Environmental Resources, Impacts, and Mitigation

Comprehensive Wetland Mitigation and Monitoring Plan
As required under Section 303, of the P.A. 451 of 1994, MDOT will prepare and submit a comprehensive mitigation and monitoring plan to document the development of the created wetland. The mitigation and monitoring plan will specifically address mitigation goals and objectives, performance standards, monitoring procedures and long-term protection (i.e. conservation easement) of the wetland. This plan will be submitted during the permitting process of the appropriate regulatory agencies in compliance with their current standards.

4.11 AQUATIC ISSUES

4.11.1 Surface Water Quality
The study area has a wide range of surface water resources, including public drains, streams and navigable waterways (primarily the Grand River). These resources, along with known groundwater resources, have been inventoried and mapped. Existing published water quality data has been collected for the Grand River, Macatawa River, and their associated tributaries.

Macatawa River
According to MDEQ reports, Lake Macatawa and all of its tributaries are included in a list of water bodies within the state that do not attain the Michigan’s desired WQS. The report states that Lake Macatawa displays the classic symptoms of a hypereutrophic lake, which includes extremely high nutrient and chlorophyll a levels, excessive turbidity, periodic nuisance algal blooms, low dissolved oxygen levels, and a high rate of sediment deposition. Monthly water quality monitoring of Lake Macatawa and its tributaries has concluded that phosphorus levels are consistently unacceptable and concentrations are extremely variable on a monthly and annual basis. Phosphorous concentrations in the river have been as high as 129 micrograms/liter, compared to the MDEQ phosphorous standard of 50 micrograms/liter.

The MACC is working to improve the quality of the Macatawa Watershed. Their effort is focusing primarily on the reduction of phosphorous. The MACC has targeted both non-point and point sources of phosphorous discharges into the Macatawa River and its tributaries, through its Macatawa Watershed Project. Sampling found that 91 percent of the phosphorous loading is from non-point sources (agricultural) and nine percent from storm water runoff and municipal and industrial discharges. The main objective of the MACC’s project is to reduce the amount of phosphorous in the Macatawa River by 70 percent in the next ten years, as described in a plan finalized on September 16, 1999 entitled Nonpoint Source Phosphorus Reduction Plan for the Macatawa Watershed, 1999-2009 (Higgins and McDonald).

Grand River
The majority of the Grand River from Lake Michigan upstream to the City of Jackson has been included on the list of water bodies that do not attain designated uses due to fish consumption advisories. Consumption of fish should be limited due to the presence of Polychlorinated biphenyl (PCBs) in the fish tissue. The Grand River in the vicinity of Walker and Johnson Parks, near Grandville, has been included on the list of water bodies that do not attain designated uses due to combined sewer overflows and elevated levels of pathogens. In addition, the Grand River near the City of Grand Haven has been included on the list of water bodies that do not attain designated uses due to levels of mercury in the water that exceed Michigan’s WQS.

GVSU’s Annis Water Resource Institute (AWRI) collected and analyzed water quality samples of the Grand River in August of 1990. The analyses were summarized in a Water Quality Index (WQI) that ranged from a score of 0 (poor water quality) to 100 (excellent water quality). The water quality parameters analyzed include fecal coliform, nitrate-nitrogen, pH, ammonia-nitrogen, total phosphorous, dissolved oxygen, temperature, chloride and total dissolved solids. The WQI indicated that the quality of the Grand River is quite variable, ranging from moderately good (WQI=83) near the city of Lowell, to poor (WQI=18) near the mouth of the river in the city of Grand Haven. Three of the 35 sampling locations were located near the study area. The Grand River had a WQI score of 19 near its confluence with Crockery Creek, a score of 18 three miles downstream of Crockery Creek near 138th Avenue, and a score of 27 in
Spring Lake. The overall results of this study indicate poor water quality within the lower reaches of the Grand River.

An MDEQ report details biological sampling and water chemistry data collected from the lower Grand River and its tributaries. Several non-point source problems were identified during this study. Cattle had unrestricted access to streams at several locations within the watershed. This contributed, along with dairy operations, manure disposal, and other farming practices, to nutrient enrichment problems within specific tributaries. Other problems include an illicit connection discharging septic water to a tributary, as well as soil erosion and sedimentation due to housing developments and road crossings. Despite the water quality problems associated with its tributaries, the lower Grand River showed no exceedence of WQS during this survey.

During this same study, macroinvertebrate communities were evaluated at 45 stations throughout the lower Grand River Watershed. The macroinvertebrate community was rated as acceptable at 37 survey locations, excellent at four stations, and poor at four stations. Stream habitat was also examined at these 45 locations. Within this examination, the habitat at 30 stations was rated as good (slightly impaired), nine stations were rated as excellent (non-impaired) and six stations were rated as marginal.

The MDEQ attributes relatively larger loadings of nutrients to non-point sources, like agricultural lands, than to specific point sources. As of January 2007, the MDEQ indicates that the Upper Grand River Watershed contains 166 permitted National Pollutant Discharge Elimination System (NPDES) discharges. Of these, 115 are storm water facilities and 51 are individual permits. In the Lower Grand Watershed there were 546 permitted NPDES dischargers. Of these, 380 are storm water facilities and 166 are individual permits.

**Impacts**

The greatest potential for water quality impacts resulting from the construction of the Preferred Alternative will be in the surface water systems crossed by the new alignment. The water quality impacts can include increased salinity due to snow removal operations, increased turbidity due to construction runoff, increased levels of motor vehicle pollutants (such as motor oil) from pavement runoff, and/or increased local water temperatures.

**Existing US-31 Crossings**

The widening of existing US-31 will result in an increase in impervious surfaces and therefore an increase in runoff containing pollutants. Construction activities could also result in soil erosion and sedimentation in the area. Temporary degradation of water quality in the river, streams, and drains near construction areas may also occur.

**New Alignment Crossings**

A new Grand River crossing will have the potential to introduce new sources of pollutants to the Grand River both during construction and during long-term operation of the facility. These new sources of contaminants could potentially impact the water quality and wildlife species of these stream systems. While bridges and culverts limit the impacts on existing drainage patterns, these aquatic systems may still be affected by pollutants contained in storm water runoff. Possible storm water contaminants may include the following:

- Temporary sediment inputs from erosion caused by construction activity,
- Salt placed on the roadways during snow storms,
- Increased storm water runoff volume that results in changes to the hydrograph and stream channel morphology,
- Petrochemicals, oil, grease and heavy metals associated with automobile traffic,
- Trash and debris discarded by motorists,
- Chemicals and hazardous materials accidentally spilled during transport.
Mitigation

MDOT has developed a Storm Water Management Plan (SWMP), with the intent of reducing or eliminating storm water pollution. In accordance with the SWMP, impacts to water quality will be mitigated through various avoidance and minimization strategies. The use of the following construction techniques and implementation of storm water Best Management Practices (BMPs) should lessen surface water quality degradation during construction and the long-term use of these structures.

