Chapter 13. Methodologies

In the interest of brevity and readability, it might seem logical to describe methodologies solely in appendices or elsewhere outside the NEPA document. But there are good reason to describe methodologies, at least briefly, within the main volume of the document.

- Describing the methodology can enhance the credibility of the NEPA document by helping the reader to see the careful, systematic process that was used to reach the results.
- Describing the methodology can be a useful a way to explain anomalies in the data. In some cases, the results may be misleading if the reader does not understand how they were developed.
- Describing the methodology can be a useful way to introduce technical terms or concepts that are important for the reader to understand e.g., how noise levels are measured.

The following approaches can be used to discuss methodologies in the main body of the NEPA document, without adding excessive detail:

- Include a methodology section just before the impacts analysis for each resource. Many NEPA documents include a brief description of the relevant methodology just before the impacts analysis for each resource. For example, the methodology for noise analysis can be summarized at the beginning of the chapter or section that presents the noise impacts.
- *Explain methodologies in steps.* One effective way to describe a methodology is to list the steps in bullets or a table. Even a complex process is easier to understand if it is broken down into steps.
- *Prominently define important technical terms.* If a technical term is used, and is important to the analysis, the NEPA document should define it early and display the definition prominently (for example, in a text box).

- *Explain noteworthy changes in methodologies.* There are times in any NEPA process when a methodology changes, or new data becomes available, or there is some other change that alters the results of the previous analysis. When this happens, the credibility of the analysis is enhanced if the EIS acknowledges and explains the change.
- Address any over-arching methodology issues at the beginning of the environmental consequences chapter. The introduction to the environmental consequences chapter is a good place to address any over-arching issues regarding the methodology for impact assessment – for example, explaining the use of GIS mapping to calculate impacts.

Methodologies Briefly Explained

(with details in appendix)

- MD: Baltimore Red Line Visual Impacts
- WA: SR 520 FEIS Cumulative Impacts

which MTA may acquire real property through a negotiated purchase or through condemnation.

5.7 Visual and Aesthetic Resources

5.7.1 Introduction and Methodology

The approach for identifying and analyzing effects to visual and aesthetic resources for the Red Line project applies a modified version of the Federal Highway Administration (FHWA) Visual Impact Assessment for Highway Projects. The FHWA methodology provides seven main components, which are addressed as follows in this section. Additional details regarding methodology for assessment and potential effects are available in the *Visual and Aesthetic Resources Technical Report* (Appendix D).

- <u>Define Project Viewshed/Setting</u>: The "project viewshed" generally encompasses the existing natural and manmade physical features that are located within 200 feet adjacent to the Preferred Alternative and up to 3 miles where longer-range views are possible. Five visual districts have been identified within the project viewshed to facilitate the assessment of visual and aesthetic conditions that may be affected from the introduction of the Preferred Alternative.
- 2. <u>Determine Viewer Groups</u>: Each visual district/sub-district was reviewed to identify the major groups of viewers who would be affected by the new visual elements of the project. Such groups might include residents; workers who are employed by businesses in the district; visitors who come to the district to access entertainment, cultural, educational, or other commercial venues in the district; and, transit riders, pedestrians, cyclists or motorists who travel through the district to locations within or outside of the district.
- 3. <u>Identify Key Viewpoints and Views and Assess Visual Quality</u>: The FHWA methodology calls for identifying very specific key viewpoints and coming up with a numerical assessment of "visual quality" based on three factors: "vividness," "intactness," and "unity," resulting in a numerical qualification of the relative value of the identified landscape. Given the diverse nature of the areas and communities through which the Preferred Alternative passes, it was determined that making a numerical judgment as to the quality of a particular visual environment would be inconsistent with the *Community Compact*. An alternative methodology was therefore applied in which both general and key views were identified and a neutral determination of the "compatibility" of the project components with the identified context was assigned.
- 4. <u>Analyze Changes in Existing Visual Resources and Viewer Response</u>: Visual change is a function of the ease of visibility of the project component and/or the amount the project component effects on existing view. Viewer response is subjective, and thus is best analyzed by applying presumed sensitivity ratings for particular identified viewer groups. In general, it is assumed that there is a direct relationship between the amount of exposure to the district by the viewer group and that group's sensitivity to changes. Similarly, it is also assumed that a viewer group's sensitivity rises with the amount that group identifies, or feels invented in, the district. Thus residents are perceived as having a higher sensitivity than workers, even if they might have a similar amount of exposure to the district.



- 5. <u>Depict Visual Appearance with the Project</u>: The Final Environmental Impact Statement (FEIS) and associated technical memoranda provide verbal descriptions and image visualizations of a range of physical components that comprise the project. These components will continue to be defined through Final Engineering, but are described to the level known at this time.
- 6. <u>Assess the Project's Visual Impacts</u>: The visual effect of the Preferred Alternative is assessed by weighing four factors: 1) the nature of the project components, 2) the context in which those components are placed, 3) the changes to the visual landscape and 4) the viewer's response to those changes.
- 7. <u>Propose Methods to Mitigate Adverse Visual Impacts</u>: A high level of visual impact does not necessarily imply that the visual effect is negative. Instead, the adverse nature of a visual effect must be determined through input from affected viewer groups, with regard to the positive or negative perception of a visual impact. Potential adverse visual impacts can be avoided decreasing the visibility of a design component or, making the component similar to existing context. Further identification of visual effects and appropriate mitigation would be defined in conjunction with community involvement through the Final Design.

Based on the criteria described above, general visual effects were assigned a rating of low, medium, or high as dependent on these factors: the nature of a project component, contextual compatibility between the visual component and its surroundings, changes to the visual landscape as a result of the visual component, and viewer sensitivity. A more detailed discussion of how the general visual effects ratings were assigned follows.

a. Nature of the Project Component

The nature of the project component refers to the design, size, and type of the project element. **Table 5-14** summarizes the types of project components that comprise the Preferred Alternative. Also identified is the anticipated level of effect that would result from the introduction of the component into the project viewshed. The project components are more fully described in **Chapter 2, Section 2.4.2** of this FEIS. The level of general visual effect reflects the visibility of a component absent from context, location, or exposure to a specific viewing group. Therefore, the level is a reflection of the components design, size, and type.

Component	General Visual Effect		
1. Overhead Catenary System (OCS)	Medium to High		
2. LRT Tracks			
-Ballasted	Medium to High		
-Direct Fixation	Medium		
-Embedded	Low		
-Green Track	Low		
3. Transitway			
-Aerial	High		
-At Grade	Medium		
-Underground	Low		



7.2 Why are cumulative effects considered in an EIS?

Federal regulations (40 CFR 1502.16, 1508.7, 1508.8) require that cumulative effects be considered in an EIS because they inform the public and decision-makers about possible unintended consequences of a project that are not always revealed by examining direct effects alone. This information places the proposed action in context with other development and transportation improvement projects planned throughout a region, and provides a brief assessment of each resource's present condition and how it is likely to change in the future as a result of the cumulative effect.

