3.0

Affected Environment / Environmental Consequences

3.1 Methodology

For the environmental impact analysis, effects to the following resources were evaluated: vegetation, cultural landscapes, National Register and National Historic Landmark listed historic properties, visual and aesthetic resources, visitor experience, National Park Service operations, public health and safety, and transportation and access. The analysis and discussion are focused on the implementation of the Proposed Action. The No Action Alternative provides a baseline for the evaluation of impacts.

3.1.1 Impact Type

Impact Type describes the classification of an impact as beneficial or adverse, direct or indirect. A beneficial impact results in a positive change in the condition or appearance of the resource or a change that moves the resource towards a desired condition. An adverse impact is a change that moves the resource away from a desired condition or detracts from its appearance or condition. A direct impact is caused by an action, occurring in the same time and place as the action. An indirect impact is an effect that is caused by an action that, while it occurs later in time or is further removed in distance, is still reasonably foreseeable.

3.1.1.1 Context

Context describes the area or location in which the impact would occur. A site-specific effect, for example, could be limited to a single Rosehill ash tree and its immediate surroundings. A local effect could encompass an area greater than the location of the individual tree but smaller than the entire ash planting. A regional effect could include the entire Memorial grounds and part of downtown St. Louis. Due to the focused nature of this EA, the context addressed in this document is limited to the site-specific and local effects. For a more expansive discussion of regional effects, refer to the 2009 GMP/EIS.

3.1.1.2 Duration

Duration describes the length of time for which the effect would last. For the purposes of this EA, short-term effects are defined as those that would last for less than one year (generally during the construction period or one growing season), medium-term effects would last from one year up to ten years, and long-term effects are those that would last for more than ten years.

3.1.1.3 Intensity

Intensity describes the degree, level, or strength of an effect. For this EA, intensity has been categorized into negligible, minor, moderate, and major. The definitions of intensity vary by resource. General definitions of intensity can be described as follows:

- Negligible: The resource would not be affected, or the effects on the resource would be below or at the lower levels of detection. Any effects to the resource would be slight.
- Minor: The effects on a resource would be small and somewhat detectable.
- Moderate: The effects on the resource would be apparent and would be detectable by casual observers. Potential changes or effects on the resource generally would be localized and short- to medium-term in duration. Mitigation measures may be needed to offset adverse effects and they would likely be successful.

- Major: The effect on a resource would be readily apparent and substantially change the character of a resource. The effects may be apparent over a wide area and may affect resources both within and outside of the Memorial. Mitigation measures to offset adverse effects would be needed, they would be extensive, and their success could not be guaranteed.

3.2 Natural Resources: Vegetation

3.2.1 Affected Environment

All of the vegetation on the Memorial grounds is planted and highly maintained, with no extant naturally occurring native plant communities. Historically, the entire landscape has been completely disturbed: first as part of the urban fabric of the 19th century St. Louis riverfront, and later with extensive cut, fill, and grading during the construction of the Memorial and grounds. The plant species present on the Memorial grounds include a mixture of ornamental native and nonnative deciduous and evergreen trees, as well as a few shrubs, turfgrass, and groundcover. The mature Rosehill ash trees that comprise the Memorial's major planting form a canopy over the walkways throughout the grounds. The Rosehill ash is the dominant tree on the grounds, comprising 46% of all trees within the boundary of the Memorial, according to a 2009 count that identified 956 ash trees. Among the other 36 tree species planted on the Memorial grounds, the largest numbers are of baldcypress (160 trees), Eastern redbud (130 trees), several types of crabapple (174 trees), river birch (77 trees), red maple (60 trees), Greenspire linden (59 trees), Bradford pear (52 trees), swamp white oak (50 trees), and bur oak (44 trees). The Memorial replaces swamp white oak with bur oak whenever the need arises. Some of these, such as the baldcypress and some of the crabapples, are, like the ash, planted according to the Kiley landscape plan; others, such as the river birch and Bradford pear, are later additions without significance in terms of the historic landscape. Refer to the CLR and the Landscape Preservation Maintenance Plan (NPS, 2010 and NPS, 2011, respectively) for additional information about the other tree plantings on the Memorial grounds.

As an essential characteristic of the landscape, the Memorial's vegetation – particularly its

