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3.17 FLOODPLAIN IMPACTS

3.17.1 Introduction

The following substantive changes have been made to this section since the Draft Environmental Impact Statement (DEIS) was published:

- This chapter has been updated to reflect the new information associated with impacts from RPA P and Alternative R

When a body of water such as a stream or channel floods as riverine flooding, excess water tops the channel banks and spills into the adjoining floodplain. Floodplains are important to both the human and natural environment. Floodplains reduce the number and severity of floods, slow the velocity of floodwaters, dampen peaks and recharge groundwater. Floodplains typically contain vegetation that absorb pollutants and reduce thermal pollution to improve water quality. They provide important food and habitat to fish and wildlife species, including many listed species (American Rivers, undated).

The Federal Emergency Management Agency (FEMA) manages the National Flood Insurance Program (NFIP) and sets the minimum floodplain management standards; but all local regulations exceeding these standards take precedence over federal standards. Indiana has established criteria exceeding the federal minimum, and all floodplains in Indiana are regulated at the state and local level.

Flooding events have varying frequency and intensity. Base Flood Elevations (BFEs) establish areas which have a one percent chance of flooding in any given year. This is referred to as a “100-Year flood.” FEMA has developed Flood Insurance Rate Maps (FIRM) to present areas estimated to be inundated during a 100-Year flood. These inundated areas are defined as Special Flood Hazard Areas (SFHA). Because detailed studies have not been conducted for all waterways, the FEMA maps are estimates. Many areas with SFHAs do not have BFEs.

The Indiana Department of Natural Resources (IDNR) regulates impacts to floodplains and has developed the Zone A Floodplain Mapping project. Zone A references SFHA zones on FIRMs without BFEs. This program enhances the FIRMs data to produce a dataset called the Best Available Floodplain Layer (BAFL) to identify areas subject to flooding regulations. Further, the Flood Control Act ([IC 14-28-1](#)) regulates various development activities (e.g. structures, obstructions, deposits, and/or excavations) within the floodway of any State waterway by requiring IDNR approval prior to the beginning of the project in the form of a permit from the Director of the Department of Natural Resources. Based on the regulatory oversight and control from the Flood Control Act limiting cumulative effects to floodplains, no adverse cumulative effects are anticipated from the project.

Floodplains associated with the Regulatory Flood are divided into two separate zones, a floodway and flood fringe (see **Figure 3.17-1**). The floodway is defined by the IDNR as “1) The channel of a river or stream; and 2) The parts of the floodplain adjoining the channel that are reasonably required to efficiently carry and discharge the flood water or flood flow of a river or stream” (IDNR, undated). Furthermore, the flood fringe is defined as the “portions of a floodplain lying outside of the floodway” (IDNR, undated).

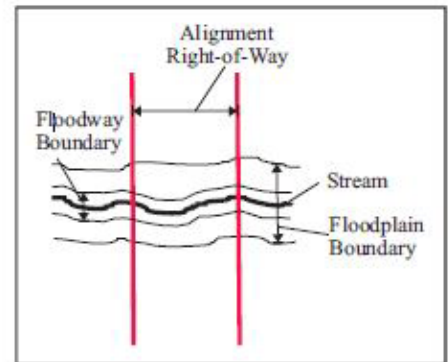


Figure 3.17-1: Floodplain/Floodway Cross Section with Transverse Floodplain Encroachment



Transportation projects, such as roads or bridges, can have two types of impacts/encroachments to the floodplain: transverse or longitudinal. Projects that cross, or are perpendicular to, the floodplain have transverse impacts (**Figure 3.17.1**). Projects that travel along, or are parallel to, the floodplain have longitudinal impacts (see **Figure 3.17-2**). Typically, longitudinal encroachments have greater effects on the floodplain than transverse encroachments. Transverse/perpendicular impacts occur at crossings and can increase upstream flood elevations but often can be mitigated through engineering design. Longitudinal/parallel impacts are more difficult to mitigate and generally reduce available flood storage by placement of fill in the floodplain. This may increase downstream flooding (INDOT, 2011). Additional details regarding potential floodplain impacts are contained in **Appendix J – Floodplain Impact Analysis**.

