-based Recreation (No Action Alternative)

Activity and Boating Crossover Rate	Annual Visits (Existing) ¹	Boating Crossover Participation Visits (Predicted)	Total Potential Visits
Picnicking (50%)	166,957	43,293	210,250
Camping (44%)	48,563	38,098	86,661
Hiking (33%)	N/A	N/A	N/A
Hunting (3%)	25,713	2,598	28,311
Sightseeing (1%)	700,122	866	700,988
Total	941,355	84,855	1,026,210

1 - Source: USACE, Value to the Nation, 2010 data

4.7.2.2 Water-based Recreation

Potential impacts on water-based recreation most likely would be significant, particularly over the long term. The recommended boating density is 15 water surface acres per boat, which equates to a recommended BAOT of 3,500 and a recommended TBC of 14,200 boats.

The No Action Alternative has the potential to allow BAOT and TBC to be over two times greater than recommended capacity limits. Maximum boat density under the No Action Alternative would be approximately 6.7 acres per boat, compared to the nationwide minimum boating density of 15 acres per boat. More common boat densities observed at recreational lakes range from 20 to 50 acres per boat. The estimated BAOT under the No Action Alternative would be 7,746 boats, which is more than twice the recommended level (3,500 BAOT). The estimated TBC would be 32,273, which would also be more than twice the recommended level of 14,200 boats.

At this level of boating density, one could reasonably expect increases in boating accidents, injuries and fatalities. For example, currently the average boating density in Lake Areas 3 and 4 is 13.7 acres per boat, while the average for all other lake areas is 57 acres per boat. Between 2003 and 2011, 66 percent of boating accidents occurred in Lake Areas 3 and 4. In addition, the number of boating accidents per thousand surface acres in Lake Areas 3 and 4 is nearly double that of other lake areas. This is a strong

indication that as the number of boats increases (and the number of acres per boat is lower), the number and frequency of boating accidents will also increase.

The No Action Alternative would most likely require the implementation of a range of mitigation measures, such as slow zones, creation of boating activity use zones, or one-way directional travel restrictions. Restricting the use of certain types of watercraft, such as personal watercraft (PWC) would most likely also be required. Increased boating law enforcement resources may also be required.

Under the No Action Alternative, recreational boating experiences and boater satisfaction would most likely be degraded. Even the implementation of mitigation measures intended to promote boating safety such as slow zones, may degrade the boating experience.

4.7.3 Alternative 1 (Recreation)

Alternative 1 reduces the Limited Development shoreline allocations to those areas mapped as Limited Development in the 1981 SMP. Under Alternative 1, there would be 42 miles of shoreline designated as Limited Development. Therefore, the maximum potential number of docks that could be permitted under the alternative is 1,355 boat docks. However, a closer analysis of the individual segments that would be allocated as Limited Development under Alternative 1 reveals that there would be sufficient space for an additional 605 docks. In addition, the existing docks would be grandfathered; therefore, the total potential number of docks under Alternative 1 would be 2,278. Applying the average of 3.3 boats per dock, this alternative would allow approximately 7,517 boats. This number would be considerably lower than the number of docks (8,746) and the number of boats (28,862) allowed under the No Action Alternative.

4.7.3.1 Land-based Recreation

Alternative 1 would have minimal potential impacts on land-based recreation at Eufaula Lake as there would be only a slight increase in the number of boat docks and boats on the lake compared to the existing condition. Furthermore, the potential number of boats and boat docks in the future would be significantly less than under the No Action Alternative and would be within the available capacity at Eufaula Lake.

4.7.3.2 Water-based Recreation

Alternative 1 would have minimal potential impacts on water-based recreation. Under Alternative 1, the potential number of docks and boats would be greatly reduced as compared to the No Action Alternative. Existing docks would be grandfathered and allowed to remain and the potential for new docks would be extremely limited.

The potential maximum number of boat docks and associated boats would be within the recommended capacity limits. Boat density would be approximately 19.9 acres per boat, which is within the range recommended from other studies on lakes similar to Eufaula Lake. The BAOT would be 2,623, which would be less than the recommended capacity limit of 3,500 BAOT, and the TBC would be 10,928, which would be less than the recommended capacity limit of 14,200 boats. Therefore, there would be no effect on water-based recreation under Alternative 1.

4.7.4 Alternative 2 (Recreation)

Under Alternative 2, the amount of Limited Development shoreline would be reduced from 271 miles under the No Action Alternative, to 182 miles. Limited Development shorelines that are unsuitable for docks and which do not have existing developments adjacent to the government lands would be converted

to Protected. The MP land use classification maps would be revised to be consistent with the SMP shoreline allocations.

Under Alternative 2, the maximum potential number of docks that could be permitted would be 5,873 boat docks. Applying the current average number of boats per boat dock (3.3) would result in a maximum of 19,381 boats.

4.7.4.1 Land-based Recreation

Although the alternative would result in fewer potential boat docks than under the No Action Alternative, there would still be a significant increase in the number of boats and boaters recreating at the lake compared to the existing condition. **Table 4.7-3** shows the potential impact to land-based recreational uses that would occur upon reaching the maximum potential build-out of docks under this alternative.

Table 4.7-3. Potential Long-term Impacts to Land-based Recreation (Alternative 2)

Activity and Boating Crossover Rate	Annual Visits (Existing) ¹	Boating Crossover Participation Visits (Predicted)	Total Potential Visits
Picnicking (50%)	166,957	29,072	196,029
Camping (44%)	48,563	25,583	74,146
Hiking (33%)	N/A	N/A	N/A
Hunting (3%)	25,713	1,744	27,457
Sightseeing (1%)	700,122	581	700,703
Total	941,355	56,980	998,335

1 - Source: USACE, Value to the Nation, 2010 data

Under Alternative 2 the lack of picnic facilities and opportunities would become more apparent. Also, the availability of campsites would be somewhat impacted, during peak use periods, particularly in the month of July.

4.7.4.2 Water-based Recreation

The potential impacts to water-based recreation most likely would be significant, particularly over time. The recommended boating capacity for Eufaula Lake is 15 water surface acres per boat, which equates to a BAOT of 3,500 and a TBC of 14,200 boats. Under Alternative 2, potential boating density would be approximately 9.6 acres per boat, which is denser than the recommended density. The estimated BAOT would be 5,470 boats, which is also greater than the recommended level (3,500 BAOT). The estimated TBC would be 22,792, which would be over the recommended level by more than 8,500 boats. As in the No Action Alternative, increases in boating accidents, injuries, and fatalities would be reasonably expected.

Alternative 2 would most likely require the implementation of a range of mitigation measures, such as slow zones, creation of boating activity use zones, or one-way directional travel restrictions. Restricting the use of certain types of watercraft, such as PWCs would most likely also be required. Increased boating law enforcement resources may also be required.

Under Alternative 2, recreational boating experiences and boater satisfaction would most likely be degraded. Even the implementation of mitigation measures intended to promote boating safety such as slow zones, may degrade the boating experience.

The maximum potential build out under Alternative 2 would not be reached for at least 50 years. Within a foreseeable planning time frame of 20 years, approximately 2,800 total docks would be expected on the lake. It is also assumed that the Lake Use Rate would continue to be 24 percent and that the average number of boats associated with each dock would continue to be approximately 3.3 boats per dock.

Using these estimates, the predicted condition 20 years into the future would result in approximately 9,240 boats from private boat docks. Assuming that the potential number of boats from car/trailer spaces in public recreation access points, marina slips, and from subdivision boat ramps stays similar to the existing condition, the total boat capacity in 20 years would be 12,651 boats. Under this scenario, the boating density would be 17.2 acres per boat and there would still be available capacity to issue permits for an additional 469 boat docks, or accommodate an additional 1,549 marina wet slips, or any combination that did not exceed the recommended TBC of 14,200.

As a result, this alternative would not exceed the carrying capacity for the lake within the 20-year planning time horizon (2032). Although, the carrying capacity could be exceeded in years beyond the 20-year planning horizon and a significant impact would result.

4.7.5 Alternative 3 (Recreation)

Under Alternative 3, the amount of Limited Development shoreline would increase to 367 miles compared to the No Action Alternative by converting Protected shorelines that are suitable for docks and which do not have an existing license agreement for use of the government land to Limited Development. MP land use classification maps would be revised to be consistent with the SMP shoreline allocations.

Under Alternative 3, the maximum number of docks that could be permitted would be 11,844 boat docks. Applying the current number of average boats per dock (3.3) would result in a maximum of approximately 39,085 boats.

4.7.5.1 Land-based Recreation

Alternative 3 would result in more potential boat docks than under the No Action Alternative and thus more boats and boaters would be expected to use the lake. The potential increase in use of land-based recreational facilities can be calculated with the crossover activity participation rates. **Table 4.7-4** shows the potential long-term impact to land-based recreational uses that would occur upon reaching the maximum potential build out of docks under this alternative.

Table 4.7-4. Potential Long-term Impacts to Land-based Recreation Under Alternative 3

Activity and Boating Crossover Rate	Annual Visits (Existing) ¹	Boating Crossover Participation Visits (Predicted)	Total Potential Visits
Picnicking (50%)	166,957	58,628	225,585
Camping (44%)	48,563	51,592	100,155
Hiking (33%)	N/A	N/A	N/A
Hunting (3%)	25,713	3,518	29,231
Sightseeing (1%)	700,122	1,173	701,295
Total	941,355	114,911	1,056,266

¹ - Source: USACE, Value to the Nation, 2010 data

Under Alternative 3 the lack of picnic facilities and opportunities would become more noticeably apparent. Also, the availability of campsites would be significantly impacted, during peak use periods, particularly in the month of July.

4.7.5.2 Water-based Recreation

The potential impacts to water-based recreation most likely would be significant, particularly over the long term. Alternative 3 would have the potential to exceed BAOT and TBC by nearly three times the recommended capacity limits. Boat density under Alternative 3 would be approximately 5.1 acres per boat compared to the minimum recommended boating density of 15 acres per boat, and the more commonly reported 20 to 50 acres per boat. The estimated BAOT would be 10,199 boats, which is almost three times the recommended level (3,500 BAOT). The estimated TBC of 42,496 would be three times greater than the recommended capacity of 14,200 boats.

At the very high boating densities that would potentially occur under Alternative 3, increases in boating accidents, injuries, and fatalities would be expected. Under current conditions at Eufaula Lake, 66 percent of the boating accidents occurred in Lake Areas 3 and 4, where existing boating density is nearly twice the boating density in the rest of the lake. This is a strong indication that as boating density increases, the number and frequency of boating accidents will also increase. Thus it is likely that at a boating density nearly three times greater than the existing condition, the number of accidents would be significantly greater than under the existing condition. Under the maximum build out scenario, Alternative 3 would result in almost 30 percent greater BAOT and TBC than the No Action Alternative and would be expected to result in a proportionate increase in impacts.