7.3 How did WSDOT assess cumulative effects?

To identify and evaluate likely cumulative effects and the extent to which the project would contribute to them, WSDOT first reviewed the general guidance in Section 412 of the *Environmental Procedures Manual* (WSDOT 2009j) and in FHWA Technical Advisory T 6640.8A (FHWA 1987). Next, it followed the eight-step procedure set forth in *Guidance on Preparing Cumulative Impact Analyses* (WSDOT et al. 2008), shown in Table 7-1.

Table 7-1. WSDOT's Approach for Assessing Cumulative Effects		
Step	Approach	
1	Identify resources to consider	
2	Define the study area for each resource	
3	Describe current status/viability and historical context for each resource	
4	Identify direct and indirect project effects that might contribute to a cumulative effect	
5	Identify other current and reasonable foreseeable actions	
6	Identify and assess cumulative effects	
7	Document the results	
8	Assess the need for mitigation	

Source: WSDOT et al. 2008.

WSDOT conducted cumulative effects assessments for the same resources for which direct and indirect effects assessments were conducted (discussed in Chapters 5 and 6). WSDOT made two general assumptions in following the guidance: first, in most cases it considered construction-related effects to be short-term, with the effect ending at the same time as the construction activity causing it. Secondly, operational effects of the project were considered to be long-term and permanent through the project design year, 2030.

Unusual/Complex Methodology Issues Are Explained

(e.g., where the appropriate methodology was uncertain)

- MD: Red Line FEIS use of thresholds in EJ analysis
- UT: West Davis Corridor FEIS effects of noise on wildlife
- UT: West Davis Corridor FEIS waters of the U.S.
- UT: West Davis Corridor FEIS environmental justice

Techniques to note: - explanation of methodology specifically describes and explains assumptions that are important to the analysis (in this case, how "low-income" areas were defined)	December 2012 s, such as diesel particulate filters, for up to 80 percent lipment rting excavated materials or other loose materials lel for diesel equipment
--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------

- For areas identified with moderate or severe impacts for noise during LRT operations, MTA will identify mitigation measures where practicable and reasonable during final design
- For areas identified with the potential for vibration impacts during LRT operations, MTA will identify mitigation measures that are both feasible and reasonable during final design
- MTA will provide noise and vibration control measures during construction whenever feasible and reasonable in accordance with applicable local and MDE noise ordinances. Such measures could include the following:
 - Construction methods that avoid pile-driving at locations containing noise- and vibration-sensitive receptors, such as residences, schools, and hospitals. Whenever possible, cast in place drilled hole (CIDH) or drilled piles rather than impact pile drivers will be used to reduce excessive noise and vibration
 - $\circ\,$ Development and implementation of a vibration monitoring program during construction.
 - Where practical, erect temporary noise barriers between noisy construction activities and noise-sensitive receptors.
 - Locate construction equipment and material staging areas away from sensitive receptors, where applicable.
 - Use best available control technologies to limit excessive noise and vibration when working near residences.
 - Notify the public of construction operations and schedules. Methods such as construction-alert publications or a Noise Complaint Hotline could be used to handle complaints quickly.

5.4 Environmental Justice

5.4.1 Introduction and Methodology

Executive Order 12898 – Federal Actions to Address Environmental Justice in Minority and Low-Income Populations requires all Federal agencies to "develop an agency-wide environmental justice strategy that identifies and addresses disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations." The United States Department of Transportation (USDOT) and the Federal Transit Administration (FTA) policies on environmental justice are included in USDOT Order 5610.2(a), *Final DOT Environmental Justice Order* (USDOT 2012) and in FTA Circular 4703.1, Environmental Justice Policy Guidance for Federal Transit Administration Recipients (FTA 2012). The strategies developed under Executive Order 12898 and the USDOT and FTA policies on environmental justice are intended to ensure that there is no discrimination based on race, color, or national origin; that communities are provided the opportunity to provide input on the planning and design of a project, as well as potential effects and mitigation measures; and that any disproportionately high and adverse effects on minority or low-income populations are appropriately addressed.

The environmental justice (EJ) analysis in this chapter describes the potential human health and environmental effects on minority and low-income neighborhoods that would result from the construction and operation of the Preferred Alternative, and evaluates whether those effects would be disproportionately high and adverse.

a. Definitions of "Minority" and "Low-Income"

Executive Order 12898, itself does not define the terms "minority" or "low-income," but these terms have been defined in the USDOT and FTA orders on environmental justice. The USDOT and FTA Orders provide the following definitions, which have been used in this analysis:

- Minority Individual The US Census Bureau classifies a minority individual as belonging to one of the following groups: American Indian or Alaskan Native, Asian American, Native Hawaiian or Other Pacific Islander, Black (not of Hispanic Origin), and Hispanic or Latino.
- Minority Populations Any readily identifiable groups of minority persons who live in geographic proximity, and if circumstances warrant, geographically dispersed/transient persons (such as migrant workers or Native Americans) who would be similarly affected by a proposed FTA program, policy, or activity.
- Low-Income Individual A person whose household income is at or below the US Department of Health and Human Services poverty guidelines.
- Low-Income Population Any readily identifiable group of low-income persons who live in geographic proximity, and, if circumstances warrant, geographically dispersed/transient persons (such as migrant workers or Native Americans) who would be similarly affected by a proposed DOT program, policy, or activity.

b. Identifying Minority and Low-Income Populations in the Project Study Area As a tool for evaluating the proportionality of impacts and benefits, this analysis identifies "EJ areas" and "non-EJ areas" within the project study corridor. An "EJ area" was defined to include any census tract in which the minority or low-income population meets either of the following thresholds:

- a) the minority or low-income population in the census tract exceeds 50 percent, or
- b) the percentage of a minority or low-income population in the affected area is "meaningfully greater" than the percentage of minority population in the general population.

For this study, "meaningfully greater" was defined to mean a census tract in which the percentage of minority or low-income residents was at least 10 percentage points more than

the corresponding percentage in the surrounding jurisdiction (Baltimore City or Baltimore County) within the project study corridor.

The use of thresholds for identifying EJ areas was based on the Council on Environmental Quality (CEQ) guidance document, *Environmental Justice Guidance under the National Environmental Policy Act* (NEPA) (CEQ 1997). This approach was used in the Alternatives Analysis/Draft Environmental Impact Statement (AA/DEIS), which identified EJ and non-EJ areas bases on the criteria described above. On August 15, 2012, FTA issued Circular 4703.1, which does not adopt the CEQ's approach and instead calls for EJ analyses to include "reasonable efforts to identify the presence of distinct minority and/or low-income communities residing both within, and in close proximity to, the proposed project, or activity." The guidance also cautions that "While the minority or low-income population in an area may be small, this does not eliminate the possibility of a disproportionately high and adverse effect of a proposed action."