Temporary

Sedimentation will be controlled by protecting the side slopes, ditches and other areas draining directly into the waterway with sod, seed, riprap, mulch, and erosion control fabric or blankets. All disturbed areas will be stabilized and re-vegetated as soon as possible. All natural vegetative growth outside the project limits will be protected. Specific design plans will be completed for the Preferred Alternative incorporating these protective measures.

Temporary water quality impacts resulting from the construction of bridges can be mitigated by the following measures, each of which will be considered during the project design:

- Avoiding the construction of bridge abutments and piers in the wetlands and waterways to the maximum extent possible,
- Minimizing excavation for the installation of bridge piers and piles,
- Minimizing wetland impacts for the approach roadways and spanning wetlands by the bridge structures,
- Minimizing dredging required for barge construction access,
- Providing soil erosion and sedimentation control (SESC) measures in accordance with MDOT’s approved Soil Erosion and Sedimentation Control Manual and MDOT’s Drainage Design and Storm Water Management Manual for all earth disturbing activities,
- Restricting in-stream work to specific times during the year when aquatic species are not reproducing,
- Constructing temporary cofferdams to contain turbidity during bridge pier construction.

Long-Term

Impacts to water quality will be minimized in accordance with MDOT’s Drainage Design and Storm Water Management Manual. Direct discharge of highway and bridge runoff to public drains and streams will be avoided when possible.

This avoidance will be accomplished by utilizing post-construction storm water BMPs that include detention basins with discharges directed to vegetative controls, such as grassy drainage ways, filter strips, overland flows and wetlands. These systems reduce pollutant and sediment loads to streams by reducing flow velocity, which allows contaminant-laden suspended solids to settle out prior to discharge. Detention basins and vegetated swales also protect water quality by detaining peak storm flows. Detaining this runoff prevents stream flows from increasing rapidly, which can lead to instability of the stream channel and habitat degradation. Potential locations for these detention basins are shown in Appendix A.

See Section 4.22.3, Soil Erosion and Sedimentation Control; and Section 4.23, Permits for further information regarding applicable permits and laws.

4.11.2 Fisheries and Aquatic Habitat

The Preferred Alternative has the potential to impact fish resources within the rivers, streams and drains of the Grand River Watershed and the Macatawa River Watershed (see Figure 4.11-1). The main impact will be along the proposed new alignment corridor as it crosses the Grand River and its associated drains and tributaries.
FIGURE 4.11-1

NORTH

NOT TO SCALE

WATERSHED BOUNDARIES

US-31 FINAL ENVIRONMENTAL IMPACT STATEMENT

PREFERRED ALTERNATIVE
3-LANE LIMITED ACCESS
6-LANE WELL-ENGINEERED
Macatawa River Watershed
The watercourses within the Macatawa River Watershed are generally characterized as degraded, shallow, warm-water habitat with a soft-bottom and are unlikely to support sustainable fisheries. Many of these drains have poor water quality and may not possess flowing water year round. If fish populations are present at all, they may include warm-water fish species such as bass (*Micropterus sp.*), minnows (*Pimephales sp.*), carp (*Cyprinus carpio*), white sucker (*Catostomus commersonii*), chubs (*Hybopsis sp.*) and members of the catfish family (*Ictaluridae*). Some of these species may also forage in connected intermittent streams when water is present, although the lack of continuous flow in these streams precludes the establishment of sustainable fisheries.

Grand River Watershed
Studies performed in the Grand River by the MDNR revealed the presence of many species of fish within the Grand River. Alewife (*Alosa pseudoharengus*), gizzard shad (*Dorosoma cepedianum*), quillback (*Carpiodes cyprinus*) and freshwater drum (*Aplodinotus grunniens*) were the dominate fish species near the mouth of the river. Northern pike (*Esox lucius*), smallmouth bass (*Micropterus dolomieu*) and channel catfish (*Ictalurus punctatus*) were the most abundant sport species while black crappie (*Pomoxis nigromaculatus*), rock bass (*Ambloplites rupestris*) and flathead catfish (*Pylodictis olivaris*) were also plentiful throughout the river. Largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), pumpkinseed (*Lepomis gibbosus*) and bullhead species (*Ameiurus sp.*) were in good numbers in the bayous and lower river locations. The bluntnose minnow (*Pimephales notatus*) occurred at every sampling station and carp (*Cyprinus carpio*) occurred at all but one.

An MDNR survey of a limited section of the lower Grand River was conducted March 22-25, 1996 using trap nets, and on July 17, 1996 using electroshocking methods. The study was restricted to an area extending from east of the Grand Isle Marina on both sides of the south and north channels to the existing US-31 bridge. The study provided some relevant migratory data in addition to providing a species list and confirming the presence of several of the fish species mentioned above. The fish identified in the survey included a breeding pair of spawning adult northern pike (*Esox lucius*), gizzard shad (*Dorosoma cepedianum*), bass (*Micropterus sp.*), white sucker (*Catostomus commersonii*), and carp (*Cyprinus carpio*) were also trapped. Species of gamefish electroshocked were those that migrate upriver in the spring to spawn and to the bayous, backwaters and shallow water edges of the Grand River in the summer. These areas also provide excellent nursery habitat for juvenile fish.

A MDNR survey performed on August 3, 2007 characterized the species composition of the Grand River near its confluence with Bass River. A total of 31 fish species were collected, consisting of 895 individuals. Bluegill (*Lepomis macrochirus*), was the most abundant species in the survey with 235 total individuals. Golden redhorse (*Moxostoma erythrurum*) with 134 individuals, and largemouth bass (*Micropterus salmoides*) with 117 individuals followed as the next two most common species. When collected fish were expressed as biomass, shorthead redhorse (*Moxostoma macrolepidotum*), largemouth bass (*Micropterus salmoides*), and golden redhorse (*Moxostoma erythrurum*) accounted for the largest percentage.

There is one commercial fishing operation within the Grand River, a regionally recognized minnow fishery. Recreational fishing is good to excellent for walleye (*Sander vitreus*), pike (*Esox lucius*), members of the sunfish family (*Centrarchidae*), and spawning salmonids including coho salmon (*Oncorhynchus kisutch*), Chinook salmon (*Oncorhynchus tsawyatscha*), steelhead (*Oncorhynchus mykiss*), brown trout (*Salmo trutta*) and lake trout (*Salvelinus namaycush*). There is some fish spawning or migration in the Grand River throughout most of the year, except during the summer months between July 1 and September 15.