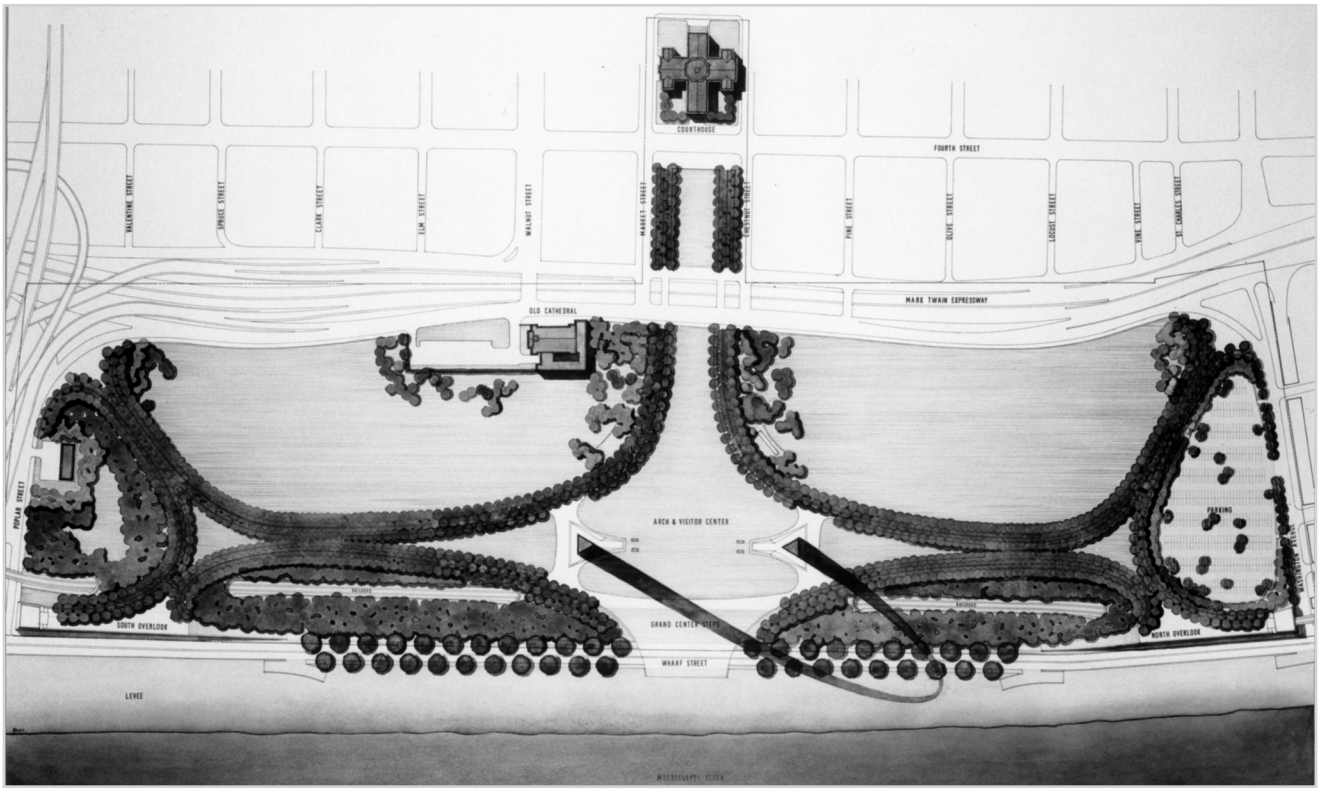

Figure 3.1 Form of the allees in relationship to the Arch, as illustrated in Kiley's landscape design

trees – functions to define spaces, direct pedestrian circulation, frame views of the Gateway Arch and ponds, and define nonprogrammed passive use areas, such as lawns. The Rosehill ash trees, which are the focus of this EA, are planted mostly in the allées along the walks, with a few (25) planted along Memorial Drive as street trees. An additional 60 ash trees are planted on the east side slopes near the grand staircase. The dominant plantings of these dense-canopied, deciduous trees along the walks provide changing character throughout the year, shading the walks that are heavily used by visitors in summer, providing a mass of orange, red, and purple leaf color in the fall, and sheltering the walkways from wind and weather during the late fall, winter, and early spring.

The planting plan by Dan Kiley was intended to define and structure spaces with the use of a consistent palette of plant species selected for their form, color, and line (see figures 1.7 and 3.1). The site layout and design were enhanced through the use of large numbers of trees chosen from a limited number of species. A single-species uniform planting was intended to create a sense of enclosure along the pedestrian walks, while around the ponds Kiley envisioned a landscape of abstracted "meadows" of grasses and "forests" of a few species of canopy trees interspersed with a few species of flowering understory trees. The plantings in these areas were not designed with the ecological function of an actual forest or meadow in mind, but were intended to aesthetically evoke the feeling and form of these landscape types (see figure 3.2).

While not a native ecosystem, the Memorial grounds vegetation is part of a system. The highly designed and planned plantings were originally selected to emphasize form and massing as part of the overall design, without consideration for what their ecological function would have been had they been part of a naturally occurring vegetation community. The idea of ecologically driven formal design is still a relatively new concept today, and was all but unknown in the mid-20th century when the Memorial landscape was designed.

As noted in Chapter 1, the majority of the Rosehill ash trees in this urban planting are approaching 40 years old, which greatly exceeds typical expectations for urban plantings in tree

Figure 3.2 Rendering of the existing conditions at the Memorial grounds, from the CLR, 2010.

pits and along paved walks. The ash trees have begun to decline and will continue to do so as they age and naturally reach senescence.

Rosehill ash is a cultivar of white ash, a tree species native to the region. As noted in Chapter 1, all ash trees are susceptible to EAB, and the trees on the Memorial grounds are at risk of mortality from the insect. For plantings of uniform species in general, there is always an inherent risk that a single disease or pest, such as EAB, could wipe out or severely damage the group of trees due to their similar susceptibility and other characteristics. The Memorial maintenance staff manages vegetation based on National Park Service policies pertaining to Integrated Pest Management (IPM). For more information on tree maintenance practices on the Memorial grounds, refer to the Landscape Preservation Maintenance Plan (2010). The Landscape Preservation Maintenance Plan, completed as a follow-on to the 2010 CLR, provides guidance on best practices for avoiding damage to vegetation resources during construction and other activities.

3.2.2 Environmental Consequences

3.2.2.1 Methodology

Potential effects on vegetation on the Memorial could occur over the short term as a result of construction activities, and over the medium to long term as a result of the replacement of the Rosehill ash trees. Impacts on vegetation would be considered minor if those impacts were consistent with the impacts resulting from routine maintenance activities, or moderate to major if activities associated with either alternative would necessitate the replacement of extensive areas of vegetation on the Memorial in addition to the Rosehill ash trees.

3.2.2.1 No Action Alternative

The No Action Alternative represents a passive or reactive approach to tree loss, with trees being removed only as they need to be taken down. The No Action Alternative includes the risk of EAB infestation occurring on the Memorial grounds before the trees can be removed. The incremental loss of tree canopy cover would have a negative impact on the vegetation character of the Memorial grounds, including the loss of shade and shelter along the walks.

A certain degree of wear and tear occurs to the existing vegetation and turfgrass in this heavily used urban park, and this wear is expected to continue through normal visitor use. The National Park Service has developed a routine maintenance program for the rehabilitation of damaged or degraded vegetation as described in the Landscape Preservation Maintenance Plan.

The No Action Alternative is not in keeping with the goals described in the GMP/EIS for natural resources. The GMP/EIS states that EAB and other threats to the ash trees would be addressed using direction provided in the CLR. Overall, the No Action Alternative would have a moderate to major adverse effect on vegetation on the Memorial, since the existing ash trees would be removed and not replaced.

3.2.2.2 Proposed Action

Under the Proposed Action, the Rosehill ash would be removed and replaced in phases to coincide with the design competition or other improvements envisioned in the GMP/EIS. The replacement of the Rosehill ash trees with immature young trees would alter the landscape over the short to medium term by opening more expansive views to the Gateway Arch and temporarily opening the enclosed space along the allées.