For consistency with the approach used in the AA/DEIS, this Final Environmental Impact Statement (FEIS) continues to identify EJ areas based on a threshold approach. In accordance with Circular 4703.1, this FEIS also considers the potential for EJ populations outside areas identified as "EJ areas."

c. Data Sources

- *Minority Populations*. The US Census 2010 tract level data provided the basis for establishing the location of minority populations in the project study corridor.
- *Low-Income Populations*. Income data was obtained from the American Community Survey (ACS) 2010 5-year estimate at the census tract level.
- Other data sources that were used to confirm the location of minority and low-income populations included information and data from the National Center for Educational Statistics (NCES), government assisted housing programs, historical references, City and County officials, field visits, community meetings and interviews and a review of revitalization efforts within the project study corridor.

5.4.2 Existing Conditions

The project study corridor for the Preferred Alternative includes all or parts of 55 census tracts (47 in Baltimore City and 8 in Baltimore County). The total population in the project study corridor is 162,287 persons, with 117,500 of these persons (72.4 percent) identifying themselves as minorities and 33,798 persons (20.8 percent) meeting the definition of low-income. **Figure 5-4** presents the EJ areas and non-EJ areas within the project study corridor, and also illustrates the 1,000 foot potential impact area beyond the project's limit of disturbance. The impact area was used in the analysis to estimate impacts that extend beyond the limit of disturbance.

Table 5-4 presents a summary of population data including the percentages for minority and low-income persons. The census data revealed that the project study corridor census tracts located within Baltimore County contained a percentage of minority persons (15.5 percent)



Techniques to note: - explains what is and it not known regarding a topic that is the subject of ongoing research, and for which there is no established methodology for assessing a highway project's impacts

14.4.3.3 Wildlife Noise Impacts

Overview of Noise Impacts

The effect of construction and traffic noise on wildlife has been an ongoing topic of research in the transportation industry. In the last decade, several studies have been published on the effects of human-induced noise on wildlife, though no conclusive distance of effect from roads has been determined. Few noise studies have been conducted for invertebrates, reptiles, or amphibians, but more studies have been conducted for fish, birds, and mammals. For birds, noise can have a substantial effect; however, the results are not consistent or universal. Some species are adversely affected, many are unaffected, and others become more common near interstate highways (Peris and Pescador 2004; Kaseloo 2005; FHWA 2007; Parris and Schneider 2009).

Possibly the greatest effect of noise on wildlife is its interference with communication if traffic noise is in the same decibel range as the audible communication range for a species. Birds use vocal signals to communicate information on many aspects of their status and behavior that are important for survival, social cohesion, and reproductive success. Songs and calls function to identify the caller's species, sex, age (experienced adult versus juvenile), territorial status, and motivational state (such as aggressive or submissive); to attract mates and repel rivals; to stimulate egg laying and synchronize hatching; to strengthen pair bonds; to signal changes in domestic duties; to entice young to eat; to warn of predators; to maintain flock cohesion; and to incite group mobbing action against intruders (FHWA 2007; Dooling and Popper 2007). Therefore, the life history period during which most species would be most sensitive to added noise from the WDC is the reproductive period, which is generally in the spring through mid-summer for most species.

Many species have complex vocal repertoires of songs and calls that can vary subtly in many ways, including frequency and timing of use, intensity (amplitude variation), and syntax (order of signal presentation). Clear transmission and reception of these signals and the subtleties of their variation are critical for maintaining the normal biological and ecological function of each species. Other noise effects include stress and damage to hearing (Dooling and Popper 2007).

Impacts from increases in noise levels could also cause an overall reduction in functional habitat area, reduce connectivity between habitats, and introduce barriers to dispersal for some species (Forman and others 2003). The reduced habitat size could decrease the habitat resources available to wildlife, which in turn would reduce the local carrying capacity (Seiler 2001; Torres and others 2011). These changes could reduce the ecological buffering capacity of the habitat areas and thus affect wildlife. These effects would be greater in previously undisturbed native habitats than in either urban or disturbed partially native habitats where species that are able to thrive in such places have presumably adapted to the increased levels of noise and other disturbances.

Highway noise typically is neither loud nor startling enough to cause marked stress effects on wildlife (Sarigul-Kligin and others 1977). However, highway noise can mask important vocal communication and natural sounds important for mate attraction, social cohesion, predator



avoidance, prey detection, navigation, and other basic behaviors. Using birds as an example for explaining how noise created from highways can affect a wildlife species, vocal communications can be masked when highway noise interferes with the transmission of a sound by drowning out the sound or parts of the sound (for example, the low-amplitude elements of a bird song) or by degrading the sound to a point where it is no longer recognizable to other members of a species (Dooling and Popper 2007).

Depending on the degree of masking and the particular species' capacity to adapt (for example, by singing louder), sound masking could cause a species to abandon an area or could reduce the species' ability to reproduce and survive (Halfwerk and others 2011). Sound masking could also prevent males from attracting mates or repelling territorial rivals. Additional energy could be

What is masking?

Masking is the direct interference of sound with effective communications between organisms.

required for a male bird to maintain a territory and to sing louder or alter the frequency of its song (Patricelli and Blickley 2006; Parris and Schneider 2009). Predator warning signals and parent-offspring signals can be impaired. All of these factors could reduce the survival and reproductive success of affected populations adjacent to the highway.

Not all bird species are affected the same way by noise. These masking effects are highly species-specific and depend largely on the unique bioacoustic characteristics of each species' vocal signals. Some species might be more tolerant of increased noise or might be able to adapt their communications by modifying the pitch or speed of their song (Slabbekoorn and den Boer-Visser 2006; Leonard and Horn 2008; Summers and others 2011). The distance at which a species could be affected by noise can extend from less than 125 feet to much greater than 3,500 feet from the highway (Benitez-Lopez and others 2010).

Noise effects might not apply equally to other groups, such as reptiles and amphibians, because of differences such as calling at night instead of the daytime (Herrera-Montes and Aide 2011). In addition, the effects of roads on reptiles and amphibians appear to be local and likely due to highway-related deaths or creating a barrier to movement. Mammals (particularly large species) might avoid highway noise, but other road effects are likely involved (Fahrig and Rytwinski 2009; Benitez-Lopez and others 2010). However, there is evidence for smaller mammal species that noise might be less important than the additional habitat and corridors for movement that could be provided by roads (FHWA 2007).