Alternative 3 would most likely require the implementation of a range of mitigation measures, such as slow zones, creation of boating activity use zones, or one-way directional travel restrictions. Restricting the use of certain types of watercraft, such as PWCs would most likely also be required. Increased boating law enforcement resources may also be required.

Under Alternative 3, recreational boating experiences and boater satisfaction would most likely be degraded. Even the implementation of mitigation measures intended to promote boating safety such as slow zones, may degrade the boating experience.

Under Alternative 3, the shoreline at Carlton Landing would be changed from Protected to Limited Development. This would allow for the construction of some additional private docks in association with this proposed development. However, it would not result in the grant of a lease necessary for the construction of a marina or other public recreational facilities on the shoreline. The additional private docks that could result from this change in shoreline allocation would represent an extremely minor proportion of the increase in private boat docks and boats that have been described for Alternative 3.

The maximum potential build out under Alternative 3 would not be reached for at least 85 years. As described under Alternative 2, the carrying capacity for the lake would not be exceeded within a 20-year planning time horizon because the rate of growth is assumed to be the same under all alternatives. Although, the carrying capacity could be exceeded in the years beyond a 20-year planning horizon and a significant impact would result.

4.7.6 Alternative 4 (Recreation)

Under Alternative 4, the amount of Limited Development area would increase to 479 miles compared to the No Action Alternative by converting all Protected areas that do not have an existing license agreement for use of the government land to Limited Development. MP land use classification maps would be revised to be consistent with the SMP shoreline allocations. Alternative 4 would grant a lease for a marina and other public recreational facilities along the shoreline at the proposed Carlton Landing development.

Under Alternative 4, the maximum potential number of docks that could be permitted would be 15,459 boat docks. Applying the current average number of boats per dock (3.3), would result in a maximum of approximately 51,015 boats.

4.7.6.1 Land-based Recreation

Alternative 4 would result in more potential boat docks than under the No Action Alternative and thus more boats and boaters would be expected to use the lake. The potential increase in the use of land-based recreational facilities can be calculated with crossover activity participation rates. **Table 4.7-5** shows the potential long-term impact to land-based recreational uses that would occur upon reaching the maximum potential build out of docks under this alternative.

Table 4.7-5. Potential Long-term Indirect Impacts to Land-based Recreation Under Alternative 4

Activity and Boating Crossover Rate	Annual Visits (Existing) ¹	Boating Crossover Participation Visits (Predicted)	Total Potential Visits
Picnicking (50%)	166,957	76,523	243,480
Camping (44%)	48,563	67,340	115,903
Hiking (33%)	N/A	N/A	N/A
Hunting (3%)	25,713	4,591	30,304
Sightseeing (1%)	700,122	1,530	701,652
Total	941,355	149,984	1,091,339

1 - Source: USACE, Value to the Nation, 2010 data

Under Alternative 4 the capacity of the existing picnic facilities would be exceeded and there would be a significant impact if the theoretical maximum number of docks were to be built. Also, the availability of campsites would be significantly impacted, during peak use periods, particularly in the month of July.

With the addition of new public recreational facilities at Carlton Landing, there would be additional capacity for land-based recreation. Under Alternative 4, new trails, a swimming beach, picnic sites, and campgrounds, including a group campground, would be developed. These facilities on the USACE-owned lands would be open to the general public. Alternative 4 is the only alternative under which new land-based, public recreational facilities would be developed.

However, due to limited public parking proposed at Carlton Landing, many of the shoreline facilities would not be as accessible to members of the general public as similar facilities elsewhere. Carlton Landing is designed as a walking community such that residents would arrive and park at their personal units and then walk or bike through the community to reach the shoreline facilities. This lack of public parking and relatively long distances that non-residential recreationists would need to walk to access the shoreline facilities would likely limit the use of these new recreational facilities for anyone other than residents and

their guests at Carlton Landing. Although these areas would be open to the general public, the conceptual design and layout of the proposed recreation facilities would provide minimal opportunity for use by drive-in visitors. The proposed recreation facilities would not represent a significant change in the available land-based recreational opportunities at the lake. Therefore, the potential benefit would be extremely limited.

4.7.6.2 Water-based Recreation

The potential impacts of Alternative 4 on water-based recreation would be significant, particularly over the long term. Alternative 4 would have the potential to exceed BAOT and TBC by nearly four times the recommended capacity limits. Boat density under Alternative 4 would be approximately 4.0 acres per boat compared to the minimum recommended boat density of 15 acres. The estimated BAOT would be 13,062 boats, which is nearly four times the recommended level (3,500 BAOT). The estimated TBC of 54,426 would also be nearly four times the recommended capacity of 14,200 boats.

At the very high boating densities that would potentially occur under Alternative 4, increases in boating accidents, injuries, and fatalities would be expected. Under current conditions at Eufaula Lake, 66 percent of the boating accidents occurred in Lake Areas 3 and 4, where existing boating density is nearly twice the boating density in the rest of the lake. This is a strong indication that as boating density increases, the number and frequency of boating accidents will also increase. Thus it is likely that at a boating density nearly four times greater than the existing condition, the number of accidents would be significantly greater than under the existing condition. Under the maximum build out scenario, Alternative 4 would result in almost 60 percent greater BAOT and TBC than the No Action Alternative and would be expected to result in a proportionate increase in impacts.

Alternative 4 would most likely require the implementation of a range of mitigation measures, such as slow zones, creation of boating activity use zones, or one-way directional travel restrictions. Restricting the use of certain types of watercraft, such as PWCs would most likely also be required. Increased boating law enforcement resources may also be required.

Under Alternative 4, recreational boating experiences and boater satisfaction would most likely be degraded. Even the implementation of mitigation measures intended to promote boating safety such as slow zones, may degrade the boating experience.

Under Alternative 4, the addition of a marina at Carlton Landing would have very little impact, compared to the scale of shoreline zoning changes and potential increases in the number of boat docks and boats elsewhere on the lake. The addition of a marina would likely only generate an additional 66 to 72 BAOT. Boats from the proposed marina would thus comprise less than one percent of the total maximum potential BAOT of 13,062 under this alternative.

The maximum potential build out under Alternative 4 would not be reached for at least 100 years. As described under Alternative 2, the carrying capacity for the lake would not be exceeded within a 20-year planning time horizon because the rate of growth is assumed to be the same under all alternatives. Although, the carrying capacity could be exceeded in the years beyond a 20-year planning horizon and a significant impact would result.

4.7.7 Potential Mitigation Measures (Recreation)

Once the carrying capacity of the lake is exceeded the following mitigation measures would be implemented:

- **Restricting the number of boats:** This mitigation measure would be accomplished by limiting access to the water surface, by restricting the number of boat docks, marina slips and car/trailer spaces at boat ramp parking lots. Public access points could be closed. This mitigation may be difficult to implement given the large number of private docks around the lake.
- **Zoning for certain activities:** Activity specific zoning may reduce conflicts between various types of users and reduce the potential for accidents. Zones might include:
 - Swim Zones: These are established at designated swimming beaches by sectioning off an area with floating buoys.
 - Water skiing and other activity area zones: Whether marked by buoys or indicated on a map, these zones may be used for safety purposes and to reduce activity conflicts.
 - Pass through zones: May be established along narrow waterway segments, especially those near waterfront developments, “pass through” zones and regulations can help move boat traffic more safely and reduce conflicts between recreational water activity and adjacent development. The zone serves solely as a transportation channel, prohibiting recreational activities.
 - Time or day zoning: For areas where certain water activities bring high traffic density or space limitations, especially on particular days or at particular times of the day, this type of zoning is used to help reduce conflict and competition for space. For example, on weekends, water skiing and high-speed traffic could be prohibited in coves or other areas.
 - “No Wake” Zones: This is probably the most used type of zoning and is typically applied within 100 to 300 feet of shorelines or moored vessels, fixed objects, swimmers, anglers, or water skiers.
- **Restrictions on certain types of watercraft:** This type of mitigation initiative would most likely be implemented on a time schedule basis, such as on weekends. Also, certain types of watercraft could be allowed only in certain areas of the lake, prohibited within coves, or within 100 feet of other watercraft, docks, or the shoreline.

4.8 Noise

4.8.1 Assessment Methods (Noise)

Implementation of the No Action Alternative and action alternatives could result in impacts from noise in the area of analysis. Potential impacts could result from construction of boat docks, increased levels of recreational activities on the lake, and increased development adjacent to the government lands around the lake. These potential impacts are analyzed qualitatively for each of the alternatives.

4.8.2 Significance Criteria (Noise)

The alternatives would cause adverse noise impacts if they result in long-term substantial increases in noise levels that are incompatible with existing noise types in the area of analysis or would disrupt human or wildlife activities around the lake.

4.8.3 No Action Alternative (Noise)

Under the No Action Alternative, there would be no change in the current SMP; the MP land use classification maps would not be updated; existing vegetation management policies would not change; the lease request for a public marina and public recreation facilities at Carlton Landing would not be approved; and, no action would be taken on any of the individual zoning requests received during scoping.

Under the No Action Alternative, up to 8,746 private boat docks could be constructed along the existing length of Limited Development shoreline. Applying the average number of boats per dock (3.3 boats/dock), there would be a potential future total of approximately 28,862 boats that could be on the lake at some point in the future under the No Action Alternative. These projected numbers represent the maximum possible future build-out scenario.

Noise impacts could occur during the construction of docks and/or residential development on adjacent private lands. Construction noise would be limited temporally and spatially. Construction would take place during normal construction hours, and noise would be limited to the immediate area around the construction site. Construction would also be spread out over many years; it is projected that it would take over 70 years to achieve full build out of the No Action Alternative. Impacts would not be adverse.

The potential impact of recreational boat noise on the lake includes consideration of several factors. Many shorelines slope up away from the water, placing potential receptors above the water. Sound carries further across water and may also be more noticeable to receptors located above the sound source when there are no intervening barriers. The lake setting is rural and existing noise levels are typical of rural and residential settings. Existing land uses around the lake are open space, agricultural, residential, and recreational. Future development would likely consist of these same land uses. Due to the size of Eufaula Lake, most boats are power boats of some sort, which would produce more noise than sailboats, canoes, or kayaks.