This replacement of the mature trees with the smaller young trees would also create a warmer microclimate along the walkways over the medium term. The turfgrass that is adjacent to the walkways would be exposed to additional sunlight once the trees have been removed. Depending on the additional exposure and slopes of the grassy surfaces, additional water may be needed to prevent the turf areas from drying out.

Replacement of the Rosehill ash also offers an opportunity to increase the species diversity on the Memorial when those replacements occur in noncontributing areas. In these noncontributing ash plantings away from the character-defining allee, (east side slopes and along Memorial Drive), there would be increased flexibility in choosing replacement species, and those species could be selected through a more ecologically driven approach. By choosing replacement trees with the intent to increase

species diversity in these noncontributing areas, the dominant tree species (based on total number of trees) could be reduced from 46% to 41% of the total trees on the Memorial.

Over the long term, the Proposed Action would have a negligible impact on the Memorial's vegetation because the Rosehill ash would be replaced with a species that has been selected for hardiness, disease resistance, and other positive horticultural qualities. In the replacement tree selection process, native species, including tulip poplar, have been given careful consideration and are generally preferred when compared with nonnative species.

3.3 Cultural Resources: Cultural Landscapes

3.3.1 Affected Environment

The Memorial grounds are considered a historic designed landscape, one of the four types of cultural landscapes recognized by the National Park Service (CLR, 2010). Per National Park Service policy, cultural landscapes require particular treatments and management approaches, which are addressed comprehensively in the 2010 CLR. The CLR identifies all of the cultural landscape elements at the Memorial, and the GMP provides direction and a framework for protecting those elements. The cultural landscape is considered a contributing resource in the National Register listed Historic District and NHL; the impact on listed properties is discussed below in Section 3.4.

The presence of a closely spaced, uniform, single-species planting along the walks, though not specifically of Rosehill ash, is a primary character-defining feature of the Memorial grounds as a cultural landscape. If the uniform planting were to be modified in terms of its spacing, density, location, and uniform character, its integrity and that of the Memorial landscape would be diminished and an important design characteristic lost.

The designed views to the Gateway Arch are another primary character-defining feature of the Memorial grounds landscape. The allée planting shapes the views along the system of walks, most notably along the north-south axis of the grounds. The current gaps in the allée planting, resulting from the selective removal of ash trees, have altered the intended continuity of the walks and the experience of viewing the Gateway Arch from the allées.

Other major character-defining features of the Memorial's landscape include the Gateway Arch; the overall landform and spatial organization of the grounds; the system of walks; the two concrete-edged ponds; the overlooks and associated staircases; the railroad open cuts and tunnels; the grand staircase; the baldcypress circles near the ponds; screen plantings and depressed service areas; entrance ramps into the Gateway Arch; and concrete benches (see figure 3.2). The CLR discusses these features and their characteristics in additional detail. These features are not expected to be impacted by the tree replacement over the long term, and are therefore not addressed further in this document.

3.3.2 Environmental Consequences

3.3.2.1 Methodology

Impacts on cultural landscapes would be considered negligible if the alternative would not affect any of the landscape character-defining features described in the CLR (2010). Impacts would be considered minor to moderate if there would be a short- to medium-term impact, respectively, to any character-defining feature of the cultural landscape. Impacts would be considered major if any character-defining landscape feature were to experience modification such that the integrity of the designed landscape was diminished or lost.

3.3.2.2 No Action Alternative

Under the No Action Alternative, the Rosehill ash trees would be removed from the allées as they decline and die and would not be replaced in keeping with current park policy. All other cultural landscape features would remain unchanged. After all of the Rosehill ash trees are removed, the designed views to the Gateway Arch would be substantially altered. Visitors would have a direct view to the Gateway Arch from all the walkways rather than the designed framed view that Kiley intended. In addition, the Gateway Arch would no longer appear like it is emerging from a stylized urban forest.

A substantial part of the feeling conveyed by the design would be lost, including the sense of enclosure provided by the canopy over the walks and the rhythmic experience of the closely spaced, uniform trunks. The cultural landscape would experience an adverse effect because a character-defining feature of the Memorial grounds would continue to be degraded and would be ultimately lost, diminishing the integrity of the cultural landscape. The No Action Alternative would have a major adverse impact on the cultural landscape, and this alternative is not consistent with the cultural landscape goals identified in the GMP/EIS or the CLR.

3.3.2.3 Proposed Action
Under the Proposed Action, the allée trees would be replaced with another single species and the location, spacing, and uniform character of the Kiley design would be maintained. The alignment, width, and location of the existing system of walkways would also be maintained. However, it is likely that materials would be replaced in-kind during the installation of new subsurface drainage systems. This is consistent with preservation standards and CLR guidance.

The proposed replacement of the Rosehill ash along the allées with a similar single-species planting is consistent with the CLR. Over the short and medium term, the cultural landscape would experience a negligible adverse impact as a result of replacing the mature trees with immature trees. This adverse impact would persist until the replacement trees grow tall enough to once again form the canopy and slot-like view of the Gateway Arch that Kiley intended. However, the visual appearance of the replacement trees as a uniform planting along the allées would be consistent with the design intent. As the trees grow in height and width, the designed framed view of the Gateway Arch would once again reappear.

The Proposed Action is consistent with the GMP/EIS, the CLR, and Kiley's original design intent because it would maintain the integrity of the single-species allée planting. Over the long term, the Proposed Action would result in a negligible impact on the cultural landscape of the Memorial.

3.3.2.4 Cumulative Effects
The Proposed Action is not anticipated to result in cumulative impacts to cultural landscapes since a character-defining feature of the Memorial would be ultimately restored to its intended condition. However, the The combination of changes associated with both the Proposed Action No Action Alternative and the design competition could have an adverse cumulative effect on cultural landscape features at the Memorial. The specific impacts of the design competition will be assessed in a separate NEPA document. To the extent that the proposed changes to the Memorial associated with the design competition were consistent with changes envisioned by the CLR, the overall cumulative effects on the cultural landscape would be minor to moderate, and would be dominated, in large part, by the impacts resulting from the No Action Alternative.