Legacy Parkway Avian Study

The Legacy Avian Noise Research Program was designed to assess the impacts of highway noise on breeding bird communities in the Great Salt Lake ecosystem in an area that is similar to the WDC study area. This section discusses the findings of the final report that summarizes and provides conclusions based on 4 years of data collection (2007–2010) (Bio-West 2011). The effects of highway noise on breeding bird communities were assessed at nine study sites throughout the Great Salt Lake ecosystem by measuring effects of noise on (1) the abundance, diversity, and richness of breeding bird communities and (2) the nesting success of two abundant and widespread semicolonially nesting shorebirds: the American



<u>Techniques to note</u>: - explains how an existing methodology was adapted for this study, with input from regulatory agencies

The WDC team analyzed the effect of each alternative on the non-inundated habitat that would remain with the high and intermediate lake levels specified above. For each alternative, the analysis summarized, by habitat quality, the acres of directly affected wildlife habitat and the percent of the total non-inundated wildlife habitat for each of the lake levels that these direct impacts would represent.

14.4.1.2 Methodology for Identifying Impacts to Wetlands and Waters of the U.S.

The Clean Water Act mandates an evaluation to	What is a Section 404
determine a proposed project's least environmentally	individual permit?
damaging practicable alternative; USACE uses this	Section 404 of the Clean Water Act
determination when deciding whether to issue a Clean	regulates the discharge of dredged,
Water Act Section 404 permit. This mandate was	excavated, or fill material in waters
considered when assessing impacts to wetlands and other	of the U.S. USACE is the federal
waters of the U.S.	agency authorized to issue
Assessment of wetland quality, in terms of functions and values, was also conducted using a methodology developed by the WDC team with cooperation from agencies such as USACE, EPA, and USFWS (HDR 2010b). In consultation with the resource agencies, the WDC team developed a streamlined version of the UDOT Functional Assessment (UDOT 2006) to characterize wetlands affected by the WDC so that this EIS co wetlands affected by the project alternatives.	Section 404 permits for certain activities conducted in wetlands or waters of the U.S. An individual permit is required for activities that would potentially affect jurisdictional wetlands that exceed 0.5 acre or 300 linear feet of stream.

Note that the GIS data layer describing wetlands and waters of the U.S. that was used for the direct and indirect wetland and waters of the U.S. analyses has not been approved by USACE and is not a formal wetland delineation. USACE and the WDC team agreed that a formal wetland delineation report would be submitted for the selected alternative and would be submitted with the Clean Water Act Section 404 permit application.

Direct Impacts within the Right-of-Way

Impacts to wetlands and other waters of the U.S. from the project alternatives were calculated and assessed using the wetland and water feature data. A GIS analysis, which overlaid each alternative's footprint on the wetlands and waters data, was performed to calculate the acreage of directly affected wetlands and waters. The directly affected wetlands were classified by quality and type for each alternative. Linear feet of all linear waters (not ponds and lakes) were also calculated by overlaying the alternative's footprint onto the water feature layer and then measuring the linear feet of each feature that would be affected by the WDC alternative.



Techniques to note:

- justifies an important assumption used in the impacts analysis (in this case, why a 300-foot buffer was used when assessing wetland impacts)

Impacts within 300 Feet of the Right-of-Way

Potential impacts to wetlands and other waters of the U.S. adjacent to the project alternatives were calculated and assessed using a 300-foot buffer from the right-of-way on each side (West Davis Corridor Team 2012a). Studies have shown that buffers between roadways and other human uses can limit the water quality disturbance to wetlands from silt, urban contaminants, and nutrients. A study conducted by USACE (Lin 2006) found that buffers between about 100 and 200 feet effectively protect water resources, and buffers of about 100 feet provide adequate protection of 77% of wetland-dependent species.

The study *Functional Assessment of the Great Salt Lake Ecosystems Slopes and Depressional Wetlands* (Keate 2005) used 300 feet as the area potentially affected by runoff from adjacent land uses. The study recommends using a 300-foot perimeter around a wetland to assess impacts from adjacent land uses for non-wildlife-related impacts. Another study (Miller 1997) concluded that buffers less than 15 to 30 feet provide little protection for aquatic resources. Buffers should be a minimum of 45 to 90 feet under most conditions. The lower range (45 feet) is necessary for maintaining physical and chemical protection, while the upper range (90 feet) is a minimum for protecting biological components.

Based on the literature cited above, most water quality effects (from silt, nutrients, and urbanrelated contaminants) and hydrology effects to wetlands occur within 300 feet of the source of the impact (in the case of the WDC, the source would be the paved roadway). Therefore, for the EIS analysis, the WDC team used 300 feet from the edge of the right-of-way, which provides a total distance of about 350 feet from the edge of the roadway pavement. However, stormwater from the WDC would be detained and would not flow into adjacent wetlands, so the water quality of the wetlands would likely not be affected.

For each alternative, the acreage of wetland and water features within the 300-foot buffer was calculated and classified by quality and type. Note that the 300-foot buffer represents only an area of potential indirect effects to wetland water quality. A full assessment of indirect impacts to wetlands adjacent to the right-of-way would be completed as part of the Clean Water Act Section 404 permitting process after wetland delineations have been completed and verified by USACE for the selected alternative.

14.4.2 No-Action Alternative

With the No-Action Alternative, the WDC would not be constructed. No direct impacts to ecosystem resources would occur from WDC-related activities. Other transportation projects identified in the Wasatch Front Regional Council's (WFRC) Regional Transportation Plan and by local communities would be constructed. These projects, along with other future projects, could affect ecosystem resources in the future.

As development continues on the west side of Davis and Weber Counties, previously undeveloped land—mostly consisting of farmland and pasture land that provides some wildlife habitat—would be lost. The Utah Governor's Office of Planning and Budget has projected that there could be 66,000 acres of new development between 2005 and 2040, most of which would occur on farmland and pasture land (GOPB 2008). The No-Action



<u>Techniques to note</u>: - explains why the methodology did not follow recommendations in guidance (in this case, CEQ's recommendation to use census data)

6.3 Affected Environment

6.3.1 Methodology

The WDC team defined minority and low-income people and identified specific environmental justice populations, communities, and individual residences using the following methods:

- Examining the 2010 U.S. Census data for minority populations
- Examining the U.S. Census Bureau's American Community Survey for low-income populations (U.S Census Bureau 2012).
- Examining student data from local schools
- Holding meetings with local city and county officials
- Holding meetings with and gathering data from the area's housing authorities, including data about Section 8 housing
- Interviewing low-income and minority community and social service providers and minority chambers of commerce
- Holding meetings with Departments of Community and Economic Development and the Utah Housing Corporation (which provides loan assistance)
- Analyzing data using geographic information systems (GIS) software
- Performing fieldwork

Even though CEQ specifically recommends using census data, these data have some limitations as a basis for identifying minority and low-income populations (which are also referred to as *communities* in this EIS) and therefore can be misleading. For example, large census tracts in rural or relatively unpopulated areas do not identify the specific locations of low-income and minority populations or individuals.

What are census tracts and block groups?

Census data are reported by geographical areas called *census tracts* and smaller areas within the census tracts called *block groups*.