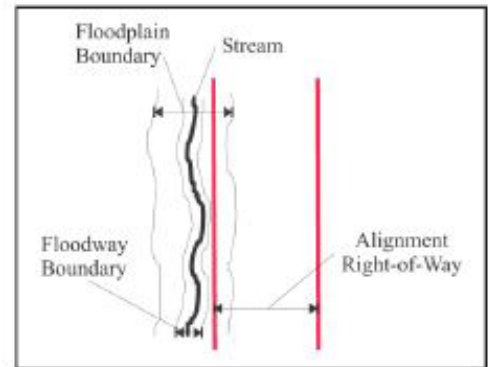


Figure 3.17-2: Floodplain/Floodway with Longitudinal Floodplain Encroachment

3.17.2 Methodology and Process

Floodplain impacts were calculated in three ways: 1) total impact acreage, 2) linear feet of transverse impacts, and 3) linear feet of longitudinal impacts. These impacts were determined based on the area within the right-of-way of the working alignment of each alternative and facility type.

The overlap of the floodplain and working alignments was calculated using the IDNR BAFL map Geographic Information Systems (GIS) data. For convergent areas that included floodplains from other tributaries, the focus of directional determination was the floodplain of the affected stream. For impacts in flood fringe areas, the directional determination was based on flow direction caused by topography. In some instances, this resulted in flow direction in the flood fringe that was perpendicular to the flow direction in the floodway. If particular segments of impacts contained both longitudinal and transverse impacts, the dominant orientation of impact was assigned.

For a more detailed explanation on how the GIS was used to determine potential impacts, please refer to **Section 3.1-Methods** in this document.

3.17.3 Analysis

All facility types for Alternatives B, C, M and O have a common centerline. Alternative P and RPA P Logoootee variations in Martin and Daviess counties have multiple centerlines. For this reason, some impacts to Alternative P and RPA P are given in ranges where impacts by other alternatives are a single number. Alternatives C, M, P, and RPA P share the same centerline in Section 2 in Dubois County and have identical floodplain impacts in Section 2. See **Appendix J** for details. Alternative O shares the same centerline with Alternatives C, P, RPA P and M in most of Section 2, but it diverges just south of the existing US 231 crossing of the East Fork of the White River. As a result, Alternative O has similar, but not identical, floodplain impacts in Section 2. Alternative B does not share a centerline with any other alternative. Alternative R represents an upgrade of the existing US 231 alignment.

Table 3.17-1 presents the impacts for each alternative. It provides the impacts to the floodplain, which includes the floodplain and flood fringe, as well as impacts to the floodway alone. Where floodplains include stream tributaries, the impacts were calculated with respect to the primary stream.



| Potential Floodway & Floodplain Impacts * | | | | | | |
|---|------------------|-------------------|-----------------|-----------------------|-------------------|-----------------|
| Alternative** | Floodway Impacts | | | Floodplain Impacts*** | | |
| | Area (ac) | Longitudinal (ft) | Transverse (ft) | Area (ac) | Longitudinal (ft) | Transverse (ft) |
| B | 260 - 291 | 2,100 | 26,700 | 394 - 441 | 5,200 | 38,100 |
| C | 285 - 352 | 0 | 38,300 | 380 - 470 | 0 | 50,800 |
| M | 657 - 747 | 2,300 | 54,800 | 957 - 1,092 | 3,900 | 77,900 |
| O | 284 - 330 | 7,400 | 31,100 | 389 - 452 | 13,800 | 41,000 |
| P | 320 - 424 | 400 - 2,700 | 40,700 - 45,200 | 419 - 607 | 900 - 6,900 | 52,500 - 58,800 |
| RPA P | 313-429 | 400 | 40,700-45,600 | 413-601 | 900 | 52,500-62,000 |
| R | 88 | 0 | 14,200 | 132 | 0 | 17,600 |

* Tier 1 Route impacts are reported in ranges including all the alternative bypass and facility type options.

**Facility type 1, freeways, has been removed from consideration. Therefore, no modifications to existing US 231 in Section 1 and existing SR 37 in Section 3 are anticipated. No impacts are anticipated on either of these facilities.

***Floodplain includes the areas of both the Floodway (the channel of the river/stream which conveys the water downstream and must remain unobstructed to prevent an increase in BFE) and the Flood Fringe (the remaining portion of the floodplain).

Table 3.17-1: Potential Floodplain and Floodway Impacts

These impacts include those for local improvements which accompany each new alignment alternative. These local improvements are introduced in **Section 2.4.2.2**. The new alignment alternatives and their accompanying local improvements address a full range of needs in the portion of the Study Area served by each alternative. These impacts are combined to consider the full range of benefits and impacts for each alternative. **Appendix J** shows the impacts of local improvements, as well as for portions of the new alignment alternative. Alternative R is an upgrade of the existing US 231; thus, it does not have any local improvements associated.