3.4 Cultural Resources: Historic Properties / National Register of Historic Places

3.4.1 Affected Environment
NEPA requires the consideration of the proposed action's impact on significant historical resources. Buildings, structures, sites, objects or districts that are listed in or eligible for listing in the National Register of Historic Places are considered significant historical resources under NEPA. The Memorial, including the Gateway Arch and surrounding landscape, is listed in the National Register, and is also designated an NHL due to its exceptional significance.

In 1976 the Memorial was listed in the National Register as an Historic District. The district covers what is described as the "T-shaped park," (the Memorial grounds), and includes specific buildings and structures that contribute to the district: the Gateway Arch, Old Courthouse, and Old Cathedral. The Memorial grounds' construction was well under way at this time but incomplete, with the overlooks, steps, and grand staircase listed in the nomination as part of the district, but described as "now under construction."

In 1987 the Memorial was also declared a National Historic Landmark. In the nomina-

tion, it is described as "Jefferson National Expansion Memorial Gateway Arch." The discussion within the nomination focuses mostly on the Gateway Arch, but the boundary of the district covers the entire Memorial area east of Memorial Drive (excluding Luther Ely Smith Square and the Old Courthouse). The nomination includes a description of existing features of the landscape as part of the significance statement: "Curvilinear, graceful staircases of toned concrete at the north and south ends provide access to the Arch grounds from the riverfront. The grounds themselves are carefully landscaped with ponds, trees, and walkways that again reflect the gentle curve of the Arch. Similar curves are repeated in the tunnel entrances for the railroad tracks that cut through the property. The design of the concrete tunnel entrances is so finely incorporated into the landscape through the curvilinear lines and placement below grade that the entrances hardly seem to exist."

Subsequent to the National Register and NHL listings, the CLR (2010) provides more detailed information to build upon the significance established in the National Register and NHL nominations. Since the significance of the landscape as a contributing resource of the NHL is directly related to the Saarinen-Kiley design concept rather than its physical implementation, those features that have a character reflecting the designers' intent were considered more significant than those constructed features that diverge from the intent.

The single-species allée tree planting is an essential character-defining feature of the NHL (CLR 2010, GMP/EIS 2009) (see figure 3.3). Permanent removal of, or substantial changes in character to this feature would diminish the integrity of the NHL.

3.4.2 Environmental Consequences

3.4.2.1 Methodology

Impacts on historic properties would be considered minor if there are visible changes to the historic property or its visual context, but there is no effect on the resource's character-defining features or integrity. A minor beneficial impact occurs when an historic resource is stabilized. Impacts would be considered moderate if they result in a change to the historic property's identified contributing features, but would not diminish its integrity. Impacts would be considered major if

Figure 3.3 Allee plantings.

the resulting change to character-defining resources diminishes the integrity of the historic property substantially or to the extent that it would no longer be eligible for listing in the National Register.

3.4.2.2 No Action Alternative
With the exception of the trees, the character-defining features of the Historic District and NHL would remain unaltered. However, the incremental loss of the trees in the character-defining allée planting would result in a long-term adverse impact to the historic property. The loss of the planting's character represents the loss of a major character-defining feature of the Memorial's significant designed landscape, and would result in diminished integrity of the National Register listed Historic District and NHL and diminished integrity of setting for the Gateway Arch. The No Action Alternative would result in a moderate to major adverse impact on Historic Properties.

3.4.2.3 Proposed Action
Over the short term, the Proposed Action would have a minor to moderate adverse impact on the Historic District as a result of the replacement of the mature trees with smaller, immature trees. However, since the new trees would occupy the same locations as the existing Rosehill ash and the rhythmic spacing contained in the original planting plan would be maintained, the integrity of the National Register listed Historic District and NHL would be retained. The Proposed Action would also retain the integrity of setting of the Gateway Arch, which is an individually listed NHL. Over the long term, the effects of the Proposed Action on historic properties would be negligible, and potentially beneficial.

3.4.2.4 Cumulative Effects
The Proposed Action is not anticipated to result in cumulative impacts to historic properties since a character-defining feature of the Memorial would be ultimately restored to its intended condition. However, the combination of changes associated with both the Proposed Action and the design competition could have an adverse cumulative effect on historic properties at the Memorial, including all the character-defining features identified in the CLR. The specific impacts of the design competition will be assessed in a separate NEPA document. To the extent that the proposed changes to the Memorial associated

Figure 3.4 View from the north of the Gateway Arch with Rosehill ash growing into the center of the designed view.

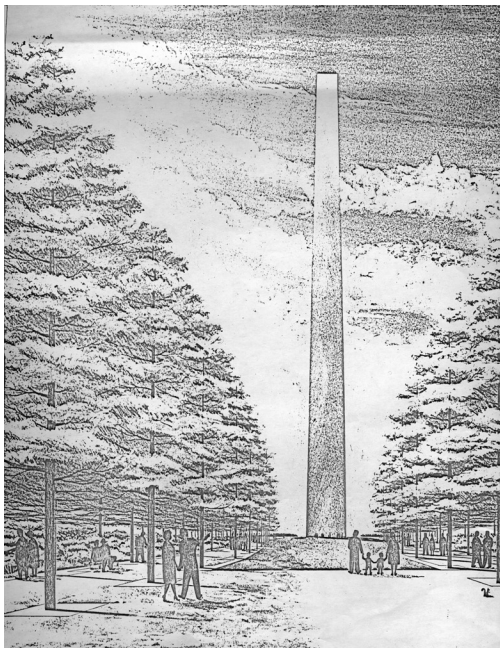

Figure 3.5 Kiley concept rendering of the same view of the Gateway Arch; note the differing form of the trees. (Given that this illustration shows an idealized tree form.)

with the design competition did not substantially alter the integrity of the Historic District or individual historic properties, the overall cumulative effects on historic resources would be minor to moderate, and would be dominated, in large part, by the impacts resulting from the No Action Alternative.