Since the WDC study area does have large, sparsely populated census tracts, other methods suggested by CEQ were also used to identify minority and low-income populations in addition to census data. A summary of the census data regarding minority and low-income communities is shown in Figure 6-1, Distribution of Minority Population by Census Block; Figure 6-2, Distribution of Hispanic or Latino Population by Census Block; and Figure 6-3, Distribution of Poverty Population by Census Tract, in Volume IV.

Furthermore, both Weber and Davis Counties as a whole have low average percentages of minority and low-income populations (see Section 6.3.3, Environmental Justice Populations). If an area has a slightly higher percentage of minority or low-income populations than the county average (for example, 11% compared to a county average of 10%), this might not mean that there is a high concentration of environmental justice populations, only that the



area's average is above the county average. Since FHWA recommends against using specific thresholds to determine the presence of environmental justice populations, this EIS considers the context of the area (such as the presence of low-income housing, ethno-centric facilities, and other factors) as well as demographic statistics to identify environmental justice populations.

To refine the census data, the WDC team contacted organizations including minority community representatives and service providers, low-income service providers, and city economic and community planners (West Davis Corridor Team 2011). The team then consolidated the information that was obtained and plotted it on a map of the impact analysis area. This map was analyzed to determine the number and location of environmental justice populations.

Census data for minority populations in the impact analysis area are shown in Figure 6-1, Distribution of Minority Population by Census Block, and Figure 6-2, Distribution of Hispanic or Latino Population by Census Block, in Volume IV. Census data for low-income populations are shown in Figure 6-3, Distribution of Poverty Population by Census Tract, in Volume IV. Information that was identified through direct contact with government and community entities or site visits is also shown on the figures and is included in the *Environmental Justice Technical Memorandum* (West Davis Corridor Team 2011).

6.3.2 Public Outreach

A primary goal of environmental justice is to reach low-income and minority populations that have historically not been able to participate in the transportation decision-making process as readily as other groups (see Chapter 30, Public and Agency Consultation and Coordination). The WDC team made specific efforts to contact all people living in the study area, including any low-income or minority populations.

The information gathered from the outreach was used to identify the environmental justice populations and service providers discussed in this chapter. The purpose of the outreach for the WDC Project was not only to identify low-income and minority populations but also to identify community service providers, recreational facilities, schools, and other areas or facilities that could be used by these populations and that could be affected by the WDC.

The area near the project alternatives consists of single-family residences with no apartment complexes. Overall, the home ownership rate within the cities in the impact analysis area is about 86%, although this number could be higher in the impact analysis area, since some cities extend to areas east of Interstate 15 (I-15), outside of the study area, where many of the apartment units are located near I-15. For comparison, Davis and Weber Counties had home ownership rates of 78% and 73%, respectively. Given the high home-ownership rate in the impact analysis area, direct mailers were used as one of many ways to inform residents.

Changes in Methodology Are Summarized

OR: OR 62 FEIS - change based on USFWS comment

www.environment.transportation.org

DI Alternative

Aquatic Species and Habitat

The DI Alternative would have many of the same indirect impacts as the SD Alternative, but some key differences exist:

- Habitat access and fish passage barriers The DI Alternative would not cross Bear Creek. However, for all other API streams, the DI Alternative would construct the same number of new and replacement stream crossings as the SD Alternative (Table 3.13-4). All new and replacement stream crossings would be constructed to be fish passable.
- Loss of Riparian Habitat The DI Alternative would not remove any Bear Creek riparian habitat. It would remove the same amount of riparian habitat as the SD Alternative for all other API streams.
- Water quality impairment Water quality impairment impacts are quantified by impervious surface acreage. The DI Alternative would create 12.5 acres of net new impervious surface within the Bear Creek watershed (1.6 acres less than the SD Alternative) and approximately the same (within 0.1 acre) of net new impervious surface within all other API stream watersheds.
- Stream Flow Modification Impacts on fish from stream flow modification are quantified by impervious surface acreage, which is guantified above for the DI Alternative.
- Predator-prey interactions Impacts on predator-prey interactions are quantified by number of stream crossings, net new impervious surface acreage, and riparian habitat removal, which are all quantified above for the DI Alternative.

Terrestrial Wildlife Species and Habitat

The DI Alternative would have similar indirect impacts on vernal pools. It would indirectly impact 0.1 acre more than the SD Alternative. The DI Alternative would impact the same amount of vernal pool fairy shrimp designated critical habitat as the SD Alternative (19.8 acres). Figure 3.13-2 shows the differences in impacts between the SD and DI Alternative. Figure 3.13-3 shows the differences in indirect impacts between design options. Figure 3.13-4 shows indirect impacts in the northern portion of the project, where the build alternatives are identical and there are no design options.

The methodology used to calculate indirect impacts to vernal pool fairy shrimp. designated critical habitat was modified by the USFWS in March 2013. The revised method was employed to refine impact numbers reported in the 2011 Biological Assessment submitted by FHWA to USFWS. The original methodology for calculating indirect impacts to critical habitat looked only at areas where the project boundaries overlapped the critical habitat polygons. Under the revised methodology, indirect impacts are considered only for impacts where the 250-foot project buffer overlaps delineated vernal pool complexes (delineated vernal pool basin plus the 100-foot upland buffer) that occur within critical habitat polygons. Consequently, the impact values have decreased from those reported in the DEIS. Under the revised assessment methodology, there are no anticipated indirect impacts to vernal pool fairy shrimp critical habitat from the preferred alternative. Table 3.13-5 includes the revised acreage impacts associated with the Preferred Alternative.

Plant Species and Habitat

The DI Alternative would have the same indirect impacts on Cook's lomatium and large-flowered woolly meadowfoam designated critical habitat as the SD Alternative.

The methodology used to calculate indirect impacts to critical habitat for Cook's Iomatium and large-flowered woolly meadowfoam was modified by the USFWS in March 2013, Under the revised assessment methodology, indirect impacts to Cook's lomatium critical habitat decreased by 6.6 acres, to a total of 4.7 acres. Indirect impacts to large-flowered woolly meadowfoam critical habitat decreased by 28.5 acres, to a total of 0.3 acre. Impacts to individuals of the species have not changed from those reported in the DEIS. Table 3.13-5 includes the revised acreage impacts associated with the Preferred Alternative.

3 - 360 CHAPTER 3: Affected Environment, Environmental Consequences, and Avoidance, Minimization, and/or Mitigation Measures

Techniques to note: - explains noteworthy changes in methodology that were made during the course of the NEPA process.

Cross-Cutting Issues Are Explained Early in Effects Chapter

(e.g., methodology for impacts analysis in tiered EIS)

- CO: I-70 tiered approach
- IN: I-69 tiered approach

What is the general methodology for the natural and human environment resource evaluations?

The Project Leadership Team and Issue Task Force processes identified the main natural and human environment resource issues. Chapter 6, Public and Agency Involvement provides more information on the following:

- Resource agency input,
- Workshops with jurisdictions and special interest groups,
- Public comment, and
- Data sources.