Impacts
The Preferred Alternative should have minimal impacts to the Macatawa River Watershed due to minor improvements on the existing US-31 roadway and the lack of quality fish habitat. The Preferred Alternative has potential for impacting Grand River fish resources with the construction of the proposed M-231 bridge. The crossing will create a new source of storm water runoff from impervious surfaces, including runoff to headwaters of streams along the alignment. The proposed M-231 Grand River crossing could potentially introduce an increased and new source of pollutants to the waterway, which...
could have long-term effects on fish resources. In addition to this main river crossing, the Preferred Alternative will cross three streams/drains on the existing US-31 alignment and seven streams/drains for the new alignment. While the streams/drains are less likely to contain sustainable, valuable fisheries, construction of the bridges and culverts over these stream/drains will impact aquatic biota due to sedimentation during construction and modifications to the streambed habitat.

**Temporary**
Fish resources within the study area will be affected by short-term impacts during construction. Sedimentation during roadway and bridge construction has the potential to degrade water quality, thus impacting fish habitat. Siltation of streambeds has an adverse effect on the habitat for fish spawning and macroinvertebrate production. Turbidity within the water column also has a negative effect on the production of rooted aquatic plants, which are important as a food source and to support the production of epiphytic organisms. Bridge construction will require pile driving or drilling for a lengthy period of time, which could impact fish migration if conducted during the spawning period due to vibration, noise and physical activity within the waterway.

**Long-Term**
Degradation of surface water quality can also affect the species composition of the stream or river, as species tolerant of poorer water quality replace those requiring higher water quality. Long-term impacts to fish resources result from the water quality and quantity effects of increased storm water runoff, increased loading of de-icing chemicals, sediment and hydrocarbons.

**Fishing Access**
Fishing access to the Grand River near 120th Avenue will not be directly affected by the Preferred Alternative and is expected to be indirectly improved due to a new river crossing located close to these sites, although the new bridge will not be a fishing access point.

**Mitigation**
Mitigation for impacts on fish and aquatic biota may include the installation of bridges and adequate sized and/or depressed culverts at road crossings to span creeks or drains, provide for fish and wildlife passage, span floodplains, and minimize impacts on stream channels. Major river, stream and drain crossings will be sized to pass the 100-year storm flow. In some locations, temporary restriction devices, such as coffer dams and flume crossings, may be needed at these structures to avoid downstream or upstream impacts while awaiting downstream and/or upstream drainage improvements. In addition, drainage and storm water management for roadway and bridge surfaces will include the routing of storm water to detention basins to be discharged to the Grand River.

The MDNR and MDEQ use standard dredge construction timeframes for work in lakes and streams that are applied as conditions in their permits. However, applications for MDEQ permits, reviewed by the MNDR, are reviewed on a case-by-case basis and the appropriateness of time restrictions is determined. The time of year restrictions are based on the type of fish inhabiting the system. According to a general time frame determined by the MDNR Fisheries Division, the peak fish migration period is March 1 to the end of June for spring migration for river spawning. The window when there is little-to-no fish spawning or migrating in the Grand River is July 1 into the fall. Salmon spawning in the fall should not be impacted by construction with the use of cofferdams. Cofferdams will be required for bridge construction.

**4.12 DRAINAGE AND HYDROLOGY**

The Preferred Alternative crosses two major watershed systems, the Macatawa River Watershed and the Grand River Watershed. These watersheds include a river, tributaries, and drains that will be impacted by construction of the proposed new alignment and improvements on existing US-31 (Table 4.12-1).

The appropriate crossing options will be analyzed and selected during the design phase. Impacts for these crossing are considered the most conservative or greatest impact scenario. During the design
phase and permit process, wildlife movements and other relevant issues will be considered as part of the evaluation of crossing options.

**Macatawa River Watershed**
The Macatawa River Watershed covers portions of northern Allegan and southern Ottawa counties, encompassing approximately 110,000 acres of land. The main branch of the river is over 16.8 miles long. The regional flow is primarily from east to west, discharging into Lake Macatawa, where it becomes navigable and connects to Lake Michigan. The total drainage area of the watershed is 174 square miles, which is small in comparison to many of the large basins in Michigan. The topography along the river varies from flat agricultural lands in its upper reaches, to undeveloped forest within urban areas of its lower reaches. Channelized tributaries of the Macatawa River flow through low lying agricultural lands that contain organic soils surrounding the urbanized Holland/Zeeland area. The main river channel becomes meandering as it approaches Holland/Zeeland, where there is gently rolling topography. The topography is level in the cities of Holland and Zeeland, except adjacent to the river. North of the river in Park, Holland and Zeeland townships, the once frequent farm fields and flat topography are rapidly being converted into residential and commercial developments. Most tributaries in this area are ditched county drains with some deep roadside ditches.

**Grand River Watershed**
The Lower Grand River Watershed connects with the Upper and Middle Grand River Watersheds, which bisect the State of Michigan. The Grand River Watershed is one of the largest watersheds in the State of Michigan and empties into Lake Michigan in the City of Grand Haven. The Lower Grand River Watershed covers 3,020 square miles of the 5,572 square miles of the entire Grand River Watershed. The main channel of the Grand River is approximately 478 miles long. The regional flow is east to west from its headwaters in Hillsdale County, to its discharge into Lake Michigan in Ottawa County. The navigable portion of the river is 17.5 miles upriver from Lake Michigan and under the jurisdiction of the U. S. Coast Guard (USCG). The topography along the river is composed primarily of relatively flat agricultural land between the urbanized metropolitan areas. The topographical relief is more pronounced within this watershed, with level floodplains consisting of many wetland types (shallow marshes, scrub/shrub wetlands, open water ponds, forested wetlands, and wet meadows) and rising, wooded river valley walls. Upland ridges and rolling topography are often adjacent to and around one or more sides of the associated large bayous, oxbows, and tributary streams. A watershed map detailing watershed boundaries and major water bodies can be found as Figure 4.11-1.