Although, the increase in the number of docks also results in a predicted increase in the potential number of boats on the lake, not all of those boats would be on the lake at one time. Boating activity varies by season; for example, early in the year, more boats are engaged in fishing which is generally quieter than other types of boating activity such as water skiing. Also, boating density varies by lake area, with Lake Areas 3 and 4 experiencing the highest levels of use. Lake Areas 3 and 4 are also where there is the greatest amount of potential development. As the level of development increases, the background noise levels increase and new noises may be less noticeable. However, it is likely that at certain times of the year and in certain portions of the lake, there would be an adverse impact due to boating activity. This potential impact is most likely to occur during the summer months and in Lake Areas 3 and 4.

4.8.4 Alternative 1 (Noise)

Alternative 1 reduces the Limited Development shoreline allocations to those areas mapped as Limited Development in the 1981 SMP; the MP land use classification maps would be updated to be consistent with the SMP shoreline allocations; the lease request for a public marina and public recreation facilities at Carlton Landing would not be approved; and, individual requests for shoreline allocations would be addressed as described in Section 2.4.3..

4.8.4.1 Direct Impacts

Under Alternative 1, only 605 new private boat docks would be allowed on the lake. Therefore, there would be minimal construction related noise as only a few docks would be under construction at any one

time and there would be little change in the existing condition. There is also capacity for additional boats to access the lake through public boat ramps, but this potential increase in use would be unlikely to result in perceptible noise impacts under Alternative 1.

Implementation of the extended vegetation management buffers on the USACE shoreline could act as a future noise buffer. Residential developments inland of the wider vegetated buffers could be buffered from noise resulting from lake recreation; although, there are too many variables of slope, vegetation density, and topography to draw general conclusions about the effectiveness of vegetation buffers at mitigating noise impacts.

4.8.4.2 Indirect Impacts

Under Alternative 1, there would be significantly fewer miles of shoreline designated as Limited Development as compared to existing conditions and few new docks would be allowed on the lake. However, there could still be additional residential development compared to existing conditions on the adjacent private lands as the lake would still provide amenities such as water views and proximity to public recreation areas. Construction of new residential areas has occurred at a rate of about three subdivisions or 123 lots per year and it would likely continue at about this rate for the foreseeable future. Residential construction noise would be limited temporally and spatially. Construction would take place during normal construction hours, and noise would be limited to the immediate area around the construction site. Thus, potential noise impacts would be negligible and would not result in an adverse impact.

4.8.5 Alternative 2 (Noise)

Under Alternative 2, the amount of Limited Development shoreline would be reduced to 182 miles as Limited Development shorelines that are unsuitable for docks and which do not have existing developments adjacent to the government lands would be converted to Protected. The MP land use classification maps would be revised to be consistent with the SMP shoreline allocations. The lease request for a public marina and public recreation facilities at Carlton Landing would not be approved. Individual zoning requests received during scoping would be addressed as described in Section 2.4.4.

4.8.5.1 Direct Impacts

Under Alternative 2, up to 5,873 private boat docks could be constructed along the proposed length of Limited Development shoreline. This would be a 33 percent decrease in the number of docks that would be allowed under the No Action Alternative. Applying the average number of boats per dock (3.3 boats/dock), there would be a potential future total of approximately 19,381 boats that could be on the lake at some point in the future under Alternative 2. These projected numbers represent the maximum possible future build-out scenario.

Noise impacts could occur during the construction of docks. Construction noise would be limited temporally and spatially. Construction would take place during normal construction hours, and noise would be limited to the immediate area around the construction site. Construction would also be spread out over many years; it is projected that it would take over 50 years to achieve full build out of Alternative 2. Impacts from construction noise would not be adverse.

The potential impact of recreational boat noise on the lake includes consideration of several factors as described under the No Action Alternative. The distribution of recreational boating activity by lake area, season, and type of activity would also likely be similar to that described under the No Action Alternative. Therefore, it is likely that at certain times of the year and in certain portions of the lake, there would be an

adverse impact due to boating activity. This potential impact is most likely to occur during the summer months and in Lake Areas 3 and 4.

Implementation of the extended vegetation management buffers on the USACE shoreline could act as a future noise buffer. Residential developments inland of the wider vegetated buffers could be buffered from noise resulting from lake recreation; although, there are too many variables of slope, vegetation density, and topography to draw general conclusions about the effectiveness of vegetation buffers at mitigating noise impacts.

4.8.5.2 Indirect Impacts

Under Alternative 2, there would be fewer miles of shoreline designated as Limited Development as compared to the No Action Alternative and fewer new docks would be allowed on the lake. However, there would still be 65 miles of shoreline available where new docks could be built and these would continue to be attractive places for new residential development. Residential construction noise would be limited temporally and spatially, with only a few new subdivisions being constructed each year. Construction would take place during normal construction hours, and noise would be limited to the immediate area around the construction site. Thus, potential noise impacts would be negligible and would not result in an adverse impact.

4.8.6 Alternative 3 (Noise)

Under Alternative 3, the amount of Limited Development shoreline would increase to 367 miles by converting Protected shorelines that are suitable for docks and which do not have an existing license agreement for use of the government land to Limited Development. MP land use classification maps would be revised to be consistent with the SMP shoreline allocations. The lease request for a public marina at Carlton Landing would not be approved, but the shoreline in this area would be changed to Limited Development. Individual zoning requests received during scoping would be addressed as described in Section 2.4.5.

4.8.6.1 Direct Impacts

Under Alternative 3, up to 11,844 private boat docks could be constructed along the proposed length of Limited Development shoreline. This would be a 35 percent increase in the number of docks that would be allowed under the No Action Alternative. Applying the average number of boats per dock (3.3 boats/dock), there would be a potential future total of approximately 39,085 boats that could be on the lake at some point in the future under Alternative 3. These projected numbers represent the maximum possible future build-out scenario.

Noise impacts could occur during the construction of docks. Construction noise would be limited temporally and spatially. Construction would take place during normal construction hours, and noise would be limited to the immediate area around the construction site. Construction would also be spread out over many years; it is projected that it would take over 85 years to achieve full build out of Alternative 3. Impacts from construction noise would not be adverse.

The potential impact of recreational boat noise on the lake includes consideration of several factors as described under the No Action Alternative. The distribution of recreational boating activity by lake area, season, and type of activity would also likely be similar to that described under the No Action Alternative. Therefore, it is likely that at certain times of the year and in certain portions of the lake, there would be an

adverse impact due to boating activity. This potential impact is most likely to occur during the summer months and in Lake Areas 3 and 4.

Implementation of the baseline vegetation management buffers on the USACE shoreline could act as a future noise buffer. Residential developments inland of these vegetated buffers could be buffered from noise resulting from lake recreation. Although there are too many variables of slope, vegetation density, and topography to draw general conclusions about the effectiveness of vegetation buffers at mitigating noise impacts it is likely that the somewhat narrower baseline buffers would not be as effective as the wider extended buffers applied under Alternatives 1 and 2.

4.8.6.2 Indirect Impacts

Under Alternative 3, there would be more miles of shoreline designated as Limited Development as compared to the No Action Alternative and more new docks would be allowed on the lake. There would be 157 additional miles of shoreline available where new docks could be built and these would be attractive places for new residential development. Residential construction noise would be limited temporally and spatially, with only a few new subdivisions being constructed each year. Construction would take place during normal construction hours, and noise would be limited to the immediate area around the construction site. Thus, potential noise impacts would be negligible and would not result in an adverse impact.

4.8.7 Alternative 4 (Noise)

Under Alternative 4, the amount of Limited Development area would increase to 479 miles compared to the No Action Alternative by converting all Protected areas that do not have an existing license agreement for use of the government land to Limited Development. MP land use classification maps would be revised to be consistent with the SMP shoreline allocations. Alternative 4 would grant a lease for a marina and other public recreational facilities along the shoreline at the proposed Carlton Landing development. Individual zoning requests received during scoping would be addressed as described in Section 2.4.6.

4.8.7.1 Direct Impacts

Under Alternative 4, up to 15,459 private boat docks could be constructed along the proposed length of Limited Development shoreline. This would be a 77 percent increase in the number of docks that would be allowed under the No Action Alternative. Applying the average number of boats per dock (3.3 boats/dock), there would be a potential future total of approximately 51,015 boats that could be on the lake at some point in the future under Alternative 4. These projected numbers represent the maximum possible future build-out scenario.

Noise impacts could occur during the construction of docks. Construction noise would be limited temporally and spatially. Construction would take place during normal construction hours, and noise would be limited to the immediate area around the construction site. Construction would also be spread out over many years; it is projected that it would take almost 100 years to achieve full build out of Alternative 4. Impacts from construction noise would not be adverse.

The potential impact of recreational boat noise on the lake includes consideration of several factors as described under the No Action Alternative. The distribution of recreational boating activity by lake area, season, and type of activity would also likely be similar to that described under the No Action Alternative. Therefore, it is likely that at certain times of the year and in certain portions of the lake, there would be an

adverse impact due to boating activity. This potential impact is most likely to occur during the summer months and in Lake Areas 3 and 4.

Implementation of the baseline vegetation management buffers on the USACE shoreline could act as a future noise buffer. Residential developments inland of these vegetated buffers could be buffered from noise resulting from lake recreation. Although there are too many variables of slope, vegetation density, and topography to draw general conclusions about the effectiveness of vegetation buffers at mitigating noise impacts it is likely that the somewhat narrower baseline buffers would not be as effective as the wider extended buffers applied under Alternatives 1 and 2.

Full build-out at Carlton Landing would include 2,570 residential lots, a K-12 school, an organic farm, a town center, community pools, public open spaces, and a conference center. Under Alternative 4, there would be full build-out of proposed recreational facilities and uses along the shoreline, including a 275 to 300 slip marina. Residential lots would be expected to be constructed over a 25 to 30 year timeframe and construction noise would be negligible. The marina is proposed to begin operations in 2014. The marina would represent a new and ongoing source of noise that would be different from the rural residential character of the shoreline. However, the marina would be constructed in a sheltered cove and noise impacts would likely not extend to the north or south due to the sound attenuation afforded by the immediate topography. There could be a noise impact on the shoreline immediately across Longtown Arm from the marina, but this area is currently undeveloped and is owned by the Carlton Landing project proponents.

There would be increased boat traffic moving up and down Longtown Arm which could affect residential receptors along the length of the Arm. However, boat traffic is predicted to increase significantly on the water under Alternative 4, and the operation of the marina would not be likely to contribute significantly to noise from boat traffic. Therefore, noise impacts from development at Carlton Landing would not be adverse.

4.8.7.2 Indirect Impacts

Under Alternative 4, there would be more miles of shoreline designated as Limited Development as compared to the No Action Alternative and more new docks would be allowed on the lake. There would be 213 additional miles of shoreline available where new docks could be built and these would be attractive places for new residential development. Residential construction noise would be limited temporally and spatially, with only a few new subdivisions being constructed each year. Construction would take place during normal construction hours, and noise would be limited to the immediate area around the construction site. Thus, potential noise impacts would be negligible and would not result in an adverse impact.