Resource and built environment specialists collected data through the use of geographic information systems, public databases, published resources, and fieldwork.

The natural and human environment resource subsections describe more specific methodologies. Techniques for assessing impacts of the alternatives at the Tier 1 level of analysis include geographic information systems resource mapping overlaid with the project footprint, alternative design interpretation, and modeling. The project footprint includes the physical conceptual footprint of the alternatives, plus an additional 30 feet on each side. The 30 feet includes a 15-foot construction disturbance zone and an additional 15-foot sensitivity zone. Alternative designs at Tier 1 are conceptual and provide detail appropriate for a first tier assessment to assess the types of impacts that could occur and compare Action Alternatives and their relative impacts. While this level of detail is adequate to make the decisions of general location, mode, and capacity at the Tier 1 level, specific locations and design decisions will be refined during Tier 2 processes. At that time alignments and alternatives and their corresponding impacts will be evaluated.

How did the lead agencies collect and update data for environmental analyses?

This project started in 2000. Some of the initial data collection to characterize the Corridor's affected environment occurred early in the study process – between 2001 and 2004 – and has not been updated. As time progressed, the lead agencies evaluated changes in the Corridor (such as development, land use, wetlands, biological resources, water quality, air quality, and visitation trends), and broader factors (such as economic conditions, gasoline prices and oil supply, and regulatory trends), to determine if these data remain representative of the Corridor conditions and provide a reasonable baseline to compare environmental impacts of the Action Alternatives. The lead agencies identified resources that might be sensitive to changes to evaluate whether data needed to be updated and, if necessary, updated those data accordingly. In most cases, the data collected in the early part of this study still accurately characterize resource conditions in the Corridor. Updating the data would not result in a discernible difference in the comparative analysis due to the relatively stable conditions in the Corridor over the last decade and because small variations in the existing conditions have little effect at the Tier 1 level when comparing impacts in 2035 or beyond. As Tier 2 processes are undertaken, new and often more detailed data will be collected and analyzed. Each resource area includes a discussion related to the validity of the data used for the comparative analysis.

How were impacts quantified?

For purposes of presenting impact quantities in this document, the Combination alternatives include the Six-Lane Highway and Rail with Intermountain Connection, Six-Lane Highway with Advanced Guideway System, and Six-Lane Highway with Bus in Guideway. The Preferred Alternative is also a Combination alternative. These following eight Preservation Alternatives are quantified within the category of Combination alternatives:

- Combination Six-Lane Highway with Rail and Intermountain Connection, Preserve for Highway Alternative
- Combination Six-Lane Highway with Rail and Intermountain Connection, Preserve for Transit Alternative
- Combination Six- Lane Highway with Dual Mode Bus in Guideway, Preserve for Highway Alternative
- Combination Six-Lane Highway with Dual Mode Bus in Guideway, Preserve for Transit Alternative
- Combination Six-Lane Highway with Diesel Bus in Guideway, Preserve for Highway Alternative
- Combination Six-Lane Highway with Diesel Bus in Guideway, Preserve for Transit Alternative
- Combination Six-Lane Highway with Advanced Guideway System, Preserve for Highway Alternative
- Combination Six-Lane Highway with Advanced Guideway System, Preserve for Transit Alternative

The Preservation Alternatives are not presented separately in this document because they are all assumed to be built, so that the components that are "preserved" or "not precluded" are actually constructed and operating in 2050. These Preservation Alternatives become phasing options for implementing whichever Combination Alternative contains those same components.

How and in what order specific components of the Combination alternatives are built create subtle differences in impacts on various resources. These could include differences such as:

- Economic or community impacts of a longer or two phased construction period
- Increases in overall construction costs because of a need to pay for mobilization of labor and materials twice
- Greater responsiveness to funding sources

The Highway alternatives and highway components of the Combination alternatives have greater construction impacts on Clear Creek County than the Transit alternatives due to the constrained right-of-way in this area and the wider construction footprint needed. The phased approach of the Preferred Alternative provides ongoing opportunities to avoid, minimize, and mitigate impacts during implementation. The impacts discussed in this chapter reflect these differences.

All Action Alternatives are included in the resource analyses, but as described in **Chapter 2, Summary and Comparison of Alternatives** the single mode alternatives, those alternatives consisting solely of roadway improvements or transit improvements, but not both, do not meet the purpose and need of the I-70 Mountain Corridor project. In addition, the Preferred Alternative Minimum Program does not meet purpose and need either, as highway capacity will be exceeded before 2050. Techniques to note: - impacts chapter begins with explanation of overall approach to impact assessment



Chapter 5 - Environmental Consequences

5.1 Methodology for Evaluating Environmental Impacts

This section provides an overview of the methodology that has been used in evaluating the environmental impacts of the Build and No Build Alternatives. More detailed explanations of the methodologies used for evaluating specific impacts can be found in subsequent sections of this chapter. The purpose of this introductory section is simply to explain the overall approach used in evaluating environmental impacts and to introduce key terms and concepts that will be used later in this chapter.

The changes to this chapter since the completion of the DEIS include:

- Impact calculations have been updated to reflect the selection of variations, route shifts, and other changes, as described in Section 5.1.3.
- Discussion on tiering has been expanded.
- Updates to GIS layers, including discussion of layers removed for homeland security reasons.

5.1.1 Tiered Approach

As a result of the size and complexity of this project, FHWA and INDOT determined that it was appropriate to use a "tiered" procedure for completing the environmental studies required under the National Environmental Policy Act (NEPA). The use of a tiered process to comply with NEPA is authorized under the Council on Environmental Quality (CEQ) regulations, which applies to all federal agencies, and under FHWA's own NEPA regulations. (See 40 CFR 1508.28 and 23 CFR 771.135(o)).

In recent years, the use of tiering for FHWA NEPA documents has increased. In the context of one recent project, which involved an existing section of I-70 in Missouri, FHWA headquarters explained the agency's overall approach to preparing tiered documents:

"As contemplated in our regulations and in the Council on Environmental Quality regulations, tiering is an option available to organize analysis and decision-making in complex circumstances in a way that takes into account the different geographic scope and timing for different decisions. The difference in scope and timing for the strategic decision of how to address long range needs on a 200 mile long section of I-70 between the major metropolitan areas in Missouri versus the specific location and design decisions for much shorter "projects" on I-70 certainly justifies a tiered approach. Because tiering is an option available to address complex situations, we have deliberately stayed away from prescriptive guidelines on how to apply tiering, so that each tiered process can be custom designed to the specific situation."

The Council on Environmental Quality (CEQ) and Federal Highway Administration (FHWA) regulations allow for the use of tiering for large-scale, complex projects. This project involves a 26-county Study Area, encompassing approximately one-quarter of the State of Indiana; it involves the consideration of alternatives approximately 150 miles in length. The alternatives under consideration are geographically widespread, resulting in the need to consider environmental issues across a broad area. As a result, the overall scale of this study is far larger than the scale



I-69 Evansville to Indianapolis Final Environmental Impact Statement

of a typical, non-tiered environmental impact statement for a highway project. It also is consistent with the scale of other tiered EISs currently being prepared or recently completed by FHWA in other states, such as Colorado and Missouri.