Figure 3.17-3 shows streams and floodplains in the project area and the alternatives which impact them. More detailed breakdowns of the potential impacts to floodplains and floodways for each alternative, including facility types and sections, are provided in **Appendix J**. Impact ranges account for variations of facility type within an alternative. Longitudinal and transverse impacts are presented as linear feet of encroachment. For alternatives that varied only by facility type on the same centerline, these encroachments were similar. These are presented as a single number, not as a range.

For floodplain impacts associated with new alignments, Alternative O has the highest longitudinal impacts, all of which occur within local improvements. Alternatives B and M have fewer longitudinal impacts, and Alternative C has no longitudinal impacts. Alternative P ranks in the middle of the impact values, with a range of 6,000 feet from low value to high value. RPA P has the second least longitudinal impacts. Alternative M has the greatest transverse impacts. Alternatives C, P, and RPA P have comparable transverse impacts, with Alternative O having fewer. Alternative B has the smallest transverse impacts. As an upgrade alignment, Alternative R has no longitudinal floodplain impacts and 17,600 feet of transverse impacts.

Alternative M has the highest floodplain acreage impacts, up to three times more than any other alternative. This is due to relatively extensive impacts along the White River and its tributaries in Martin County, and to a lesser extent in Lawrence County. Alternative P and RPA P have the next-highest acreage impacts. For Alternative P and RPA P, the high end of the range reflects impacts along their respective variations in SIU 4 in Section 3 east of Loogootee, which result in the highest impacts (Pe and RPA P4 respectively). Alternatives B, C and O have similar acreage impacts and are the lowest among new alignment alternatives. Alternative R has about one-third the floodplain acreage impacts of the lowest new alignment alternative.

For floodway impacts, Alternative O has the highest linear feet of longitudinal impacts, all of which occur within local improvements. Alternatives M, B, and the eastern Loogootee variation of Alternative P, all have similar impacts. The