4.8.8 Potential Mitigation Measures (Noise)

Increased boat activity on the lake could result in adverse noise impacts. This effect is most likely to occur in Lake Areas 3 and 4 during the summer months under the No Action Alternative, and Alternatives 2, 3 and 4 where the recommended boat capacity of the lake would be exceeded. In areas where boating activity is concentrated under these alternatives, the implementation of no wake zones close to sensitive receptors, such as campgrounds and residential developments, may help mitigate potential noise impacts. In addition, the vegetation buffers may also help mitigate some of the potential noise impacts in some locations.

4.9 Transportation

4.9.1 Assessment Methods (Transportation)

Transportation impacts under the No Action Alternative and action alternatives are analyzed qualitatively based on potential increases in recreation visitation and residential development in the area of analysis. Changes in shoreline allocations, land use classifications, and vegetation management policies would not directly result in changes to traffic; however, changes in development potentials under the alternatives could result in different patterns of future residential development.

4.9.2 Significance Criteria (Transportation)

Transportation impacts would be considered adverse if the action alternatives result in an adverse impact on the physical conditions or traffic flow of roads within the area of analysis.

4.9.3 No Action Alternative (Transportation)

Under the No Action Alternative, there would be no change to the existing distribution of shoreline allocations and the MP land use classification maps would not be updated.

As described in Section 3.9, existing county and public local roads around the lake are two-lane roads, many of which are unpaved. Increases in vehicle traffic could impact the condition of these roads. Detrimental impacts on roadway conditions would be an adverse effect that would have to be addressed by road improvements.

Under the No Action Alternative, the number of private boat docks could increase to 8,746 total docks. Each dock would be associated with at least one lot on adjacent residential land. This would give an estimate of the number of new homes and is an indicator of the potential increase in traffic on area roads that could occur. This predicted full build out condition would likely take over 70 years to achieve under the No Action Alternative.

Another way to measure potential changes in traffic associated with residential development is to consider subdivision development rates. There is an average of three new subdivisions per year in the six county region around Eufaula Lake. These subdivisions have an average total of approximately 123 lots and most of them have been located close to the lake. It is assumed that this level of residential development would continue into the future. This amount of residential development also corresponds closely to the predicted rate of private dock construction.

Under existing conditions, there are no traffic congestion issues in the region. While there are some roadway sufficiency issues with small, unpaved local roads, new subdivisions are required to maintain their access roads. The predicted residential development would not occur all at once, but would be gradual and predictable. Thus, if repairs or updates are needed to accommodate increases in traffic, state and county transportation agencies would be able to plan for necessary repairs and improvements. Therefore, there would be no adverse impacts on regional transportation networks under the No Action Alternative.

Under the No Action Alternative, the proposed Carlton Landing development request for a change in the shoreline designation would not be approved by USACE and the request for a lease for construction of a marina and other public recreation facilities on the shoreline would not be granted. Thus, under the No Action Alternative, approximately 170 residential lots would be developed into a mix of single family and multifamily residential. There could be over 300 units developed under the No Action Alternative. This

development would take place over the next two to five years. Regional roadways would not be adversely affected by this amount of development.

4.9.4 Alternative 1 (Transportation)

Under Alternative 1, Limited Development shoreline allocations would be reduced to only those areas that were mapped as Limited Development in the 1981 SMP and MP land classifications would be changed to be consistent with the shoreline allocations.

Under Alternative 1, only 605 new docks would be allowed to be constructed. In addition to residential development associated with these new docks, there could also be some additional residential development on lands adjacent to the government lands around the lake, compared to existing conditions, as the lake would still provide amenities such as water views and proximity to public recreation areas.

Under existing conditions, there are no traffic problems in the region. While there are some issues with small, unpaved local roads, new subdivisions are required to maintain their access roads. New residential development would not occur all at once, but would be gradual and predictable. Thus, if repairs or updates are needed to accommodate increases in traffic, state and county transportation agencies would be able to plan for necessary repairs and improvements. Therefore, there would be no adverse impacts on regional transportation networks under Alternative 1.

Under Alternative 1, the proposed Carlton Landing development request for a change in the shoreline designation would not be approved by USACE and the request for a lease for construction of a marina and other public recreation facilities on the shoreline would not be granted. Thus, there could be over 300 units on 170 lots developed under Alternative 1. This development would take place over the next two to five years. Regional roadways would not be adversely affected by this amount of development.

4.9.5 Alternative 2 (Transportation)

Under Alternative 2, the amount of Limited Development shoreline would be reduced to 182 miles as Limited Development shorelines that are unsuitable for docks and which do not have existing developments adjacent to the government lands would be converted to Protected. The MP land use classification maps would be revised to be consistent with the SMP shoreline allocations. The lease request for a public marina and public recreation facilities at Carlton Landing would not be approved.

Under Alternative 2, up to 5,873 private boat docks could be constructed along the proposed length of Limited Development shoreline. This would be a 33 percent decrease in the number of docks that would be allowed under the No Action Alternative. Each dock would be associated with at least one lot on adjacent residential land. This would give an estimate of the number of new homes and is an indicator of the potential increase in traffic on area roads that could occur. This predicted level of growth is similar to the amount of residential development that would be estimated to occur based on the average number of subdivisions that are built in the region. This predicted full build out condition would likely take over 50 years to achieve under Alternative 2.

Under existing conditions, there are no traffic problems in the region. The predicted residential development would not occur all at once, but would be gradual and predictable. Thus, if repairs or updates are needed to accommodate increases in traffic, state and county transportation agencies would be able to plan for necessary repairs and improvements. Therefore, there would be no adverse impacts on regional transportation networks under Alternative 2.

Under Alternative 2, the proposed Carlton Landing development request for a change in the shoreline designation would not be approved by USACE and the request for a lease for construction of a marina and other public recreation facilities on the shoreline would not be granted. Thus, there could be over 300 units on 170 lots developed under Alternative 2. This development would take place over the next two to five years. Regional roadways would not be adversely affected by this amount of development.

4.9.6 Alternative 3 (Transportation)

Under Alternative 3, the amount of Limited Development shoreline would increase to 367 miles by converting Protected shorelines that are suitable for docks and which do not have an existing license agreement for use of the government land to Limited Development. MP land use classification maps would be revised to be consistent with the SMP shoreline allocations. The lease request for a public marina at Carlton Landing would not be approved, but the shoreline in this area would be changed to Limited Development.

Under Alternative 3, up to 11,844 private boat docks could be constructed along the proposed length of Limited Development shoreline. This would be a 35 percent increase in the number of docks that would be allowed under the No Action Alternative. The number of private docks at full build out would give an estimate of the potential minimum number of new homes in the area and would be an indicator of the potential increase in traffic on area roads that could occur. This predicted level of growth is similar to the amount of residential development that would be estimated to occur based on the average number of subdivisions that are built in the region. This predicted full build out condition would likely take over 85 years to achieve under Alternative 3.

Under existing conditions, there are no traffic problems in the region. The predicted residential development would not occur all at once, but would be gradual and predictable. Thus, if repairs or updates are needed to accommodate increases in traffic, state and county transportation agencies would be able to plan for necessary repairs and improvements. Therefore, there would be no adverse impacts on regional transportation networks under Alternative 3.

Under Alternative 3, the expected development at Carlton Landing would be the same as described for the No Action Alternative and Alternatives 1 and 2. Regional roadways would not be adversely affected by this amount of development.

4.9.7 Alternative 4 (Transportation)

Under Alternative 4, the amount of Limited Development area would increase to 479 miles compared to the No Action Alternative by converting all Protected areas that do not have an existing license agreement for use of the government land to Limited Development. MP land use classification maps would be revised to be consistent with the SMP shoreline allocations. Alternative 4 would grant a lease for a marina and other public recreational facilities along the shoreline at the proposed Carlton Landing development.

Under Alternative 4, up to 15,459 private boat docks could be constructed along the proposed length of Limited Development shoreline. This would be a 77 percent increase in the number of docks that would be allowed under the No Action Alternative. The number of private docks at full build out gives an estimate of the potential minimum number of new homes in the area and would be an indicator of the potential increase in traffic on area roads that could occur. This predicted level of growth is greater than the amount of residential development that would be estimated to occur based on the average number of subdivisions that are built in the region. However, this predicted full build out condition would likely take over 100

years to achieve under Alternative 4, and growth rate predictions over this timeframe would be somewhat unreliable.

Under existing conditions, there are no traffic problems in the region. Although the total potential growth in private docks and associated residential development would represent a significant change compared to the No Action Alternative, this growth would be gradual and relatively predictable over capital budget planning horizons. Thus, if repairs or updates are needed to accommodate increases in traffic, state and county transportation agencies would be able to plan for necessary repairs and improvements. Therefore, there would be no adverse impacts on regional transportation networks under Alternative 4.

Full build-out at Carlton Landing would include 2,570 residential lots, a K-12 school, an organic farm, a town center, community pools, public open spaces, and a conference center. Under Alternative 4, there would be full build-out of proposed recreational facilities and uses along the shoreline, including a 275 to 300 slip marina. Residential lots would be expected to be constructed over a 25 to 30 year timeframe. The marina is proposed to begin operations in 2014.

There have been no traffic studies conducted to date that evaluate the potential effects of full build out of Carlton Landing on the regional road network. However, based on the number of residential units proposed and the fact that there would be a mix of permanent and recreational residents, a conservative estimate of vehicle trip generation might be 10 trips per day per unit. This would generate over 25,000 trips per day from the development which accesses Highway 9A at a single point. Typically, a two-lane rural highway might be able to handle approximately 15,000 trips per day. Assuming that half of the trips turn south and that half turn north upon leaving Carlton Landing, the number of trips per day that would be added to the highway would be likely to generate total traffic volumes that are close to or over the threshold where improvement to a four-lane roadway would be needed. If more trips go in one direction, or if there are peak use periods, the need for significant roadway improvements would be more likely. At a minimum, highway improvements to provide channelized turn lanes and a signal would likely be required. It is possible that needed roadway improvements could also include expansion to four lanes north to Highway 9 and interchange improvements at the intersection of Highway 9 and 9A.

The potential for adverse impacts on the existing roadway network would depend on many factors including the mix of residential units, the development of commercial and retail amenities within the development, the mix of permanent vs. recreational residents, the age and life-stage of the residents, and trip distribution patterns (*e.g.* the percentage of trips that go to Eufaula vs. McAlester). These issues would need to be studied by the Carlton Landing developer and coordinated with Pittsburg County and ODOT.