**Table 4.12-1**

<table>
<thead>
<tr>
<th>Watershed</th>
<th>Body of Water</th>
<th>Roadway Crossing</th>
<th>Proposed Crossing Treatment</th>
<th>Approximate Proposed Crossing Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Macatawa River</td>
<td>Drain 9 Existing US-31 south of James Street</td>
<td>Extend existing 48 inch x 120 foot concrete culvert</td>
<td>175 feet</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bareman Drain Existing US-31 at Riley Street</td>
<td>Extend existing 72 inch x 240 foot concrete culvert</td>
<td>280 feet</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Drain 15 &amp; 17 Existing US-31 between Quincy and Greenly Streets</td>
<td>Extend existing 140 inch x 74 inch culvert</td>
<td>280 feet</td>
<td></td>
</tr>
<tr>
<td>Grand River</td>
<td>Beeline Drain (immediately upstream of Stearns Creek) New Alignment between Johnson &amp; Lincoln Streets</td>
<td>Proposed culvert</td>
<td>120 feet</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stearns Creek New Alignment between Johnson &amp; Lincoln Streets</td>
<td>Proposed bridge</td>
<td>210 feet</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Little Robinson Creek New Alignment south of North Cedar Drive</td>
<td>Proposed bridge</td>
<td>503 feet</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Grand River New Alignment</td>
<td>Proposed bridge</td>
<td>3,998 feet</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Unnamed Drain New Alignment at Cypress Street</td>
<td>Proposed culvert</td>
<td>120 feet</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Black Creek Tributary M-104 west of 120th Ave</td>
<td>Extend existing 48 inch x 84 foot concrete culvert</td>
<td>120 feet</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Black Creek Tributary New Alignment I-96 Interchange</td>
<td>Extend existing 72 inch x 48 inch x 100 foot box culverts</td>
<td>120 feet</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Unnamed Drain I-96/112th Interchange ramps</td>
<td>Extend or replace existing 36 inch x 100 foot concrete culverts</td>
<td>120 feet</td>
<td></td>
</tr>
</tbody>
</table>
4.12.1 River, Creek, and Drain Crossings

The Preferred Alternative will traverse several watercourses within both watersheds. Most watercourses will be crossed using culverts; however, bridges will be constructed for the following crossings: Grand River, Little Robinson Creek, and Stearns Creek. Many of these waterways have already had their drainage courses altered, primarily to improve drainage of agricultural lands for farming. Most are now county-maintained and regulated drains.

New culverts or bridges will be constructed within four small watercourses including Little Robinson Creek, Stearns Creek, Beeline Drain, and an unnamed drain at Cypress Street. To provide a general evaluation of macrohabitat and potentially present wildlife, these streams were assessed using the Ohio Environmental Protection Agency’s (EPA) Qualitative Habitat Evaluation Index (QHEI). This method was created to assess habitat in flowing waters and coupled with field observations will provide insight about the quality and productivity of these watercourses. The following table summarizes the results of the stream assessments and details important data collected in the field. The type of structure in these crossings will be determined during the design phase/permit process of the project. Impacts presented in the FEIS for these crossing are considered the most conservative or greatest impact scenario.

<table>
<thead>
<tr>
<th>Substrate</th>
<th>Beeline Drain</th>
<th>Stearns Creek</th>
<th>Little Robinson Creek</th>
<th>Upstream Little Robinson Creek (survey purposes only)</th>
<th>Unnamed Drain</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Substrate</strong></td>
<td>Sand – 80% Silt – 20%</td>
<td>Sand – 65% Silt - 20% Gravel – 15%</td>
<td>Muck – 100%</td>
<td>Sand – 50% Gravel – 25% Silt – 20% Cobble – 5%</td>
<td>Sand – 80% Silt – 20%</td>
</tr>
<tr>
<td><strong>Instream Cover</strong></td>
<td>Logs/Woody Debris</td>
<td>Overhanging Vegetation, Shallows, Rootmats, Logs/Woody Debris</td>
<td>Shallow, Oxbows/Backwaters, Logs/Woody Debris</td>
<td>Undercut Banks, Overhanging Vegetation, Pools, Logs/Woody Debris</td>
<td>Undercut Banks, Overhanging Vegetation, Pools, Logs/Woody Debris</td>
</tr>
<tr>
<td><strong>Bank Erosion</strong></td>
<td>Moderate</td>
<td>Little</td>
<td>None</td>
<td>Little to Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td><strong>Riparian Zone</strong></td>
<td>Wide</td>
<td>Moderate to Wide</td>
<td>Moderate to Wide</td>
<td>Forest, Swamp</td>
<td>Moderate</td>
</tr>
<tr>
<td><strong>Floodplain Quality</strong></td>
<td>Forest, Swamp</td>
<td>Forest, Swamp</td>
<td>Forest, Swamp</td>
<td>Run – 80% Pool – 15% Run – 5%</td>
<td>Run – 90% Pool – 10%</td>
</tr>
<tr>
<td><strong>Instream Habitat</strong></td>
<td>Run</td>
<td>Run</td>
<td>Pool</td>
<td>Run – 10-15 ft Depth = 33.9 Flooded Depth = 18.9 Flooded Width = 328 ft</td>
<td>Run – 80% Pool – 15% Run – 5%</td>
</tr>
<tr>
<td><strong>Current Velocity</strong></td>
<td>Slow</td>
<td>Moderate</td>
<td>Intertidal</td>
<td>Moderate</td>
<td>Intermittent</td>
</tr>
<tr>
<td><strong>Average Measurements (inches unless noted)</strong></td>
<td>Width = 5.0 ft Depth = 2.6 Max Depth = 6.3</td>
<td>Width = 8.7 Depth = 3.9 Max Depth = 7.1</td>
<td>Width = 10-15 ft Depth = 33.9 Flooded Depth = 18.9 Flooded Width = 328 ft</td>
<td>Width = 6.9 ft Depth = 1.6 Max Depth = 16.9</td>
<td>Width = 19.3 Depth = 5.9 Max Depth = 8.3</td>
</tr>
<tr>
<td><strong>QHEI Score</strong></td>
<td>Poor – 35</td>
<td>Fair – 48.5</td>
<td>Poor – 43.5</td>
<td>Good – 61.5</td>
<td>Poor – 43</td>
</tr>
<tr>
<td><strong>Fisheries</strong></td>
<td>No trout, no fish observed, very limited fisheries if any, possibly small minnow-like species</td>
<td>No trout, no fish observed, very limited fisheries if any, possibly small minnow-like species</td>
<td>No trout, no fish observed, may be some limited warmwater fish</td>
<td>No trout, no fish observed, some fisheries, possibly minnows, chubs, darters, or daces</td>
<td>No trout, no fish observed, no fisheries due to intermittent flow</td>
</tr>
<tr>
<td><strong>Benthic Invertebrates</strong></td>
<td>Gastropoda – Rare Oligochaeta – Rare</td>
<td>Amphipoda – Common Odonata – Rare</td>
<td>None observed</td>
<td>Amphipoda – Abundant Gastropoda – Rare Trichoptera (Limnephilidae) - Rare</td>
<td>None observed</td>
</tr>
<tr>
<td><strong>Wetland Impact</strong></td>
<td>None</td>
<td>0.25 acre</td>
<td>0.41 acre</td>
<td>Not Applicable</td>
<td>0.12 acre</td>
</tr>
<tr>
<td><strong>Other Issues</strong></td>
<td>Flash Flooding, Erosion</td>
<td>Drainage has been altered greatly</td>
<td>Beaver impoundment has caused flooding covering the entire floodplain area, channel barely recognizable</td>
<td>Sample location upstream of site and before its confluence with another waterway</td>
<td>Only has intermittent flow, drainage has been altered</td>
</tr>
</tbody>
</table>
Beeline Drain
The Beeline Drain is a very slow-moving silt-laden stream with a sandy bottom. Because of past human alterations, it is prone to flash flooding, high water levels, and erosion. According to the MDEQ, the Beeline Drain is a designated coldwater trout stream, however, no trout associated habitat, or common coldwater trout stream benthic invertebrates were observed within the stream. Due to the size, depth, and flow regime of the stream, potential fisheries are very limited. The low amounts of benthic invertebrates suggest that the waterway may be intermittent during the summer and drier periods.