3.5 Cultural Resources: Visual and Aesthetic Resources

3.5.1 Affected Environment

The Memorial's designed views and vistas, both along the east-west and north-south axes of the symmetrical plan of the grounds, centered on the Gateway Arch, are an essential character-defining feature of the Saarinen-Kiley design. In addition, the east-west views, both from and towards the Memorial grounds, establish crucial connections between the Memorial, the city of St. Louis, the Mississippi River, and East St. Louis. The views and vistas control visitor perception and experience of the Gateway Arch by framing its immense size and sculptural qualities (see figures 3.4 and 3.5). In turn, the Gateway Arch provides a framing element, particularly when viewed from the east or the west. The important axial relationships of the Memorial landscape's design are enhanced, in part, through these designed views and vistas (GMP, 2009) (see figures 3.6 and 3.7).

The Memorial's vegetation, primarily the Rosehill ash, frames the Gateway Arch legs from either view. In the views to the west from across the Mississippi River in East St. Louis, the Gateway Arch frames the Old Courthouse against the urban skyline of the city of St. Louis. When the Gateway Arch is viewed from the west in the general area of the Old Courthouse, the base of the Gateway Arch legs are obscured by the lawn-covered berm and the crowns of the ash trees. From other locations within the city along the Memorial's street edges, the allées obscure the base of the Gateway Arch, and the upper part of the Gateway Arch appears to rise from the uniform mass of trees. Views from the Gateway Mall to the west of the Old Courthouse focus on the upper part of the Gateway Arch in the background, soaring above the Old Courthouse dome in the foreground, with little of the Memorial grounds (including the Rosehill ash tree planting) visible from that perspective.

Figure 3.6 View of the Gateway Arch from the east side of the Old Courthouse at Luther Ely Smith Square.

Figure 3.7 View of the Gateway Arch from East St. Louis.

The north-south views along the walkways are framed by the single-species allée planting, in what has been described as the "narrow monument" view (see figures 3.4 and 3.5). Views north and south from the base of the Gateway Arch across the Memorial are dominated by the rows of ash trees because their height, width, and crown create a tall mass of vegetation. Due to the undulating topography and the mature ash trees, the Gateway Arch parking garage and the maintenance facilities at the north and south ends of the Memorial, respectively, are minimally visible (GMP, 2009).

The mature Rosehill ash trees along the walks are, on average, approximately 40 feet tall. The close spacing of the trees in double or triple rows along the walkways has resulted in a sense of enclosure due to the dense canopies when the trees are in leaf. As a result of the close spacing of the Rosehill ash in the allées, the spreading canopies of the trees have grown together along the north-south axial walkways and have begun to block the designed views to the Gateway Arch (see figure 3.4).

There are filtered views from the walkways through the Rosehill ash trees to the north and south reflecting ponds (see figure 3.8). The character of the views from the north and south reflecting ponds is shaped by the designed topography and plantings. The masses of trees and contrasting open areas were intended to draw the eye to dramatic views of the Gateway Arch from various points around the ponds, as well as to screen nearby service areas. The existing views reflect the Saarinen-Kiley design concept and thus contribute to the significance of the landscape. These views illustrate the variety and complexity of the Memorial's Modernist designed landscape and its urban, riverfront context: the soaring Gateway Arch, the expanse of the Mississippi River, the industrial uses on the river's east bank, and the Memorial's abstracted urban forest and meadow planted forms (NPS, 2009).

3.5.2 Environmental Consequences

3.5.2.1 Methodology

Impacts on visual and aesthetic resources would be considered minor if the impacts were short term or would only affect a small portion of the Memorial. Impacts on visual and aesthetic resources would be considered moderate if the impact were medium term or would affect views of up to one-half of the Memorial grounds. Impacts would be considered major if the impact were long term, would affect the entire Memorial, or would substantially affect views from the Memorial to off-site areas, or vice versa.

3.5.2.2 No Action Alternative

Under the No Action Alternative, the incremental removal of trees would affect the appearance of the uniform single-species planting and would create large gaps in the landscape. The views to the Gateway Arch from the north-south walks would no longer be symmetrically framed. Consequently, the Gateway Arch would not appear to be rising out of a stylized urban forest, but rather would be visible intermittently and unevenly through periodic gaps in the canopy. Eventually, the framing trees would be lost completely.

The No Action Alternative would result in major adverse long-term visual impacts because the removal of affected trees in the allées would alter the framed views to the Gateway Arch along the north-south axes, and would alter the rhythmic pattern and arrangement of tree trunks and arching branches in the allées.

3.5.2.3 Proposed Action

Replacing the Rosehill ash trees, per the selection process and CLR guidance, with a species

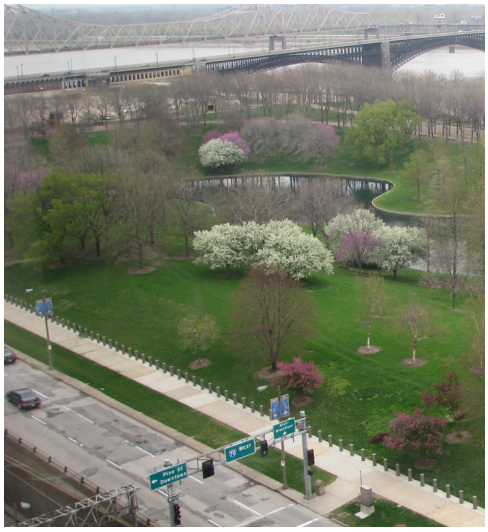

Figure 3.8 North reflecting pond with ash trees (leafless).

that has a more upright, oval, or pyramidal shape would ultimately maintain the character-defining framed views to the Gateway Arch. However, over the short and medium term, the views and vistas at the Memorial would be altered as a result of the tree removal and replacement process. The defined views from the walkways to the Gateway Arch would be affected as the large, mature trees are replaced with younger, smaller trees that lack the height, width, and crown of the existing Rosehill ash. While the trees are maturing, the Gateway Arch would not be framed by the trees. This would result in a short- to medium-term moderate adverse impact. However, this is a temporary condition as, over time, the replacement trees would grow and mature, creating a planting of uniform trees that would once again frame the Gateway Arch as Kiley intended.