4.9.8 Potential Mitigation Measures (Transportation)

There would be the potential for adverse impacts related to Carlton Landing. Traffic studies should be conducted to determine the type and extent of needed roadway improvements. These studies and any subsequent roadway improvements would be coordinated between the developer, the county, and ODOT.

4.10 Public Lands and Access

This section describes potential impacts related to public lands and access for each of the alternatives. Potential impacts are assessed qualitatively based on the potential for future changes in recreational use levels under the No Action Alternative and action alternatives. Changes in vegetation management policies

would not result in impacts on public lands and access; however, changes in shoreline allocations and related changes in recreational demand under each of the alternatives could result in effects on public lands and access.

4.10.1 Assessment Methods (Public Lands and Access)

The method for assessing potential impacts involved reviewing available information describing the existing conditions with respect to public lands and access and then identifying direct and indirect impacts in consideration of the regulatory setting and the significance criteria presented in the next section.

4.10.2 Significance Criteria (Public Lands and Access)

Potential impacts on public lands and access would be considered significant if they would result in the following:

- Restriction of public access to the lake through the loss or alteration of public recreation areas along the shoreline;
- Restriction of access for disabled persons to public recreation areas; or
- Recreational demand exceeds capacity of public recreational facilities.

4.10.3 No Action Alternative (Public Lands and Access)

Under the No Action Alternative, the existing shoreline allocations, land use classifications, and vegetation management policies at Eufaula Lake would not change. The lease request for a public marina and other public recreational facilities at Carlton Landing would not be approved, and individual requests to change shoreline allocations would not be approved.

4.10.3.1 Potential Impacts

Under the No Action Alternative, the number of private boat docks could increase to 8,746 total docks. These new docks would increase the opportunities for dispersed use recreation and increase access to the lake and surrounding public lands for the public. This predicted full build out condition would likely take over 70 years to achieve under the No Action Alternative.

In addition to increased boating access, the increase in the number of private docks would be expected to increase use of land-based recreational areas, as described in Section 3.7. Under the No Action Alternative, the increase in use of land-based facilities attributable to boating crossover would not be expected to exceed the capacity of the existing facilities. Public recreation areas would also continue to provide the required access for disabled persons. Therefore, direct impacts on public lands and access under the No Action Alternative would not be significant.

As there would be no shoreline development at the proposed Carlton Landing development under the No Action Alternative, there would be no effect on public lands and access.

4.10.4 Alternative 1 (Public Lands and Access)

Under Alternative 1, the existing shoreline allocations of Limited Development would be reduced to those areas that were mapped as Limited Development in the 1981 SMP; the MP land use classification maps would be revised to be consistent with the SMP; and the lease request for a public marina and other public recreational facilities at Carlton Landing would not be approved.

Under Alternative 1, only 605 new docks would be allowed to be constructed. However, existing docks would be grandfathered and allowed to remain. Therefore, there would be minimal change in existing levels of access to the lake.

As compared to the No Action Alternative, the increase in Protected shorelines might result in an increase in hunting access on public lands, while the reduction in Limited Development shoreline would result in a decrease in potential boating access through dispersed use recreation originating from private boat docks.

Proposed development at Carlton Landing would be the same as described under the No Action Alternative and there would be no effect on public lands and access.

4.10.5 Alternative 2 (Public Lands and Access)

Under Alternative 2, the amount of Limited Development shoreline would be reduced to 182 miles as Limited Development shorelines that are unsuitable for docks and which do not have existing developments adjacent to the government lands would be converted to Protected. The MP land use classification maps would be revised to be consistent with the SMP shoreline allocations. The lease request for a public marina and public recreation facilities at Carlton Landing would not be approved.

Under Alternative 2, the potential number of private boat docks would be reduced to 5,873. Compared to the existing condition, this would be an increase in the number of new docks, which would increase the opportunities for dispersed use recreation and increase access to the lake and surrounding public lands for the public. However, it would be a 33 percent decrease in the number of docks that would be allowed under the No Action Alternative.

In addition to increased boating access, the growth in the number of private docks would be expected to increase use of land-based recreational areas, as described in Section 3.7. Under Alternative 2, the increase in use of land-based facilities attributable to boating crossover would not be expected to exceed the capacity of the existing facilities. Public recreation areas would also continue to provide the required access for disabled persons. Therefore, direct impacts on public lands and access under Alternative 2 would not be significant.

As there would be no shoreline development at the proposed Carlton Landing development under Alternative 2, there would be no effect on public lands and access.

4.10.6 Alternative 3 (Public Lands and Access)

Under Alternative 3, the amount of Limited Development shoreline would increase to 367 miles by converting Protected shorelines that are suitable for docks and which do not have an existing license agreement for use of the government land to Limited Development. MP land use classification maps would be revised to be consistent with the SMP shoreline allocations. The lease request for a public marina at Carlton Landing would not be approved, but the shoreline in this area would be changed to Limited Development.

Under Alternative 3, up to 11,844 private boat docks could be constructed along the proposed length of Limited Development shoreline. This would be a 35 percent increase in the number of docks that would be allowed under the No Action Alternative, which would increase opportunities for dispersed use recreation and increase access to the lake and surrounding public lands for the public.

In addition to increased boating access, the growth in the number of private docks would be expected to increase use of land-based recreational areas, as described in Section 3.7. Under Alternative 3, the increase in use of land-based facilities attributable to boating crossover would not be expected to exceed the capacity of the existing facilities. Public recreation areas would also continue to provide the required access for disabled persons. Therefore, direct impacts on public lands and access under Alternative 3 would not be significant.

As there would be no shoreline development at the proposed Carlton Landing development under Alternative 3, there would be no effect on public lands and access.

4.10.7 Alternative 4 (Public Lands and Access)

Under Alternative 4, the amount of Limited Development area would increase to 479 miles compared to the No Action Alternative by converting all Protected areas that do not have an existing license agreement for use of the government land to Limited Development. MP land use classification maps would be revised to be consistent with the SMP shoreline allocations. Alternative 4 would grant a lease for a marina and other public recreational facilities along the shoreline at the proposed Carlton Landing development.

Under Alternative 4, up to 15,459 private boat docks could be constructed along the proposed length of Limited Development shoreline. This would be a 77 percent increase in the number of docks that would be allowed under the No Action Alternative, which would increase opportunities for dispersed use recreation and increase access to the lake and surrounding public lands for the public.

In addition to increased boating access, the growth in the number of private docks would be expected to increase use of land-based recreational areas, as described in Section 3.7. Under Alternative 4, the increase in use of land-based facilities attributable to boating crossover would exceed the capacity of the some types of existing facilities such as picnic sites. This would likely result in people not being able to access public lands or facilities or choosing to go elsewhere due to overcrowding. Facilities designed to accommodate persons with disabilities would be more likely to be used by non-disabled recreationists and thus overall access for persons with disabilities would likely be reduced. Therefore, there would be an impact on public lands and access under Alternative 4 if the theoretical maximum number of docks were constructed.

Within a reasonably foreseeable planning horizon of 20 years, the potential number of new docks would not result in boating crossover levels that would exceed the capacity of existing land-based recreational facilities. Therefore, there would be no impact on public lands and access within 20 years under Alternative 4.

Full build-out of the proposed Carlton Landing development would include construction of the proposed recreational facilities and uses along the shoreline, including a 275 to 300 slip marina. The marina is proposed to begin operations in 2014. Development at Carlton Landing under Alternative 4 would increase access to the lake and to public lands along the lakeshore, and thus result in a beneficial effect. However, this effect would not be sufficient to offset the potential for overcrowding that could occur from the effects of boating crossover recreation on land-based recreation facilities.

4.10.8 Potential Mitigation Measures (Public Lands and Access)

Mitigation measures would not be required for Alternatives 1, 2, or 3. Under Alternative 4, the capacity of existing land-based recreational facilities could be exceeded and reduce access. Mitigation measures might

include the construction of new facilities or the restriction of boating access. However, capacity would not be exceeded for over 20 years.

4.11 Socioeconomics and Demographics

4.11.1 Assessment Methods (Socioeconomics and Demographics)

The 2010 U.S. Census Bureau socioeconomic and demographic statistics for the study area were compiled and analyzed. The proposed alternatives were evaluated to determine if the significance criteria were exceeded.

The other social factors of health and safety, economic vitality, social connectedness, identity, vulnerability and resiliency are considered in the section. Children's health and safety is considered in this section. General public safety on Eufaula Lake is considered under Section 3.7, Recreation, as is the social factor of leisure and recreation. Economic vitality is related to housing, employment and, at Eufaula Lake, to the value of recreation at the Lake to the local economy. The demographic information presented in Section 3.11 informs the public outreach efforts to ensure that potential barriers to participation in the planning process are addressed. Public participation measures are described in Chapter 7.

4.11.2 Significance Criteria (Socioeconomics and Demographics)

Socioeconomic and demographic impacts are considered significant when there is a substantial change in population, housing, employment, education, and children's health and safety characteristics that deviates from projected trends without the proposed action.

4.11.3 No Action Alternative (Socioeconomics and Demographics)

4.11.3.1 Potential Impacts

Under the No Action Alternative, the existing shoreline allocations, land use classifications, and vegetation management policies at Eufaula Lake would not change. The lease request for a public marina and other public recreational facilities at Carlton Landing would not be approved, and individual requests to change shoreline allocations would not be approved. There would be no change from the current management direction or level of management intensity.

Dock construction and shoreline vegetation management would not affect socioeconomics or demographics. However, boating and other recreation would contribute to the recreation economy of the region. For all types of recreation at Eufaula Lake, the annual economic impact is currently estimated to be \$56,496,600 (Appendix E). It is difficult to break out economic impacts based upon type of recreation activity because there is significant crossover recreation among recreation activities. However, according to visitation data provided by USACE, approximately 59 percent of the annual visits to Eufaula Lake are attributable to land-based recreation activities. Therefore, approximately 40 percent of the annual recreational economic impact could be attributed to boating. The existing marinas and public and private boat ramps contribute 3,411 boats to the existing total boats at the lake. The existing private docks contribute 5,523 boats to the total boats at the lake (Appendix E). Therefore, the existing private docks could be said to contribute 62 percent of the economic impact of the boating value, or approximately \$14 million per year.

Assuming that other recreational opportunities stay constant, the alternatives vary only by the number of private boat docks that might be added to the lake. Under full build out of the No Action Alternative, up to 8,746 private boat docks could be constructed. This could contribute up to four times the current economic value, or approximately \$56 million per year to the regional economy. However, it is unlikely that this total benefit would be realized because the boating capacity of the lake would be exceeded at full build out under the No Action Alternative, which would degrade the recreational experience to the point where many people would be likely to make other recreational choices (Section 4.7). Within a reasonably foreseeable planning horizon of 20 years, the number of private boats could total 2800, which would result in a potential economic impact from boating of over \$23 million per year without exceeding the carrying capacity of the lake.