Impacts
The potential impacts on waterway hydrology are associated with the increased highway impervious surfaces and include increased peak flows, loss of existing flood storage capacity, and degraded water quality due to introduced contaminants. New sources of contaminants could potentially impact the water quality and wildlife species of the Beeline Drain. While the new culvert will limit the impacts on existing drainage patterns, the aquatic system may still be affected by pollutants contained in storm water runoff. Possible storm water contaminants may include the following:

- Temporary sediment inputs from erosion caused by construction activity,
- Salt placed on the roadways during snow storms,
- Increased storm water runoff volume that results in changes to the hydrograph and stream channel morphology,
- Petrochemicals, oil, grease and heavy metals associated with automobile traffic,
- Trash and debris discarded by motorists,
- Chemicals and hazardous materials accidentally spilled during transport.

Any impacts to the Beeline Drain should be minor. The waterway has already been greatly altered by human activities and is now subjected to flash flooding, high water levels, and erosion. The drain's instream environment and hydrologic regime provides very little suitable habitat for fish and benthic macroinvertebrates.

Mitigation
The use of appropriate construction techniques should lessen temporary water quality degradation of the Beeline Drain during construction. Sedimentation will be controlled by protecting the side slopes, ditches and other areas draining directly into the waterway with sod, seed, riprap, mulch, and erosion control fabric or blankets. All disturbed areas will be stabilized and re-vegetated as soon as possible. All natural vegetative growth outside the project limits will be protected.

Long term impacts to water quality will be minimized by the construction of detention basins with discharges directed to vegetative controls, such as grassy drainage ways, filter strips, overland flows and wetlands. These systems reduce pollutant and sediment loads to streams by reducing flow velocity, which allows contaminant-laden suspended solids to settle out prior to discharge. Detention basins and vegetated swales also protect water quality by detaining peak storm flows. Detaining this runoff prevents stream flows from increasing rapidly, which can lead to instability of the stream channel and habitat degradation. The culvert installed in the Beeline Drain will be sized correctly and allow the waterway to retain its current drainage patterns.

Stearns Creek
Upstream of the site, Stearns Creek is a very slow-moving silt-laden stream with a sandy bottom. Because of alterations in its drainage, mainly installed culverts, it pools into a wetland area onsite. The wetland then empties through the culverts to a swifter moving, shallow stream with some small areas of gravel substrate. According to the MDEQ, Stearns Creek is a designated trout stream, however, no trout associated habitat, or common coldwater trout stream benthic invertebrates were observed within the wetland or stream area. Due to the size, depth, and flow regime of the stream potential fisheries are limited.
**Impacts**

The potential impacts on stream hydrology are associated with the increased highway impervious surfaces and include increased peak flows, loss of existing flood storage capacity, and degraded water quality due to introduced contaminants. New sources of contaminants could potentially impact the water quality and wildlife species of Stearns Creek. While the new bridge will limit impacts on the morphology and drainage patterns of the creek, the aquatic system may still be affected by pollutants contained in storm water runoff. Possible storm water contaminants may include the following:

- Temporary sediment inputs from erosion caused by construction activity,
- Salt placed on the roadways during snow storms,
- Increased storm water runoff volume that results in changes to the hydrograph and stream channel morphology,
- Petrochemicals, oil, grease and heavy metals associated with automobile traffic,
- Trash and debris discarded by motorists,
- Chemicals and hazardous materials accidentally spilled during transport.

Any impacts to Stearns Creek should be minor. The waterway has already been altered by human activities including the installation of double culverts within the project ROW. The culverts have significantly impacted stream hydrology and morphology. It has slowed the flow of the stream and created a backwater wetland area. Due to the construction a bridge, the creek’s instream habitat and hydrologic regime should not be significantly impacted.

**Mitigation**

The use of appropriate construction techniques should lessen temporary water quality degradation of Stearns Creek during construction. Sedimentation will be controlled by protecting the side slopes, ditches and other areas draining directly into the waterway with sod, seed, riprap, mulch, and erosion control fabric or blankets. All disturbed areas will be stabilized and re-vegetated as soon as possible. All natural vegetative growth outside the project limits will be protected.

Long term impacts to water quality will be minimized by the construction of detention basins with discharges directed to vegetative controls, such as grassy drainage ways, filter strips, overland flows and wetlands. These systems reduce pollutant and sediment loads to streams by reducing flow velocity, which allows contaminant-laden suspended solids to settle out prior to discharge. Detention basins and vegetated swales also protect water quality by detaining peak storm flows. Detaining this runoff prevents stream flows from increasing rapidly, which can lead to instability of the stream channel and habitat degradation.

The Stearns Creek bridge will be approximately 210 feet long, which will span most of the adjacent wetlands. Specific length, pier spacing, and construction methods will be determined during the design process.

**Little Robinson Creek**

Little Robinson Creek was assessed in two separate locations. Due to beaver activities, Little Robinson Creek has been impounded within the project area. The old stream channel is barely recognizable and the entire floodplain area around the stream is inundated with stagnant water. A beaver hut is located onsite. According to the MDEQ, Little Robinson Creek is a designated coldwater trout stream, however, at this location the stream resembles a large emergent wetland and no trout species or associated benthic invertebrates are likely to be present. An adjacent landowner reported that the stream used to contain trout until the beavers arrived approximately 3 years ago, but common carp and northern pike still exist. Based on field observations, it is possible that warm water fish are present like common carp, sunfish, and white suckers; however, the potential for northern pike to inhabit the area is unlikely.