There would be less of an impact to the views from east and west. Because these views occur along the open area aligned with the Gateway Arch, they are not framed in the foreground by the enclosure of trees along the walks. The visual effect of the Gateway Arch rising from an urban forest would be reduced slightly as the trees would be smaller, but the mass of uniform planting would be similar to the current view.

The active construction areas, staging areas, and chipping operation during the proposed tree replacement activities would introduce temporary new visual elements. A brief period of mobilization, demobilization, and restoration of the staging areas would also occur during the tree replacement period. The construction activities and staging areas would represent moderate short-term visual impacts for the duration of the construction period.

In addition, other noncontributing elements on the Memorial, such as the parking garage and the maintenance facility at the north and south ends, respectively, may become more visible once the mature trees have been removed from the landscape. These moderate adverse impacts on visual and aesthetic resources would persist over the short to medium term. Over the long term, growth of the replacement trees would gradually screen these elements, and the effects on visual and aesthetic resources would be negligible.

3.5.2.4 Cumulative Effects

Implementation of the design competition may add additional visual elements to the Memorial. These additional visual elements will be evaluated in more detail in the NEPA document prepared for the design competition. Removing the Rosehill ash trees would make the addition of new elements to the Memorial grounds much more visible. These additional visual elements added as a result of the design competition, when combined with the effects of removing the Rosehill ash trees, could create a moderate to major cumulative visual impact. This cumulative impact would diminish over time as the replacement trees begin to mature.

Figure 3.9 Transportation context.

3.6 Visitor Use and Experience

3.6.1 Affected Environment

The Gateway Arch and Memorial grounds are poplar visitor destinations that draw an estimated 2.5 million visitors per year. Based on the results of surveys taken in 2006, the average visitor spends just over two hours visiting the Gateway Arch and the Memorial grounds. The bulk of visitation occurs during the summer months; however, the Gateway Arch and Memorial draws visitors year-round.

Public vehicular circulation and parking are located at the perimeter of the Memorial (see figure 3.9). This arrangement allows visitors a full pedestrian experience throughout the landscape on the walkways and promenades, generally without vehicular conflict. However, due to maintenance activities, visitors may periodically encounter National Park Service maintenance vehicles on the grounds, depending on the maintenance tasks being performed.

The Memorial grounds are used by visitors who pass through on their way to the Gateway Arch and the Museum of Westward Expansion, as well as local downtown workers who visit the grounds during their lunch hours and before and after work. Other visitor activities on the Memorial grounds include walking, jogging, and viewing the Mississippi River. Some recreational activities, such as Frisbee tossing, are allowed on the lawn areas of the Memorial as long as these activities do not conflict with the commemorative character and use of the landscape as laid out in the Memorial's enabling legislation (GMP, 2009).

The alignment of the walkways within the allées directs circulation along the long (north-south) axis of the Memorial and provides views to the Gateway Arch and other landscaped areas. In the allées, the tree trunks create a rhythmic pattern along the walkways and the arching branches enclose and vertically define the space. The Rosehill ash provide a shaded canopy cover for the pedestrian routes from the Gateway Arch parking garage (see figure 3.10), the Poplar Street entrance, north and south overlooks, and Memorial Drive to the Visitor Center and Museum of Westward Expansion at the base of the Gateway Arch. This canopy creates a cooler microclimate along the allées, which contributes to a positive visitor experience.

3.6.2 Environmental Consequences

3.6.2.1 Methodology

Impacts on visitor use and experience are defined primarily by the duration and extent of the impact. Impacts would be considered minor if the impacts were to be short term or would only affect visitors in limited areas of the Memorial. Impacts would be moderate if

Figure 3.10 Canopy cover along the walks.

these impacts were medium term or would affect visitors over much of their visit to the Memorial. Impacts on visitor use and experience would be major if the impacts were long term, would cover most of the Memorial grounds, or would affect visitors during nearly their entire visit to the Memorial. For example, without the provision of alternative transportation, the elimination of shade along the allées could have a major impact on visitor experience for a percentage of visitors to the Memorial.

3.6.2.2 No Action Alternative
Since the ash trees would not be replaced, the experience of viewing the Gateway Arch along the major axes or walking under a canopy of trees in the allée would be adversely affected. Gaps in the canopy would allow large patches of sunlight onto the walkways below, which would create uneven bright and dark areas as visitors walk along the allées, representing a loss of the consistent and uniform experience that was intended by the design. The rhythmic pattern of tree trunks and arching branches would be lost due to the piecemeal removal of affected trees.

In addition, shade from the tree canopy would be reduced over time as the Rosehill ash are individually removed. This removal of trees would begin to impact visitor experience over both the short and medium term. The ultimate removal of all the trees along the allées would result in a moderate to major long-term adverse impact on visitor experience as the walkways would be in full, direct sunlight during the summer months and would greatly affect visitor comfort.

3.6.2.3 Proposed Action
The Proposed Action would result in a short-term adverse effect on visitor experience during the construction period. The removal of the trees would temporarily alter the pedestrian circulation during construction, possibly making some routes across the Memorial longer. For example, during tree removal activities, the walkways along the allées may be cordoned off and visitors would need to take a substantially longer path to avoid the areas of active construction. These impacts could be reduced by conducting the bulk of the tree removal activities during the fall or spring seasons when there tend to be fewer visitors to the Memorial.

The location of the construction and staging areas would also have a moderate short-term adverse effect on visitor experience. Visitors would experience noise from construction activities and would observe the movement of construction equipment and cordoned off areas during periods of active construction. These activities would tend to degrade the experience of visiting the Memorial, particularly for visitors that access the Memorial grounds from the north or the south. Visitors that access the Memorial from the east or west entrances would be less affected by the removal of the ash trees when compared with visitors accessing the Memorial from the north or the south.

Over the short and medium term following tree removal and replacement, the shade along the allées would be greatly reduced as the mature trees are replaced with smaller trees. This reduction in shade could result in a substantially hotter walk from the north parking garage to the base of the Gateway Arch, and some visitors (e.g., children or the elderly) may find this reduction in shade intolerable, particularly during the hot summer months. However, the shade would increase over time as the width and density of the replacement tree canopy increased, resulting in a beneficial long-term effect.