Under this alternative, the Carlton Landing development would likely be limited to the construction of approximately 170 lots representing approximately 300 residential units. The developers for Carlton Landing expect an average single family home value for the first phase of the development of \$386,052 within five years of build-out, which is more than five times greater than the current average home value of \$71,200 within the study area census tracts. Though 170 lots is a relatively small number, these homes would serve to raise, at least slightly, the average property values of the area. In addition, the development is marketed to older singles or couples with college-aged or adult children, retirees, dual-income family households, and younger singles and childless couples. Such individuals who can afford a more expensive than average home would likely increase the median income of the study area.

Additionally, the National Association of Home Builders estimates that three jobs are created for each home that is constructed (National Association of Home Builders 2012). The proposed development would potentially create 420 jobs, thereby possibly lowering the local unemployment rate. Thus, implementation of the No Action Alternative is anticipated to result in direct beneficial impacts.

As described in Section 3.9 in Appendix H, under the No Action Alternative, new residential development would be expected adjacent to USACE lands where new private docks would be permitted. The predicted full build out condition would result in an approximate 10 percent increase in population and would likely take over 70 years to achieve under the No Action Alternative. The projected increase over a more reasonably foreseeable planning horizon of 20 years would be expected to be a 3 percent increase, which is within the expected range of growth for the region. Therefore, no indirect adverse impacts are anticipated under the No Action Alternative.

4.11.4 Alternative 1 (Socioeconomics and Demographics)

4.11.4.1 Direct Impacts

Under Alternative 1, the existing shoreline allocations of Limited Development would be reduced to those areas that were mapped as Limited Development in the 1981 SMP; the MP land use classification maps would be revised to be consistent with the SMP; and the lease request for a public marina and other public recreational facilities at Carlton Landing would not be approved.

Potential effects would be similar to those described under the No Action Alternative and would not result in changes to the social and demographic characteristics of the study area. However, since few new private docks would be permitted, there would be only minimal change in the existing level of economic benefit from recreation in the region.

Potential effects of the proposed Carlton Landing development under Alternative 1 would be similar to those described for the No Action Alternative and there would be no adverse impact on the social, economic, and demographic characteristics of the study area.

4.11.4.2 Indirect Impacts

Under Alternative 1, only 605 new docks would be allowed to be constructed. In addition to residential development associated with these new docks, there could also be some additional residential development on lands adjacent to the government lands around the lake, compared to existing conditions, as the lake would still provide amenities such as water views and proximity to public recreation areas.

As described in Section 3.9 of Appendix H, the projected growth rate would be somewhat less than the existing condition; therefore, no indirect adverse impacts are anticipated under Alternative 1.

4.11.5 Alternative 2 (Socioeconomics and Demographics)

4.11.5.1 Direct Impacts

Under Alternative 2, the amount of Limited Development shoreline would be reduced to 182 miles as Limited Development shorelines that are unsuitable for docks and which do not have existing developments adjacent to the government lands would be converted to Protected. The MP land use classification maps would be revised to be consistent with the SMP shoreline allocations. The lease request for a public marina and public recreation facilities at Carlton Landing would not be approved.

Potential effects would be similar to those described under the No Action Alternative. Under full build out of Alternative 2, up to 5,873 private boat docks could be constructed. This could contribute up to 2.5 times the current economic value, or approximately \$35 million per year to the regional economy. However, it is unlikely that this total benefit would be realized because the boating capacity of the lake would be exceeded at full build out under Alternative 2, which would degrade the recreational experience to the point where many people would be likely to make other recreational choices (Section 4.7). Within a reasonably foreseeable planning horizon of 20 years, the number of private boats could total 2800, which would result in a potential economic impact from boating of over \$23 million per year without exceeding the carrying capacity of the lake.

Potential effects of the proposed Carlton Landing development under Alternative 2 would be similar to those described for the No Action Alternative and there would be no impact on the social, economic and demographic characteristics of the study area. Under Alternative 2, the proposed Carlton Landing development would result in direct beneficial impacts.

4.11.5.2 Indirect Impacts

As described in Section 3.9 of Appendix H, under Alternative 2, new residential development would be expected adjacent to USACE lands where new private docks would be permitted. The predicted full build out condition would result in an approximate 7 percent increase in population and would likely take over 50 years to achieve under Alternative 2. The projected increase over a more reasonably foreseeable planning horizon of 20 years would be expected to be a 3 percent increase, which is within the expected range of growth for the region. Therefore, no indirect adverse impacts are anticipated under Alternative 2.

4.11.6 Alternative 3 (Socioeconomics and Demographics)

4.11.6.1 Direct Impacts

Under Alternative 3, the amount of Limited Development shoreline would increase to 367 miles by converting Protected shorelines that are suitable for docks and which do not have an existing license agreement for use of the government land to Limited Development. MP land use classification maps would be revised to be consistent with the SMP shoreline allocations. The lease request for a public marina at Carlton Landing would not be approved, but the shoreline in this area would be changed to Limited Development.

Potential effects would be similar to those described under the No Action Alternative. Under full build out of Alternative 3, up to 11,844 private boat docks could be constructed. This could contribute up to six times the current economic value, or approximately \$84 million per year to the regional economy. However, it is unlikely that this total benefit would be realized because the boating capacity of the lake would be exceeded at full build out under Alternative 3, which would degrade the recreational experience to the point where many people would be likely to make other recreational choices (Section 4.7). Within a reasonably foreseeable planning horizon of 20 years, the number of private boats could total 2800, which would result in a potential economic impact from boating of over \$23 million per year without exceeding the carrying capacity of the lake.

Potential effects of the proposed Carlton Landing development under Alternative 3 would be similar to those described for the No Action Alternative and there would be no impact on the social, economic and demographic characteristics of the study area. Under Alternative 3, the proposed Carlton Landing development would result in direct beneficial impacts.

4.11.6.2 Indirect Impacts

As described in Section 3.9 of Appendix H, under Alternative 3, new residential development would be expected adjacent to USACE lands where new private docks would be permitted. The predicted full build out condition would result in an approximate 15 percent increase in population and would likely take over 85 years to achieve under Alternative 3. The projected increase over a more reasonably foreseeable planning horizon of 20 years would be expected to be a 3 percent increase, which is within the expected range of growth for the region. Therefore, no indirect adverse impacts are anticipated under Alternative 3.

4.11.7 Alternative 4 (Socioeconomics and Demographics)

4.11.7.1 Direct Impacts

Under Alternative 4, the amount of Limited Development area would increase to 479 miles compared to the No Action Alternative by converting all Protected areas that do not have an existing license agreement for use of the government land to Limited Development. MP land use classification maps would be revised to be consistent with the SMP shoreline allocations. Alternative 4 would grant a lease for a marina and other public recreational facilities along the shoreline at the proposed Carlton Landing development.

Potential effects would be similar to those described under the No Action Alternative. Under full build out of Alternative 4, up to 15,459 private boat docks could be constructed. This could contribute up to eight times the current economic value, or approximately \$112 million per year to the regional economy. However, it is unlikely that this total benefit would be realized because the boating capacity of the lake would be exceeded at full build out under Alternative 4, which would degrade the recreational experience to the point where many people would be likely to make other recreational choices (Section 4.7). Within a

reasonably foreseeable planning horizon of 20 years, the number of private boats could total 2800, which would result in a potential economic impact from boating of over \$23 million per year without exceeding the carrying capacity of the lake.

Full build-out at Carlton Landing would include 2,570 residential units representing a mix of single family and multifamily housing. The proposed development would also include a K-12 school, an organic farm, a town center, community pools, public open spaces, and a conference center. Under Alternative 4, there would be full build-out of proposed recreational facilities and uses along the shoreline, including a 275 to 300 slip marina. Residential units would be expected to be constructed over a 25 to 30 year timeframe. The marina is proposed to begin operations in 2014.

The full construction of the proposed Carlton Landing development, 2,570 homes over the next 30 years, would result in even greater positive social, economic and demographic impacts than those described under the No Action Alternative.

4.11.7.2 Indirect Impacts

As described in Section 3.9 of Appendix H, under Alternative 4, new residential development would be expected adjacent to USACE lands where new private docks would be permitted. The predicted full build out condition would result in an approximate 19 percent increase in population and would likely take over 100 years to achieve under Alternative 4. The projected increase over a more reasonably foreseeable planning horizon of 20 years would be expected to be a 3 percent increase, which is within the expected range of growth for the region. Therefore, no indirect adverse impacts are anticipated under Alternative 4.

4.11.8 Potential Mitigation Measures (Socioeconomics and Demographics)

No mitigation would be necessary.

4.12 Summary of Potential Impacts by Alternative

Table 4.12-1 summarizes the potential impacts by alternative. Alternatives are compared to the No Action Alternative. The potential revisions to the SMP, supplement to the MP land classification maps, and actions on the request for a lease of government land at Carlton Landing and the individual zoning requests were found to have minimal to no effect on several of the resource areas analyzed and there were minimal differences between the potential effects under each alternative. These resource areas are listed below and are not included in **Table 4.12-1**. The detailed analysis of these resources is located in Appendix H.

- Agricultural Lands
- Air Quality
- Climate Change and Greenhouse Gas Emissions
- Water Supply, Flood Storage, and Operation
- Hazardous Materials
- Cultural and Historic Resources
- Navigation
- Energy
- Land Use Compatibility
- Public Infrastructure and Utilities

- Social Services and Community Facilities
- Environmental Justice

Although there were no significant effects identified related to socioeconomics and demographics, issues were raised during scoping related to socioeconomic concerns and the analysis of the topic was retained in Chapter 4. However, because no significant issues were identified the resource category is not included in **Table 4.12-1**.

Resource categories with potentially significant direct, indirect, and/or cumulative impacts under one or more alternatives are listed below and are summarized in **Table 4.12-1**.