A second area upstream from the impoundment and project area was assessed to determine the past condition of the creek prior to beaver activity. However an unnamed waterway does flow into the creek between the two assessment locations making comparisons difficult. The upstream location was in the best condition of all the waterways analyzed and actually contained some cobble substrate and a small
amount of riffle habitat. Although the size and depth of the creek make it unlikely to support trout species, small fish species may be present including minnows, chubs, daces, and darters. Although rare, one caddisfly species was present within the gravel-bottomed portions of the stream, probably from the Limnephilidae family.

Impacts
The potential impacts on stream hydrology are associated with the increased highway impervious surfaces and include increased peak flows, loss of existing flood storage capacity, and degraded water quality due to introduced contaminants. New sources of contaminants could potentially impact the water quality and wildlife species of Little Robinson Creek. While the new bridge will limit impacts on the hydrology and wetland areas associated with the creek, the aquatic system may still be affected by pollutants contained in storm water runoff. Possible storm water contaminants may include the following:

- Temporary sediment inputs from erosion caused by construction activity,
- Salt placed on the roadways during snow storms,
- Increased storm water runoff volume that results in changes to the hydrograph and stream channel morphology,
- Petrochemicals, oil, grease and heavy metals associated with automobile traffic,
- Trash and debris discarded by motorists,
- Chemicals and hazardous materials accidentally spilled during transport.

Any impacts to Little Robinson Creek should be minor. The waterway has already been significantly altered by beaver activity and now resembles a large wetland area. This drastic change in habitat has already severely impact any previously existing fish or benthic macroinvertebrate populations. Bridge construction should not impact the old stream channel but will impact approximately 0.012 acre of associated wetland habitat. This 0.012 acre is already included in the total 3.4 acres of total wetland impact for the entire project.

Mitigation
The use of appropriate construction techniques should lessen temporary water quality degradation of Little Robinson Creek and associated wetland areas during construction. Sedimentation will be controlled by protecting the side slopes, ditches and other areas draining directly into the waterway with sod, seed, riprap, mulch, and erosion control fabric or blankets. All disturbed areas will be stabilized and re-vegetated as soon as possible. All natural vegetative growth outside the project limits will be protected.

Long term impacts to water quality will be minimized by the construction of detention basins with discharges directed to vegetative controls, such as grassy drainage ways, filter strips, overland flows and wetlands. These systems reduce pollutant and sediment loads to streams by reducing flow velocity, which allows contaminant-laden suspended solids to settle out prior to discharge. Detention basins and vegetated swales also protect water quality by detaining peak storm flows. Detaining this runoff prevents stream flows from increasing rapidly, which can lead to instability of the stream channel and habitat degradation.

The Little Robinson Creek bridge will be approximately 503 feet long, which will span the 100-year floodplain and adjacent wetlands. The only planned wetland impact are due to the construction of 4 piers. Specific length, pier spacing, and construction methods will be determined during the design process.

Unnamed Drain
The unnamed drain near Cypress Street drains nearby agricultural fields and is present on site as a wide wetland swale flowing into a small stream with well-defined bed and banks. The flow through the drain is most likely intermittent based on field observations and the lack of a benthic invertebrate population. Consequently no fisheries are likely to be present.

Impacts
The potential impacts on waterway hydrology are associated with the increased highway impervious surfaces and include increased peak flows, loss of existing flood storage capacity, and degraded water
quality due to introduced contaminants. New sources of contaminants could potentially impact the water quality and wildlife species of the Unnamed Drain. While the new culvert will limit the impacts on existing drainage patterns, the aquatic system may still be affected by pollutants contained in storm water runoff. Possible storm water contaminants may include the following:

- Temporary sediment inputs from erosion caused by construction activity,
- Salt placed on the roadways during snow storms,
- Increased storm water runoff volume that results in changes to the hydrograph and stream channel morphology,
- Petrochemicals, oil, grease and heavy metals associated with automobile traffic,
- Trash and debris discarded by motorists,
- Chemicals and hazardous materials accidentally spilled during transport.

Any impacts to the Unnamed Drain should be minor. The waterway has already been greatly altered by human activities and has several shoddily installed culverts near the project ROW. Additionally, the hydrologic regime and intermittent flow of the Unnamed Drain severely limits the suitable habitat for fish and benthic macroinvertebrates.

**Mitigation**

The use of appropriate construction techniques should lessen temporary water quality degradation of the Unnamed Drain during construction. Sedimentation will be controlled by protecting the side slopes, ditches and other areas draining directly into the waterway with sod, seed, riprap, mulch, and erosion control fabric or blankets. All disturbed areas will be stabilized and re-vegetated as soon as possible. All natural vegetative growth outside the project limits will be protected.

Long term impacts to water quality will be minimized by the construction of detention basins with discharges directed to vegetative controls, such as grassy drainage ways, filter strips, overland flows and wetlands. These systems reduce pollutant and sediment loads to streams by reducing flow velocity, which allows contaminant-laden suspended solids to settle out prior to discharge. Detention basins and vegetated swales also protect water quality by detaining peak storm flows. Detaining this runoff prevents stream flows from increasing rapidly, which can lead to instability of the stream channel and habitat degradation. The culvert installed in the Unnamed Drain will be sized correctly and allow the waterway to retain its current drainage patterns.

**General Impacts**

Storm water management for the Preferred Alternative is consistent with the goals and objectives of the Ottawa County Parks Department, River Greenway Project. This project's mission supports the improvement of water quality within the watersheds, through such actions as storm water management, protection of riparian buffers, and wetland restoration. There will be no impacts to the parks along the river.

**River, Creek, and Drain Crossings**

The long-term impacts on stream hydrology are associated with the increased highway impervious surfaces and include increased peak flows, loss of existing flood storage capacity, and degraded water quality. Long-term effects will be minimized by the construction of detention basins.

Culverts constructed on designated county drains will be sized according to the regulating authorities’ standards and in accordance with MDOT’s Drainage Manual guidelines.

**General Mitigation**

Storm water will be collected and routed to detention basins before being released back into receiving waterways. The basins will be constructed to attenuate storm flows to pre-construction rates and will consist of approximately ten detention areas along the proposed new alignment and two along existing US-31 in Holland Township. Potential locations of the basins with estimated storage volumes (acres-feet) are shown in the Appendix A. Detention basins as shown in Appendix A do not impact existing wetlands. The location, size, and design of these basins will be finalized during the design of the project,
in coordination with the MDNR to avoid negative impacts on the receiving waterways. No direct discharges of storm water from the Grand River bridge to the river below the bridge will be provided without routing the water through a detention basin first.