The tiered approach for this study was developed in consultation with resource agencies and the public. From the onset, FHWA and INDOT have stated that the goal in Tier 1 is to develop sufficient information to make a Build/No Build decision and to select a corridor for I-69 between Evansville and Indianapolis; it is not intended to resolve the exact alignment or to specify details of mitigation measures. This approach has guided all decisions regarding the level of detail to be developed in Tier 1.

In accordance with this flexible approach, a tiered process has been developed to meet the specific needs of this project. In this process, the purpose of the Tier 1 EIS is to provide the basis for an informed decision on a "corridor" for I-69 between Evansville and Indianapolis, *not* to determine the exact alignment for the highway. (The concept of a corridor is explained further below.) As a result, the environmental data in this Tier 1 EIS has been developed with the intention of providing the level of detail needed to make an informed decision on a corridor. As can be seen by the scope of this document, FHWA



Figure 5.1-1: Illustration of Study Band Corridor and Working Alignment

and INDOT have determined that a substantial amount of information is needed even at this first tier. Nonetheless, it must also be recognized that this study is not intended to provide the basis for selection of an exact alignment, and therefore does not contain the level of engineering or environmental detail that would be needed to make a specific alignment decision. That information will be developed in Tier 2 NEPA studies.

5.1.2 Key Concepts: Study Bands, Corridors, and Working Alignments

Each build alternative considered in the initial screening stage of this study was developed as a "route concept," which may be thought of as a simple line connecting points on a map. Throughout the screening process, the initial set of route concepts (A through L) was reduced to five major alternatives (1 through 5). These five alternatives – several of which include a range of potential connections to Indianapolis, or Options, at their northern end – were carried forward for detailed analysis. Including these Options, there were a total of 12 distinct alternatives considered in the EIS. These 12 alternatives are: 1, 2A, 2B, 2C, 3A, 3B, 3C, 4A, 4B, 4C, 5A, and 5B.

In order to provide a set of tools for analyzing environmental impacts of these alternatives, the study team defined each alternative as a set of three overlapping bands (see Figure 5.1-1).

• **Study Band** – A "study band" is a <u>2-mile-wide</u> band within which the environmental data-gathering efforts were focused for each alternative. It should be noted that much of the environmental data was gathered throughout the entire 26-county Study Area. However, more intensive efforts – for example, field verification of recorded resources – were concentrated within the two-mile-wide study bands.



Final Environmental Impact Statement

- Corridor A "corridor" is generally 2000 feet wide, but its width is narrower in some places and broader in others. If a Build Alternative is selected, it is FHWA's intention to approve a Record of Decision (ROD) for a corridor at the end of Tier 1, rather than approving a specific alignment.
- Working Alignment A "working alignment" is a potential location for a highway right-of-way within the 2000-foot-wide corridor. The Tier 1 EIS is not intended to result in the selection of a specific alignment. However, working alignments have been developed within each corridor in order to provide a sound basis for estimating the environmental impacts of each alternative. The working alignments range in width from 240 to 470 feet. Three factors were considered in estimating the right-of-way width for sections of each working alignment: (1) the topography of the land, (i.e. flat, rolling, hilly); (2) the number of local service (frontage) roads expected, if any; and (3) the number of lanes expected. (See Appendix E, "Typical Sections," for detailed information on the widths of each working alignment.)

5.1.3 Calculation of Environmental Impacts

Use of GIS

The basic tool used for estimating the environmental impacts of each alternative, was the project's Geographic Information System (GIS). As explained in Section 4.1, *GIS Approach*, the GIS is an electronic database that consists of a series of data layers. The GIS database for this project includes layers containing each of the study bands, corridors, and working alignments, as well as more than 170 layers containing the locations of various environmental resources and other features.

The GIS database provided two powerful tools for developing the environmental impact information that has been presented in this Tier 1 EIS. First, the GIS was used to generate maps showing the relationship between each alternative and specific environmental resources and other features. Some of these maps are contained in Chapter 5, *Environmental Consequences*; additional maps are included in the Environmental Atlas, which is contained in a separate volume but also is part of the Tier 1 EIS. In addition to generating these maps, the GIS also was used to calculate the impacts that would be caused by each of the working alignments. The impact calculations are given in the tables contained in Chapter 5 and elsewhere in the document.

Since completion of the DEIS, several GIS layers used in this study have been updated to reflect more current information received from agency and public comment. The following information has been updated in the FEIS, including the Environmental Atlas for Preferred Alternative 3C: Cemeteries, Martin State Forest Boundary, Resource Conservation and Recovery Act (RCRA) Sites, Landfills, Patoka National Wildlife Refuge Boundary, Petroleum Wells, Pipelines, Powerlines, Recreation Areas, Superfund Sites, Threatened & Endangered Species, Recreation Trails, Towers, Underground Storage Tanks (USTs), and Leaking Underground Storage Tanks (LUSTs). Also, in recognition of recently enacted state laws and evolving regulations for state agencies, certain data layers were removed from the FEIS Environmental Atlas at the request of the Indiana Department of Environmental Management (IDEM) in the interest of homeland security. These files were considered for impacts and are discussed as applicable within the text of the FEIS. The treatment of this data was comparable to the established confidentiality procedures for sensitive sites such as archaeology sites and endangered species locations. These data layers include: Public Water Wells, Public Water Intakes, Wellhead Protection Areas, Drinking Water Supply Sites, Wastewater/Runoff Treatment Plants, and Water Towers.

Methodology for Calculating Impacts

The direct impact calculations shown in this document reflect the impacts *within the footprint of the working alignment of each alternative,* subject to the following qualifications:



I-69 Evansville to Indianapolis Final Environmental Impact Statement

- Impacts of I-70 Widening and SR 641 (Terre Haute Bypass) Project. The impacts associated with the planned widening of I-70 and the completion of SR 641 have not been counted as part of the impacts for the alternatives presented in this document. Instead, the impact calculations are based on the impacts of each alternative from its southern terminus at I-64 near Evansville to the point at which the alternative connects with I-70 or SR 641 (or I-465 in the case of those alternatives that do not use any portion of I-70 or SR 641). This approach has been followed because the completion of SR 641 and the widening of I-70 are expected to occur without regard to whether I-69 is completed. Excluding the impacts of those projects from the alternatives analysis for this project allows the reader to compare the I-69 alternatives based on the additional impact that each alternative would cause, over and above the impact that would result from projects that will occur independently of the I-69 project. (The impacts of the SR 641 were disclosed in a Final Environmental Impact Statement, which was signed by FHWA on January 3, 2000. The impacts of the I-70 widening have not been studied in a separate NEPA document, but are summarized in the Cumulative Effects chapter of this document based on existing information, along with other reasonably foreseeable actions that are independent of the I-69 project.)
- Use of Existing SR 37 and US 41 Right-of-Way. Several alternatives incorporate portions of existing SR 37 and US 41. Both of these routes are four-lane, divided highways with at-grade access points (partial access control, with signalized and unsignalized intersections). Upgrading these routes to meet freeway standards (which do not allow for at-grade access) would require additional right-of-way for interchanges, local service (frontage) roads, and other improvements. For sections of alternatives that follow these routes, the impact estimates reflect only the additional right-of-way that would be needed beyond the existing SR 37 or US 41 right-of-way.
- Working Alignments with Multiple Variations. In the DEIS, several of the working alignments included multiple variations. Each variation had slightly different impacts. Consequently, the impact totals for each alternative were presented as ranges in the DEIS. The ranges reflected the different levels of impact associated with the various working alignments that had been developed in these areas. For a description of these variations see Section 3.3.4.
- **Interchanges.** This document reflects potential interchange locations. Interchange locations and access issues will be refined in Tier 2. These potential locations were determined using the following criteria:
 - The functional classification of intersecting roadways
 - The traffic volumes on intersecting roadways
 - Service to significant communities which otherwise would be isolated
 - Distance between interchanges
 - Ability to relocate/consolidate state highways which are close to each other
 - The number of interchanges serving particular communities
 - The presence of sensitive resources (such as karst) and thus the desire to minimize potential indirect impacts in those areas

During the Tier 2 NEPA studies and design analysis, some interchange locations could be discarded. New locations could also be added.

I-69 Evansville to Indianapolis Final Environmental Impact Statement

Techniques to note: - impacts chapter explains changes in impact calculations between DEIS and FEIS



For this I-69 project, right-of-way needs of approximately 10 acres were assumed for each potential interchange. The actual amount of land could be greater than or less than 10 acres depending upon the interchange configuration. The 10 acre estimate of land for an interchange includes only the land needed for the interchange. Impacts from indirect development as a result of the interchange are incorporated into the Cumulative Impacts analysis in Section 5.26. *Cumulative Impacts*.

Post-DEIS Changes Affecting Impact Calculations

Since publication of the DEIS, Alternative 3C has been selected as the Preferred Alternative. In addition, several changes have been made that affect the environmental impact calculations. These changes are discussed below.

- Southport Road Interchange. Since the publication of the DEIS, an interchange has been added at SR 37/ Southport Road in Marion County. This interchange is now shown in the Volume III Environmental Atlas of the FEIS. The traffic modeling and impact calculations in the FEIS include the Southport Road interchange.
- **Rest Areas.** Specific rest area locations have not been identified for this I-69 project. If a build alternative is approved in the Tier 1 ROD, rest areas will be identified and located in the Tier 2 NEPA studies. However, to avoid underestimating the right-of-way needs for the I-69 alternatives, the acreage for four potential rest areas (two northbound and two southbound) has been included in the total right-of-way needs for each alternative. It is expected that approximately 40 acres will be needed for each rest area, for a total of 160 acres. The land acquired for the rest areas is assumed to be agricultural land. In addition, solely for the purposes of calculating impacts, the land for rest areas was assumed to be prime farmland. In the DEIS, acreage required for rest areas was not included.
- Alignment Shifts. Several alignment shifts occurred after the distribution of the DEIS in response to comments received from the public and environmental review agencies. These shifts affected the corridor and working alignment for Alternatives 3, 4, and 5. See Section 6.3.5 for more information. Such shifts are as follows:
 - **Prides Creek Shift (Alternatives 3, 4, and 5).** The corridor and working alignment was shifted approximately 0.4 mile to the east to minimize impacts to the Prides Creek wetland complex in Pike County. This shift reduced wetland impacts by approximately 35 acres. Information on the impact trade-offs for the Prides Creek Shift can be found in Section 6.3.5.
 - **Combs Forest Property Shift (Alternative 3).** The corridor and working alignment was shifted approximately 0.2 mile to the south to avoid direct impacts to the Combs Unit of the Martin State Forest. The Combs Unit was recently acquired by the Martin State Forest and is located just south of Koleen in Greene County. In shifting the alignment care was given to avoid both human (homes) and natural (springs, caves) environmental concerns. Information on the impact trade-offs for the Combs Forest Property Shift can be found in Section 6.3.5.
 - Virginia Iron Works Shift (Alternative 3). The corridor and working alignment and corridor was shifted approximately 800 feet to the west to avoid the Virginia Iron Works, which contains a number of industrial archaeological sites. It has been determined to be potentially eligible for the National Register of Historic Places. Information on the impact trade-offs for the Virginia Iron Works Shift can be found in Section 6.3.5.
- Variation Selections. Since the completion of the DEIS, a single route was selected for the Preferred Alternative 3C by selecting a single variation in the vicinity of Washington and eliminating the Mann Road



Variation. In addition, for purposes of the analysis in the FEIS, a single variation was selected for Alternative 4 at the crossing of the West Fork of the White River, and for Alternatives 3A and 3B in the vicinity of the Keisler Forest Legacy Property. As a result, impact calculations for Alternatives 3, 4, and 5 are presented in the FEIS as a single number rather than as ranges. As a result, impact calculations for Alternatives 1 and 2 are still presented as a range because they still contain variations near Fort Branch, Vincennes, or Farmersburg. Variations were not selected in these areas because of complex issues associated with the decision about whether to remain on US 41 through densely developed areas or construct the project as a bypass around those areas. For a description and map of the variations, refer to Section 3.3.4. The variation selections are described below.

- Mann Road Variation (Alternatives 2C, 3B, 3C, 4C, and 5B). The Mann Road Variation that diverted from SR 37 and connected to I-465 to the west has been eliminated from further study due to wetlands, social, and neighborhood impacts. For a further explanation on the Mann Road Variation see Section 6.3.4.
- Washington Variation (Alternatives 3, 4, and 5). There were originally four variations around Washington in Daviess County, two to the west and two to the east. The easternmost variation (WE2) has been chosen due to lower natural environmental impacts and resource agency comments. However, the flexibility is being preserved to consider the other eastern variation (WE1) during the Tier 2 studies if necessary in order to avoid or minimize impacts. For a further explanation of the Washington Variation, see Section 6.3.3.

5.1.4 Format for Impact Evaluations

Each section within the Environmental Consequences chapter of this document typically includes: (1) introduction to the resource; (2) methodology used to analyze the resource; (3) policies that may accompany the resource; (4) results of the analysis; (5) mitigation for impacts to the resource; and (6) summary of the discussion. The procedure detailed above describes the process used to determine potential environmental impacts. If a different process was used for a particular resource, it is noted in the methodology section of that discussion.

The alternatives that are discussed in the following sections of this Section are shown in Figure 5.1-2.

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