- Vegetation, Wetlands, and Aquatic Habitats
- Fish and Wildlife
- Water Quality
- Geology, Soils, and Mineral Resources
- Aesthetics and Visual Resources
- Recreation
- Noise
- Transportation
- Public Lands and Access

Table 4.12-1. Summary of Impacts by Alternative

Resource Category	No Action	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Unavoidable Impacts
Vegetation, Wetlands, and Aquatic Habitats	Loss of terrestrial vegetation types, especially forest cover due to increase in potential development and recreation; potential for disruption of natural hydrology, increase in sediment and nutrient input; introduction and dispersal of invasive species; and/or impact existing populations of rare, unique and imperiled vegetation.	None – beneficial effect	Not significant	Loss of terrestrial vegetation types, especially forest cover due to increase in potential development and recreation; potential for disruption of natural hydrology, increase in sediment and nutrient input; introduction and dispersal of invasive species; and/or impact existing populations of rare, unique and imperiled vegetation.	Loss of terrestrial vegetation types, especially forest cover due to increase in potential development and recreation; potential for disruption of natural hydrology, increase in sediment and nutrient input; introduction and dispersal of invasive species; and/or impact existing populations of rare, unique and imperiled vegetation.	Loss of terrestrial habitats on adjacent private lands would be significant under Alternatives 3 and 4. See Section 4.1.7 for potential mitigation measures.

Resource Category	No Action	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Unavoidable Impacts
Fish and Wildlife	Not significant	None – beneficial effect	Not significant	Loss of terrestrial and aquatic habitat due to increased potential development and recreation.	Loss of terrestrial and aquatic habitat due to increased potential development and recreation. Adverse impact on American burying beetle at Carlton Landing.	Alternatives 3 and 4: Loss of terrestrial habitats on adjacent private lands would be significant. See Section 4.2.7 for potential mitigation measures.
Water Quality	Increases in development and recreation within existing land use designations would continue to degrade water quality through erosion, nutrient transport, and decreased dissolved oxygen	None – potential pollutant loading reduced	None – potential pollutant loading reduced	Pollutant loads would increase due to increased potential levels of development and recreation; potential for further degradation of water quality through increased erosion, nutrient transport, and turbidity.	Pollutant loads would increase due to increased potential levels of development and recreation; potential for further degradation of water quality through increased erosion, nutrient transport, and turbidity. Additional potential for increased pollutant loading from shoreline recreational development and use at Carlton Landing.	Mitigation measures would be required. Vegetation buffers provide some mitigation. See Section 4.3.8 for potential mitigation measures.

Resource Category	No Action	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Unavoidable Impacts
Geology, Soils, and Mineral Resources	Potential for erosion and soil loss due to increased development and recreational use.	Not significant	Potential for erosion and soil loss due to increased development and recreational use.	Potential for erosion and soil loss due to increased development and recreational use.	Potential for erosion and soil loss due to increased development and recreational use.	See Section 4.4.8 for potential mitigation measures. Vegetation buffers provide some mitigation.
Aesthetics and Visual Resources	Not significant	Not significant	Not significant	Visual Impact Assessment Rating “unacceptable” due to loss of forest cover.	Visual Impact Assessment Rating “unacceptable” due to loss of forest cover.	Available mitigation measures would not completely address impacts. See Section 4.5.10 for potential mitigation measures.
Cultural and Historic Resources	145 known sites located along Limited Development shorelines. Mitigation required to avoid impacts. No effect at Carlton Landing.	6 known sites located along Limited Development shorelines. Mitigation required to avoid impacts. No effect at Carlton Landing.	106 known sites located along Limited Development shorelines. Mitigation required to avoid impacts. No effect at Carlton Landing.	196 known sites located along Limited Development shorelines. Mitigation required to avoid impacts. No effect at Carlton Landing.	243 known sites located along Limited Development shorelines. Mitigation required to avoid impacts. No effect on USACE lands at Carlton Landing; potential effect on unknown resources on private lands.	Unknown sites on USACE lands would require mitigation to avoid impacts. Unknown sites on adjacent private lands would potentially be affected by indirect impacts.

Resource Category	No Action	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Unavoidable Impacts
Recreation	Boat carrying capacity of the lake would be exceeded.	Not significant	Boat carrying capacity of the lake would be exceeded.	Boat carrying capacity of the lake would be exceeded.	Boat carrying capacity of the lake would be exceeded. Capacity of some land-based recreation facilities also exceeded.	Mitigation measures may address safety but also result in degradation of recreational experience. See Section 4.7.7 for potential mitigation measures.
Noise	Increased boating use could create noise levels out of character for rural setting at some times in some locations.	Not significant	Increased boating use could create noise levels out of character for rural setting at some times in some locations.	Increased boating use could create noise levels out of character for rural setting at some times in some locations.	Increased boating use could create noise levels out of character for rural setting at some times in some locations.	Vegetation buffers and no wake zones may provide some mitigation but some impacts likely remain. See Section 4.8.8 for potential mitigation measures.
Transportation	Not significant	Not significant	Not significant	Not significant	Transportation improvements to Highway 9A and potentially Highway 9 would be needed for Carlton Landing.	Construction of highway improvements would mitigate traffic impacts; coordination with county and state transportation agencies required. See Section 4.9.8 for potential mitigation measures.

Resource Category	No Action	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Unavoidable Impacts
Public Lands and Access	Not significant	Minimal increase in new docks may limit access to lake and result in potential overcrowding at public access points.	Not significant	Not significant	Capacity of some land-based recreation facilities exceeded.	Mitigation would require construction of new facilities. See Section 4.10.8 for potential mitigation measures.

4.13 Unavoidable Adverse Environmental Effects

Significant and unavoidable adverse effects refer to the environmental consequences of an action that cannot be avoided by redesigning the project, changing the nature of the project, or implementing mitigation measures. NEPA requires a discussion of any adverse impacts that cannot be avoided (40 CFR Section 1502.16). The unavoidable adverse effects are summarized below.

Vegetation, Wetlands, and Aquatic Habitats

Implementation of Alternative 3 would result in the reallocation of lands from Protected to Limited Development. The amount of Limited Development shoreline under Alternative 3 and the resulting increase in the number of private docks and associated infrastructure would encourage conversion of crosstimbers, oak-hickory, and oak-pine habitat to more open woodland habitat, which would be expected to also affect the associated wildlife communities. Fragmentation of oak-pine forests would likely increase edge effects and increase the susceptibility of disturbed areas to invasive exotics. Increased construction of private boat docks under Alternative 3 would likely lower the productivity of littoral habitats, lead to direct vegetation removal, and could promote the establishment of invasive species. The presence of increased recreation activity in shallow areas of the lake could lead to removal of shoreline aquatic vegetation, increased spills and discarded trash, and additional littoral zone disruptions, especially in sandy beach areas. While the establishment of the baseline vegetation management buffers under Alternative 3 would function to conserve rare and imperiled plants, Alternative 3 is also likely to lead to greater disturbance and conversion of many natural habitats. Other potential indirect impacts under Alternative 3 include effects on wetlands and aquatic habitats from increased impervious surfaces and fertilizer use.

Unavoidable terrestrial habitat impacts under Alternative 4 would be similar to those described for Alternative 3; however, they would likely be magnified and more widespread due to the greater number of shoreline miles that would be reallocated from Protected to Limited Development. There would also be additional impacts in the area of Carlton Landing where six miles of shoreline adjacent would be reallocated from Protected to Public Recreation under this alternative. As shorelines designated Public Recreation are not subject to the proposed vegetation management policy buffers, there would be greater potential for impacts on terrestrial habitats along the shoreline. Full build out under Alternative 4 would lead to conversion of crosstimbers and oak-pine habitats at Carlton Landing shorelines to parkland and recreational facilities. Retained areas of natural habitat would be changed to landscaping and affected by high levels of foot and recreational traffic.

Potential impacts to wetland and aquatic habitats under Alternative 4 would also be similar to those described for Alternative 3; however, they would be magnified given greater amount of Limited Development and Public Recreation shoreline miles. Adverse and unavoidable indirect impacts would also potentially occur due to the greater amount of residential development on private lands adjacent to government-owned lands that might be expected to be built in response to the greater opportunities to build private docks. Development on private lands could disrupt natural hydrology and increase sediment and nutrient inputs through land disturbance activities. These direct and indirect impacts to vegetation, wetlands, and aquatic habitats would be adverse and unavoidable.

Fish and Wildlife

Similar to the significant and unavoidable impacts discussed for Vegetation, Wetlands, and Aquatic Habitats, increases in both shoreline and upland development under Alternatives 3 and 4 would result in significant and unavoidable impacts to fish and wildlife resources. Under Alternative 3, a greater amount

of Limited Development shoreline would allow for a larger number of potential private docks to be constructed in the future. The potential for more docks and increased public recreational opportunities at the lake would likely result in increased development on private lands adjacent to government-owned land. This residential development could disrupt natural hydrology and increase sediment and nutrient inputs through land disturbing construction activities. In addition, increased impervious surfaces adjacent to USACE-owned lands and active vegetation management on both private and public lands would impact fish and wildlife resident species. In the long-term, indirect effects from increases in residential development on adjacent private lands would be significant and unavoidable.

Alternative 4 has the potential for the greatest amount of development on private lands adjacent to USACE-owned lands; thus, Alternative 4 has the greatest potential for indirect impacts to aquatic and terrestrial species. Similar to Alternative 3, development on privately-owned uplands could disrupt natural hydrologic conditions and increase sediment and nutrient inputs to the lake. These impacts would be significant and unavoidable.

Water Quality

Under Alternative 3, increased development and recreational activity around and on the lake could result in increased erosion, lower dissolved oxygen, higher turbidity, and larger phosphorous and nitrogen loads. Alternative 4 would likely have the greatest potential for adverse impacts to water quality as a result of increased construction of boat docks on the lake; increased recreational activities on the lake and on USACE-owned shoreline; and, increased residential development adjacent to the lakeshore. In particular, increases in turbidity and decreases in dissolved oxygen could lead to general degradation of water quality and lead to related adverse impacts to aesthetic and recreational amenities. Additionally, as water quality standards for turbidity and dissolved oxygen are currently exceeded in Eufaula Lake, any impact on these water quality conditions would be considered significant.

Proposed mitigation measures could lessen water quality impacts associated with Alternatives 3 and 4; however, they would not completely eliminate adverse impacts as any future increases in turbidity or decreases in dissolved oxygen would be considered significant. Long-term water quality impacts related to increased turbidity or decreased dissolved oxygen resulting from greater on-lake and off-lake construction and recreational activity under Alternatives 3 and 4 would be significant and unavoidable.

Aesthetics and Visual Resources

Alternatives 3 and 4 would likely lead to increases in development on private lands adjacent to USACE-owned lands around the lake. This potential increase in development would result in indirect visual impacts compared as to the No Action Alternative. The overall long-term potential impact to visual resources under the alternatives was assessed using a VIA rating. The VIA ratings for LSZs would all be in the acceptable range for each MCS threshold except for the Forest LSZ under Alternatives 3 and 4. The VIA for the Forest LSZ under both Alternatives 3 and 4 would be adverse. These long-term impacts would be significant and unavoidable.