**Existing US-31**
A combination of enclosed drainage and/or roadside ditches will be incorporated into all urban areas. Drainage within the City of Grand Haven will consist of an enclosed system with curbs and gutters. This enclosed drainage system will be designed to carry a 10-year storm event, in accordance with MDOT’s Drainage Manual guidelines. Storm water in Holland Township will be controlled using open drainage.

**New Alignment**
Wherever possible, the new alignment grades will be set to allow for open drainage ditches in the median and outside shoulder areas. These roadside ditches will be designed to handle a 50-year storm event, in accordance with MDOT’s Drainage Manual guidelines. The lack of driveways due to the limited access roadway will limit the amount of impervious surface associated with the new alignment. The lack of impervious surface will result in less storm water runoff. Three bridges will be constructed over existing waterways, including the Grand River, Little Robinson Creek, and Stearns Creek. Each of these structures will span most wetlands and the entire 100-year floodplain.

The Grand River bridge is discussed in the floodplain section of this chapter. The number of substructures outside of the river will be limited to minimize impacts to the wetland areas. Specific length, pier spacing, and construction methods will be determined during the design process.

Existing and proposed culverts will be designed during the design process in accordance with MDOT’s Drainage Manual guidelines.

**Short-Term Impacts**
All road fill, slopes, ditches, and other cleared areas that drain directly to any stream channel will be stabilized through the use of riprap, sod, seed, and/or mulch. Silt fencing will be used to prevent sediment from entering any wetland or watercourse. Construction activities in the watercourses during periods of above normal flow will be avoided.

**4.12.2 Floodplains**
The Preferred Alternative crosses one major hydrologic system, the Grand River, which contains floodplains within the project area. The Preferred Alternative also crosses Little Robinson Creek and Stearns Creek.

The following were used to determine the limits of floodplains and floodways within the study area:
- A preliminary HEC-RAS model of the Grand River in Ottawa County, developed by the MDEQ for future use by the Federal Emergency Management Agency (FEMA) in the preparation of a county-wide Flood Insurance Study (FIS)
- This study’s 3.2-foot Digital Terrain Model (DTM)
- This study’s hydraulic analysis of the proposed Grand River bridge
- This study’s hydraulic analysis of the proposed Little Robinson Creek bridge

The 100-year floodway boundary has been adopted by FEMA as the base floodway for purposes of floodplain management. **Figure 4.12-1** and **Appendix A** depict the extent of the 100-year floodplains that have been mapped.

Encroachment, such as artificial fill on floodplains, reduces the flood-carrying capacity, and potentially increases the flood heights of streams, as well as potentially increasing flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For the purposes of the National Flood Insurance Program (NFIP), the concept of a floodway is used as a tool to assist local communities in this aspect of floodplain management.
Under Part 31, Water Resources Protection, Natural Resources and Environmental Protection Act, 1994, PA 451, as amended, encroachment in the floodplain cannot be permitted if it will cause a harmful interference with the stage and discharge characteristics of the streams. Harmful interference is site specific and is defined as likely to cause any of the following: 1) damage to property, 2) a threat to life, 3) a threat to personal injury, 4) pollution impairment, or 5) destruction of water or other natural resources. In areas subject to potential flood damage, an increase in flood stage of more than 0.00 feet may be considered harmful. Affected property owners would have to be notified of increases in flood stage, and a damage assessment certification would be required to be completed by a licensed engineer.

As part of its administration of the NFIP, FEMA publishes flood hazard maps, called Flood Insurance Rate Maps, or FIRMs. If the project causes an increase in flood stage or more than 0.00 feet, MDOT is required under Part 31 to coordinate with the FEMA to update these maps. This process is described Section 4.23.

**Impacts and Mitigation**

The FHWA’s 23 CFR 650, Subpart A, requires an analysis of alternatives crossing floodplains to determine whether or not there will be encroachment upon the base (100-year) floodplain. If an encroachment is projected, a discussion on the level of risk or environmental impact must address the following items:

- Flooding risk,
- Impacts on natural and beneficial floodplain values,
- Support of probable incompatible floodplain development,
- Measures to minimize floodplain impacts, and
- Measures to restore and preserve the natural and beneficial floodplain values.

Since this study is of a north-south corridor and the Grand River flows east-west, avoidance is not possible. In addition, the width of the floodplain makes construction of a long single span structure without piers located in the floodplain impractical. At the proposed crossing site, The Grand River is about 580 feet wide and varies in depth up to 21 feet deep during normal flow. The 100-year floodplain varies from about 3,800 to 4,500 feet wide.

A hydraulic analysis was conducted to examine the upstream effect of the proposed bridge on the 100-year water surface elevation. The analysis used the FEMA HEC-RAS model, with the addition of four surveyed cross-sections near the proposed bridge. For the model, the bridge was assumed to be 3,998 feet long and 70 feet wide with two traffic lanes, as shown in Figures 4.12-1 and 4.12-2. A second model was also created to examine the upstream effects of a possible future bridge configuration. For the second model, the bridge was assumed to be 127 feet wide with four traffic lanes.

As shown in Table 4.12-3, when these bridges are added to the HEC-RAS model, the 100-year water surface elevation (WSEL) would increase by 0.01 feet in both cases.

<table>
<thead>
<tr>
<th>Impacts to the 100-Year Floodplain Elevation of the Grand River</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing Elevation (feet)</td>
</tr>
<tr>
<td>Future Elevation (feet) with 70 foot wide bridge</td>
</tr>
<tr>
<td>Future Elevation (feet) with 127 foot wide bridge</td>
</tr>
</tbody>
</table>

Note: Elevations are for a point immediately upstream from the proposed bridge.
TYPICAL CROSS-SECTION FOR THE PROPOSED M-231 GRAND RIVER BRIDGE

APPROXIMATELY 70'

CONCEPTUAL 12'-14'

NON-MOTORIZED

12' SHLDR

12' LANE

12' LANE

10' SHLDR

POTENTIAL SUBSTRUCTURE FOR FUTURE FOUR-LANE ROADWAY
Piers were assumed to be seven feet wide. It was determined that for a 3,998-foot bridge, a maximum of 26 piers could be used while limiting the increase in backwater to 0.01 feet. This number of piers leaves room for the minimum required navigable channel clearance (160 feet). Soil borings reveal no unusual subsurface conditions that would require more than 26 piers. The width of the navigation channel will require that at least part of the bridge be made of steel, since concrete spans are generally limited to approximately 140’-150’. The hydraulic model assumed two long steel center spans, allowing the use of only 26 piers, reducing cost by minimizing piers in the river, and improving aesthetics. It further allows the remainder of the bridge to be constructed with concrete, which is more cost-effective than steel. See Figure 4.12-3 for an elevation view of the modeled bridge.