3.6.2.4 Cumulative Effects
When combined with the potential effects of the design competition, the removal of the Rosehill ash trees could create a potential cumulative impact on visitor experience. The design competition would result in the construction of a number of new features on the Memorial grounds. To the extent that construction of these features would occur simultaneously with the removal of the ash trees, visitors could experience an extensive period of construction that would affect large portions of the Memorial grounds over the medium term, and would result in a moderate to major adverse cumulative effect on visitor experience.

However, over the long term, the cumulative effect of the replacement of the Rosehill ash and the new elements associated with the design competition would create a long-term beneficial effect on visitor experience. Some of the original elements from the Saarinen-Kiley design would remain, while new active and passive park elements would be introduced. These elements would generate new interest in the Memorial for visitors and would result in improved visitor experience. The replacement of the ash trees with smaller trees would have a short- to medium-term adverse effect on visitor experience due to altered views of the Gateway Arch and increased summertime temperatures along the walkways; however, as the trees began to mature, the long-term visitor experience of walking along the allées would be comparable to the current experience. Overall, the cumulative effect on visitor experience would be beneficial.

3.7 National Park Service Operations

3.7.1 Affected Environment

Memorial staff performs routine and periodic maintenance to the landscaping. Some maintenance activities, such as tree pruning, are performed annually and other activities, such as lawn mowing, are performed weekly during the growing season. Turfgrass areas may be periodically reseeded to address impacted areas from high visitor use or programmed events.

Memorial staff prunes canopy and ornamental trees on an annual basis to remove hazardous limbs using chain saws or limb pruners. Canopy trees that are located near visitor circulation areas are cordoned off while upper limbs are removed. Damaged limbs are removed after storm events as necessary. Periodically a tree will sustain extensive damage from a storm or will die, and then the entire tree would be removed. Depending on the tree species and location, replacement of the tree would occur during the appropriate replanting season. Between 2004 and 2009, removed ash were not replaced. In 2010, the Memorial replaced a limited number of missing ash to reduce the number of gaps in strategic locations.

Memorial staff uses a variety of vehicles, including lawn mowers, small utility vehicles, and pickup trucks to conduct periodic maintenance activities. Specialized vehicles and equipment may be used on an as-needed basis to prepare for or clean up from storms, flooding, and events on the Memorial grounds.

3.7.2 Environmental Consequences

3.7.2.1 Methodology

Impacts on National Park Service operations would be considered minor if the alternative could be implemented with existing National Park Service staff and within current operational procedures. Impacts on operations would be considered moderate if the alternative would require the hiring of between one and three new full-time employees or would require a budget increase of less than 10%. Impacts on operations would be considered major if the alternative would require hiring more than three full-time employees, a budget increase of more than 10%, or would require substantial changes to current operational procedures.

3.7.2.2 No Action Alternative

Under the No Action Alternative, the current care and maintenance activities related to the Rosehill ash would continue. The Rosehill ash trees would be removed as they decline and die from various causes, including current diseases such as BLS. However, the rate at which the trees are removed could increase if EAB infests Rosehill ash trees at the Memorial. The onset and rapid decline of the trees may increase the number of trees removed at any one time. This could affect National Park Service operations because additional staff resources could be required for tree removal. The No Action Alternative could have a minor to moderate impact on National Park Service operations over the medium term due to the potential increase in staffing required.

3.7.2.3 Proposed Action

The removal and replacement of the Rosehill ash trees would result in a short- to medium-term impact on National Park Service operations. This impact would include increased staffing requirements and increased maintenance vehicle traffic to support active construction. The increased traffic would

be associated with a variety of activities, including tree removal, soil preparation, and tree replacement operations. The additional traffic would be above the normal maintenance activity at the Memorial. During the tree removal and replacement, the infested wood debris would be collected at the active construction area and shuttled to the staging area, or intermediate point, where it would be chipped and loaded onto trucks for disposal. The movement and loading of the wood debris would be a short-term event that would occur during the active construction process and would cease once all of the Rosehill ash are removed.

There would also be a direct medium-term effect on National Park Service operations as the Rosehill ash are replaced with immature trees. The replacement trees would require additional maintenance for the initial period after planting, and maintenance staff would likely follow a three-year maintenance plan for the newly planted trees. The following planting and maintenance specifications would be typical for new trees:

- Planting: Trees would be planted using the Missouri Department of Conservation Standard Tree Planting Detail. Trees may or may not be staked, depending on the condition of the tree root ball, location, and other factors. Broken, damaged, diseased branches would be properly removed at time of planting. No other pruning would be performed at the time of planting. A minimum 4-foot diameter area around the base of the tree would be mulched, with no mulch touching the trunk.

- Maintenance 1st year: Trees would be checked and watered as often as weekly if necessary. Broken, damaged, diseased branches would be properly removed when discovered. If staking is used, ties would be checked at every watering to ensure they are not too tight. Trees would also be checked for insect or disease activity at each watering, and weeds would be removed from the mulched area.

- Maintenance 2nd year: Trees would be checked and watered as needed. Broken, damaged, diseased branches would be properly removed any time discovered. Pruning to achieve desired branch spacing would begin to occur after the second growing season. If stakes were used, the materials attached to the tree would be removed. The stake may remain for protection and to identify it as a newly planted tree. Trees would also be checked for insect or disease activity several times during the year. The mulched area would be maintained weed free.

- Maintenance 3rd year: Trees should be established enough to not require additional watering, except for times of drought. Broken, damaged, diseased branches would be properly removed any time discovered. Pruning to achieve desired branch spacing would be performed after the third growing season. Pruning to remove sucker or sprout growth would occur in early spring and again in August. Trees would be checked for insect or disease activity several times during the year. Gardeners who perform mowing are trained to observe trees while mowing to report any problems.

The care of the replacement trees would continue into the long term; however, the younger trees would require less care after the initial three-year period because they would be generally healthier and more vigorous than the declining Rosehill ash. The Proposed Action would have a moderate medium-term impact on National Park Service operations and could require increased seasonal staffing to complete the tree removal and replacement process. In addition, if a taller-growing species were to be selected, it may be necessary for the National Park Service to hire or contract specialty tree-trimming crews to trim the taller trees.