Cultural and Historic Resources

Indirect adverse effects could occur to historic properties under all of the alternatives. Residential and other development on privately-owned uplands could disturb unknown historic properties. Private residential development typically does not involve surveys or mitigation for effects on historic properties. Thus, potential indirect effects on historic properties from increased development on privately-owned land adjacent to USACE-owned shoreline would not be mitigated and could be significant and unavoidable.

Recreation

Full build out of Alternatives 2, 3, and 4 as well as the No Action Alternative would result in boating activity levels that would exceed the recommended level. While these potential impacts under each of these alternatives would not occur within the 20-year planning horizon, the long-term impact would be significant and unavoidable. Increases in boating densities under the No Action Alternative and under Alternatives 2 through 4 would require implementation of a range of mitigation measures to ensure boating safety on the lake including slow zones, the creation of boating activity use zones, or one-way directional travel restrictions. Additionally, restrictions on the use of certain watercraft, such as PWCs, would most likely also be required. Increased boating law enforcement resources could also be required. Such mitigation measures would likely decrease the quality of boating experiences and boater satisfaction. These impacts would be adverse and unavoidable.

Noise

Under Alternatives 3 and 4, future increases in boating noise on the lake would result in adverse noise impacts to other recreationalists and residences around the lake. Implementation of baseline vegetation management policies could buffer some of the future increase in noise levels. However, it is unknown to what extent this would reduce adverse impacts. Additionally, baseline vegetation management buffers under Alternatives 3 and 4 would not be as effective at blocking noise as the extended vegetation management buffers under Alternatives 1 and 2. Adverse noise impacts resulting from increased lake-based recreation would be most likely to occur during the summer months in Lake Areas 3 and 4 where boating activity is typically the greatest. These impacts would be significant and unavoidable.

Public Lands and Access

Increased boating access and growth in the number of private boat docks under Alternative 4 would increase the use of land-based recreational facilities. Under Alternative 4, this increase in use of land-based facilities would exceed the capacity of some types of existing facilities such as picnic sites. The result would be people not being able to access public lands or facilities and/or choosing to go to other outdoor public recreational areas due to overcrowding at Eufaula Lake. Additionally, under overcrowded conditions, facilities designed for persons with disabilities would be more likely to be used by non-disabled recreationists; thus, overall access for persons with disabilities would also likely be decreased. These long-term impacts to public lands and access would be significant and unavoidable.

4.14 Irreversible and Irrecoverable Commitment of Resources

According to the National Environmental Policy Act (NEPA), an environmental impact statement (EIS) must contain a discussion of the irreversible and irretrievable commitment of resources that would result from the alternatives if implemented (40 CFR Section 1502.16). The irreversible commitment of resources generally refers to the use or destruction of a resource that cannot be replaced or restored over a long period of time. The irretrievable commitment of resources refers to the loss of production or use of natural resources and represents lost opportunities for the period when the resource cannot be used.

Federal actions proposed under the Alternatives 1 through 4 would include a combination of revisions to the Eufaula Lake SMP to change the shoreline allocations and vegetation management policies; supplements to the Eufaula Lake MP land use classifications to be consistent with the shoreline allocations in the SMP; and consideration of a lease on government property for a marina and other public recreational facilities along the shoreline at Carlton Landing. Implementation of these actions would result in the irreversible and irretrievable commitment of staff time and fiscal resources.

Under the No Action Alternative, there would be no revisions to SMP shoreline allocations and vegetation management policies or MP land use classifications; therefore, there would be no impact on staff time and fiscal resources from these actions. Under any of the action alternatives, staff time and fiscal resources would be required for SMP and MP revisions and creation of vegetation management policies.

All alternatives, including the No Action Alternative, would commit staff time and fiscal resources for the review and processing of shoreline use permits for private dock construction and vegetation management. Under Alternative 1 and 2, there would be fewer opportunities for private docks and so the commitment of staff and fiscal resources would be less than under the No Action Alternative or Alternatives 3 and 4. Alternative 4 would have the largest potential number of docks and the largest potential commitment of resources. In addition, shoreline use permits must be reviewed and renewed every five years. Therefore, alternatives with larger potential numbers of docks would represent a greater commitment of staff and fiscal resources in the future. The use of staff time and fiscal resources would be an irretrievable commitment of resources.

The construction of docks would involve the use and consumption of nonrenewable natural resources including wood, metal, and petroleum fuels. Construction debris would have to be disposed of at pre-determined disposal sites, and the use of these areas for disposal would also constitute an irreversible and irretrievable commitment of resources.

Construction of the proposed public recreation facilities on USACE-owned lands at Carlton Landing (under Alternative 4) would involve the use and consumption of nonrenewable natural resources. These nonrenewable natural resources would include petroleum for fuels necessary to operate equipment used during construction activities as well as wood, metal, and other materials necessary for construction of docks. Construction activities would also result in the generation of wastes in the form of excavated soils and other excavated materials and general construction refuse. Petroleum fuels would be used to haul these materials to disposal sites. In addition to fuels used in transportation, the use of the disposal sites would constitute an irreversible and irretrievable commitment of resources.

Under all of the alternatives, but most particularly under the No Action Alternative and Alternatives 3 and 4, construction of docks and associated infrastructure as well as increased recreational use would lead to vegetation removal and habitat fragmentation that could encourage permanent conversion of native forest habitat to more open woodland habitats. Additionally, adverse impacts to water quality and wetlands from increased recreational activity could result in permanent changes to the productivity of littoral habitats as well as increase the susceptibility of native habitats to invasive species. These changes in native habitats would be permanent and irreversible.

The implementation of mitigation measures to minimize short- and long-term adverse effects under Alternatives 3 and 4 would also result in the irreversible and irretrievable commitment of resources. Proposed mitigation measures include BMPs such as shoreline stabilization, dock structure protection, and erosion control planning. Implementation of mitigation measures would result in the irreversible and irretrievable commitment of staff time, fiscal resources, and construction resources required carrying out physical mitigation measures.

Future development of residential subdivisions on private lands adjacent to USACE-owned lands could result under all of the alternatives. Construction related to these developments would cause an irreversible and irretrievable commitment of non-renewable resources including petroleum fuels, wood,

metal, and concrete among other potential resources used for construction of buildings and associated infrastructure. Construction on privately-owned uplands would also produce waste materials; these materials would require the use of petroleum fuels for the transportation to disposal sites. In turn, the use of these disposal sites would constitute an irreversible and irretrievable commitment of land resources.

4.15 Relationship Between Short-Term Uses and Long-Term Productivity

As required by NEPA (40 CFR Section 1502.16), this section describes the relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity.

4.15.1 Revisions to Eufaula Lake SMP and Vegetation Management Policies

For the majority of the resource categories, there would be no significant conflicts between the short-term use and long-term sustainability of the environment at Eufaula Lake under Alternative 1 and Alternative 2. Implementation of Alternative 1, and reductions in Limited Development shoreline allocations would result in long-term beneficial effects to vegetation, wetlands, fish and wildlife, geology and soil resources, lake aesthetics, and the availability of existing recreational facilities. Additionally, reduced development of private docks over the long-term under Alternative 1 could reduce pollutant loading and result in long-term benefits to water quality. Implementation of the extended buffer vegetation management policies under Alternatives 1 and 2 would result in long-term beneficial impacts to vegetation communities near the shoreline and to water quality compared to the No Action Alternative. Additionally, implementation of extended vegetation buffers as part of Alternatives 1 and 2 would result in beneficial impacts related to the buffering of increased noise levels at the lake; the prevention of soil erosion on the shoreline and sedimentation impacts to water quality; and the screening of residential development on adjacent private lands around the lake. Alternatives 1 and 2 would allow for the approval and issuance of more dock permits compared to existing conditions. As dock permits are issued for 5 years and can be renewed if they are properly maintained, capital and labor may need to be used for the reissuance of permits under these alternatives. Construction of docks under Alternatives 1 and 2 would also result in the short-term use of fuels and construction materials. Alternatives 1 and 2 would potentially result in less private residential development on lands adjacent to USACE-owned lands around the lake as compared to Alternatives 3 and 4; however, there would still likely be some increase in residential development adjacent to government-owned lands. Future residential development on adjacent private lands would result in the short-term use of construction materials under Alternatives 1 and 2.

Under Alternatives 3 and 4, short-term uses involved in revising the SMP and changing vegetation management policies would include capital and labor. As described for Alternatives 1 and 2, dock permits are issued for 5 years; therefore, renewal of permits could result in long-term uses of capital and labor. Construction of new docks would result in short-term uses of fuels and construction materials. In the long-term, as described in Section 4.14, construction of new docks and increased recreational activity under Alternatives 3 and 4 would result in long-term adverse impacts to natural resources at the lake including vegetation, wildlife, and wetlands. In addition, long-term increases in adjacent residential development and recreational uses on the lake would cause erosion and soil loss as well as adverse impacts to lake aesthetics and noise levels. Changes to shoreline allocations under Alternatives 3 and 4 would be likely to result in a greater amount of residential development on privately-owned lands adjacent to the USACE-owned lands around the lake. This development would result in the short-term use of construction materials.

4.15.2 Supplement Eufaula Lake MP

Revisions to the Eufaula Lake MP and changes in land use classifications would occur under Alternatives 1, 2, 3, and 4. While these actions would require short-term uses of capital and labor, there would be no long-term effects because implementation of the land use classifications is expressed through the SMP.

4.15.3 Carlton Landing Development

There would be no significant conflicts between short-term uses and long-term sustainability of the environment at Eufaula Lake related to future development at Carlton Landing under the No Action Alternative, Alternative 1, or Alternative 2.

Similar to the effects of the SMP revisions under each of the alternatives described above, shoreline allocation changes related to development at Carlton Landing under Alternatives 3 and 4 would require short-term uses of capital and labor. Alternative 3 would result in more Limited Development shoreline on the north side of Longtown Arm, which could allow some additional dock construction and boating access. Construction of docks would require short-term use of fuels and construction materials, although the number of docks that could be constructed at this location under Alternative 3 would be minimal compared to the total number of new docks that could potentially be constructed around the lake under Alternative 3.

Alternative 4 would change Protected Shoreline to Public Recreation along approximately 5.8 miles of shoreline near Carlton Landing and would allow for development of public recreational facilities on USACE-owned lands at Carlton Landing. In the long-term, these changes would result in increased recreational use of the lake shoreline and could contribute to long-term adverse effects to water quality, aquatic resources, recreation capacity, aesthetics, soil erosion, and noise. The change to Public Recreation shoreline near Carlton Landing would allow for full build out of Carlton Landing on the privately-owned lands adjacent to the USACE-owned lands. In the long-term, the proposed residential and commercial development on these uplands would lead to alterations of the natural hydrology and to native vegetation and wildlife communities.