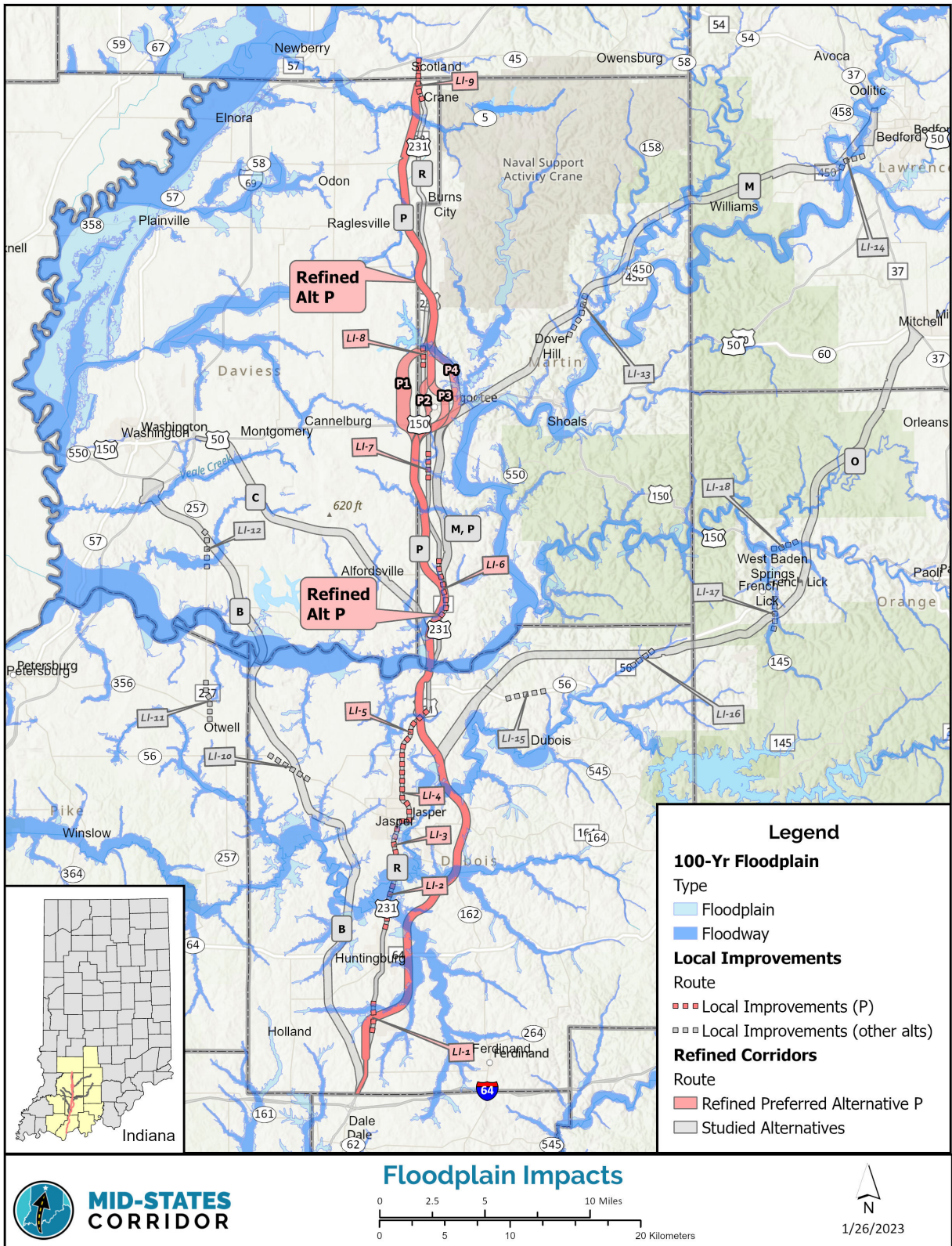


Figure 3.17-3: Streams and Floodplains Potentially Impacted



western Loogootee variations of Alternative P and RPA P have much lower longitudinal impacts. See **Appendix J** for details. Alternative M has the highest linear feet of transverse impacts successively followed by Alternatives RPA P, P, C and O. Alternative B has the smallest transverse impacts among new alignment alternatives. As an upgrade alternative, Alternative R has no longitudinal floodway impacts and 14,200 feet of transverse impacts.

For floodway acreage impacts, Alternative M has two to three times more impacts than the other alternatives due to impacts along the White River and its tributaries. Other new terrain alternatives have lower ranges of impacts which are similar. Alternative R has about one-third the floodway acreage impacts of the lowest new alignment alternative.

The No-Build alternative has no floodplain impacts. Of the build alternatives, Alternative R has the lowest floodway and floodplain impacts.

3.17.4 Mitigation

Working alignments for each alternative were designed to avoid and minimize potential impacts to the floodplain and floodway, in particular longitudinal impacts. The working alignments to the extent possible used existing crossings, placed new structures near existing crossings, used existing roadway corridors and incorporated transverse crossings of notable rivers such as East Fork White River and Patoka River. The designs in Tier 2 NEPA studies will further minimize potential floodplain and floodway impacts.

In response to comments on the DEIS, the following commitment has been added. In areas with significant floodplains, Tier 2 engineering assessments will consider the tradeoffs between costs and impacts of bridge construction versus other design approaches.

Following standard engineering design practices, all potential roadway crossing structures will be sized to hydraulically convey, at a minimum, the Regulatory Flood event. Additionally, potential structures will be designed to facilitate fish and wildlife passage through the crossing, including during low-flow conditions.

3.17.5 Summary

Overall, Alternative M has the highest floodplain and floodway impacts. This is due to significant impacts to the White River and its tributaries in Martin and Lawrence counties. Alternative M is second to Alternative O only in longitudinal impacts, due to impacts associated with local improvement segments near French Lick. Alternative P and RPA P have the second highest impacts to floodplains and floodways regardless of which variation is evaluated. Of the Loogootee variations, the eastern variations have higher floodplain impacts. There are significant floodplain and floodway impacts for all alternatives in Dubois County due to potential impacts to the Patoka River floodplain. As an upgrade alternative, Alternative R has no longitudinal floodway or floodplain impacts. Alternative R's acreage impacts to floodways and floodplains are approximately one-third those of the least impactful new alignment alternatives.

Transverse impacts to streams increase in the northern reaches of Study Area. This reflects more irregular topography associated with the East Fork of the White River and numerous associated tributaries. Patoka River and its tributaries, which form a broad floodplain area, are also a source of impacts. As required by state regulations, new bridges on a new alignment will be designed so that the resultant backwater is less than 0.14 feet. Replacement structures backwater will be less than or equal to existing backwater elevations. For bridge replacements, it is not anticipated that crossings will cause an increase in surcharge of existing water surface elevations (INDOT, 2013). As noted in the previous section, crossings will be designed to hydraulically convey, at a minimum, the 100-Year flood event. Bridge designs will be analyzed in greater detail in Tier 2 NEPA studies.

After completion of the Tier 2 NEPA studies, permits relating to floodway and floodplain impacts will be obtained from appropriate agencies.