3.8 Public Health and Safety

3.8.1 Affected Environment

The health and safety of visitors entering the Memorial grounds is of utmost important to National Park Service staff. Memorial staff use safety management plans for construction operations and access management during construction activities. For example, during any type of construction or maintenance

activity, care is taken to ensure that hazardous areas are properly cordoned off and that visitors are provided with clear alternate routes to arrive at their designation.

The interior of the site is not open to public vehicles, and visitors use the tree-lined walkways to access the Gateway Arch, grand staircase, and open space areas. However, there is some vehicular use by maintenance staff and park rangers on site, and the use of these vehicles presents a potential risk to park visitors.

In addition to vehicular use on site, various maintenance activities present potential risks to visitors. For example, during tree trimming operations, falling branches and limbs could present hazards to visitors. To reduce risk, areas are cordoned off during these activities to prevent pedestrian access.

3.8.2 Environmental Consequences

3.8.2.1 Methodology

Impacts on public health and safety would be negligible to minor if the public could be effectively excluded from hazards associated with construction or implementation of the alternative. Impacts on public health and safety would be moderate if there were a measurable increased risk to members of the public, and impacts would be considered major if there were a substantial unmitigated risk to a visitor to the Memorial associated with any of the alternatives.

3.8.2.2 No Action Alternative

During tree removal activities, small areas along the walkways would be temporarily cordoned off. Cordoning off areas would prevent potential conflicts with visitors and would provide an adequate margin of safety.

The current safety plans and policies employed by the National Park Service would be used during removal of the Rosehill ash. There would be a minor short-term alteration of pedestrian traffic in the vicinity of the trees being removed to prevent conflicts between visitors and the tree removal operation. Since a single tree or small groups of trees would be removed, the cordoned off area would be small and of short duration. There would be a minor increase in maintenance traffic as individual trees or small groups of trees are removed. A minor short-term impact on public health and safety may occur due to the increased maintenance vehicle activity.

3.8.2.3 Proposed Action

Under the Proposed Action, the Rosehill ash trees would be removed in phases and extensive areas of the walkways would be cordoned off during tree removal activities to eliminate conflicts between visitors and the construction activity. Signs would direct pedestrians around the areas of active construction, and these measures are expected to provide an adequate margin of safety to visitors to the Memorial.

Due to the large number of trees to be removed in any one phase, there would be an increase in maintenance and construction vehicle traffic during the active construction period. Vehicle routes would be chosen to minimize conflicts between maintenance vehicles and pedestrians. In addition, the locations of construction staging areas would be planned and designed to minimize dust, noise, and other hazards to visitors and Memorial staff. As a result of precautions taken during the active construction period, the impact on public health and safety would be minor.

3.9 Transportation and Access

3.9.1 Affected Environment

There are nearly 5 miles of pedestrian walkways on the Memorial grounds. The walkways and allées that traverse the Memorial guide and direct visitor movement through the landscape between the north parking garage and the Gateway Arch and Museum of Westward Expansion, and between the Mississippi River, the city of St. Louis, and the Memorial. The organization of the path system in the Memorial enhances the spatial organization of the site (NPS, 2009).

The majority of visitors to the Memorial park in the parking garage located at the north end of the Memorial along Washington Avenue. From this point, visitors can easily access the Memorial grounds and can walk along the allées along the north-south axis towards the Gateway Arch and the Museum of Westward Expansion.

Visitors can also access the Memorial from the west by crossing Memorial Drive or disembarking from a bus near the Old Cathedral. From the east, visitors can access the Memorial by walking up the grand staircase or the stairways to the north and south overlooks from Leonor K. Sullivan Boulevard.

3.9.2 Environmental Consequences

3.9.2.1 Methodology

Impacts on transportation and access would be minor if small areas needed to be cordoned off for short periods during construction and the resulting detours were fairly short. Impacts would be moderate if substantial detours around work areas needed to be established for periods of time less than one year to preclude access. Impacts would be considered major if there were to be any permanent changes to existing walkways or access points to the Memorial, or if closures of existing walkways for periods exceeding one year were to be required.

3.9.2.2 No Action Alternative

Tree removal activities under the No Action Alternative would continue based on current operational procedures. During tree removal activities, there may be temporary closures of walkways or portions of walkways to visitors. During periods of active construction, pedestrians would be directed around the construction areas. If entire walkways were to be closed, the alternate travel routes would be slightly longer. Overall, the No Action Alternative would have a minor impact on pedestrian circulation.

3.9.2.3. Proposed Action

Under the Proposed Action, pedestrian circulation on the Memorial grounds would be altered during tree removal. The impacts to pedestrian circulation would be greater than under the No Action Alternative because the construction area would likely be larger as multiple trees, and potentially an entire allée, would be removed and replanted in each phase. In addition, the pedestrian circulation would likely be altered for a longer period of time.

During construction, visitor circulation in key areas of Memorial grounds (e.g., parking garage to the Gateway Arch, Luther Ely Smith Square to the Gateway Arch, Leonor K. Sullivan Boulevard to the grand staircase and north and south overlooks) would be maintained to the greatest extent possible. If main walkways along these key routes would need to be closed, alternate routes with adequate signs would be provided during tree removal activities. Depending on the extent of the required detours, alternate routes could be substantially longer when compared with the direct pedestrian routes along the allées. Access and pedestrian circulation would return to normal patterns after construction was complete.

Construction staging areas would be located in areas that would provide convenient access for construction staff as well as minimize conflicts with visitors to the Memorial, as well as where resource impacts would be minimized (for instance, away from tree roots). Depending on the location selected for staging areas, pedestrian circulation may be temporarily affected, particularly during deliveries of supplies or to accommodate the safe movement of construction and maintenance vehicles. Overall, the Proposed Action would have a moderate short- to medium-term impact on transportation and access, particularly during the fall season when the trees would be removed and replanted. Impacts could be minimized if the periods of greatest construction activity were to occur after Labor Day, when visitation to the Memorial tends to decrease.