A calculated backwater increase of 0.01 feet is within the margin of error of this study’s computational model. A final hydraulic study based on the actual construction plans will be required prior to the construction of the bridge. The final bridge length, width, and pier spacing may be different from the assumptions made in this study. If such a study determines that the project causes backwater impacts beyond the limits of the project right of way, there are two available mitigation measures:

1. Remove a sufficient number of piers (i.e. increase pier spacing) to eliminate backwater impacts that extend beyond the limits of the road right of way, or
2. Obtain flood damage waivers from affected property owners.

The proposed Grand River bridge will span the entire floodplain and therefore have only a minimal adverse impact to the natural and beneficial qualities of the floodplain. Beneficial qualities of the floodplain include flood attenuation, water quality, and wildlife habitat and shoreline protection. Only two piers will need to be constructed in the main river channel. The floodplain impact of all the piers will be approximately 0.29 acres for the two lane bridge and 0.53 acres for the four lane bridge. Measures that may be implemented to minimize floodplain impacts during the construction phase include, but are not limited to:

- Proper application of soil erosion and sedimentation control measures,
- Restricting construction activities in the watercourse during periods of above normal flow.
- Compensating cuts to offset placing piers in the floodplain.

Final mitigation design plans will be developed in consultation with the appropriate agencies. Ottawa County is currently pursuing federal grants to assist in the acquisition of some properties that are within the floodplains and often flooded. Specific acquisitions would be dependent on owner participation.

Like the Grand River, Little Robinson Creek flows east-west and, since the corridor is north-south, avoidance is not possible. The width of the floodplain at Little Robinson Creek makes construction of a long single span structure without piers located in the floodplain impractical. At the proposed crossing site, the 100-year floodplain is approximately 400 feet wide.

A hydraulic analysis was conducted to examine the upstream effect of the proposed Little Robinson Creek bridge on the 100-year water surface elevation. The analysis used a HEC-RAS model based on surveyed cross-sections near the proposed bridge. For the model, the bridge was assumed to be 503 feet long and 70 feet wide with two traffic lanes, similar to the Grand River bridge crossing as shown in 4.12-2. A second model was also created to examine the upstream effects of a possible future bridge configuration. For the second model, the bridge was assumed to be 127 feet wide with four traffic lanes.

Piers were assumed to be seven feet wide. It was determined that for a 503-foot bridge, four piers could be used with no increase in backwater. The proposed Little Robinson Creek bridge will span the entire floodplain and therefore have only a minimal adverse impact to the natural and beneficial qualities of the floodplain.

At Stearns Creek, the floodplain is approximately 210 feet wide. A long, single span structure without piers in the floodplain is a practical alternative. The proposed bridge would span the entire floodplain.
and therefore have no backwater increase and only a minimal adverse impact to the natural and beneficial qualities of the floodplain.

4.12.3 Navigation

The general definition of a navigable waterway is “waters that are...presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce” (33 CFR 329.4). All construction or modification of a bridge or causeway across navigable waters of the United States requires approval by the USCG under Section 9 of the Rivers and Harbors Act of 1899. A bridge permit approved by the USCG is required before construction or modification work begins.

USACE (under Section 10) is responsible for the maintenance of the navigable river channel and its approval of the location and design of structures crossing a navigable waterway is required. It is concerned with such things as maneuvering room, sight distance necessary for safe navigation, and pier protection.

The Grand River is a navigable waterway and under the jurisdiction of the USCG eastward from the mouth of the river at Lake Michigan to approximately 102nd Avenue (approximately 2.5 miles upstream from the proposed M-231 Grand River crossing). The USACE maintains a navigation channel to a width of 300 feet and a depth of 21 feet west of US-31, and a width of 100 feet and a depth of eight feet east of US-31. Starting at Lake Michigan and moving east upstream, overhead obstructions to vessel passage on the Grand River include:

- Railroad swing bridge located immediately downstream of the US-31 bascule bridge,
- US-31 bascule bridge (23 feet clearance when closed),
- Overhead power lines immediately upstream of US-31,
- Overhead power lines west of 148th Avenue, and
- Overhead power lines east of 120th Avenue.

A Navigation Boat Survey was performed in 1995 to assist the USCG in determining the number, type and height of vessels using the Grand River for navigation. This study was conducted over a two-week period in August, including the Grand Haven Coast Guard Festival, which is typically the river’s busiest use time. Based on this study and an update completed in 2001, vessels currently using the Grand River include:

- Lake freighters (west of the railroad swing bridge only),
- Cruise ships (west of the railroad swing bridge only),
- Tug boats,
- Barges,
- USCG vessels, and
- Pleasure craft – sail and motor boats.

Impacts to Navigation

Boating traffic disruptions may occur at the new Grand River crossing. Impacts to boating traffic will be minimized.

Vertical Clearance: The proposed M-231 Grand River crossing will be a fixed-span bridge with a minimum vertical clearance of 35 feet. Vessels taller than 35 feet will not be able to pass under this structure. All vessels currently using this segment of the Grand River require less than 35 feet of vertical clearance.

Horizontal Clearance: The proposed M-231 Grand River crossing will maintain the 100 feet navigable channel with at least 30 feet buffer on either side of the channel, for a total horizontal clearance between piers of at least 160 feet. All vessels currently using this segment of the Grand River require less than 160 feet of horizontal clearance.
4.13 WILD AND SCENIC RIVERS

No Federal Wild or Scenic River systems are located within the study area, nor are there any State
designated Natural River systems that are regulated by Part 305 (Michigan Natural Rivers) of Act 451,
NREPA.

4.14 COASTAL BARRIERS CRITICAL DUNES

The improvements planned for the existing US-31 segment within the city limits of Grand Haven, from
south of Franklin Avenue to the Grand River, is located in a Coastal Zone Management Area. These
improvements are within existing ROW, and will not impact any Coastal Zone Management Areas. The
new alignment is not located in a Critical Dune Protection/Management Area or a high risk erosion area.

4.15 WILDLIFE AND VEGETATION

The Michigan Resource Information System Land Cover Use Classification System was used to map the
impacted areas by cover types. Figures 4.15-1 thru 5 shows the areas mapped and the acreage of
impact within the ROW. The paragraphs below outline the general characteristics and plant species
present in each cover type area.

Cropland areas are under cultivation for food crops as well as fallow farm fields and pastures used for
grazing livestock. Typical plant species found in this cover type area include goldenrod (Solidago sp.),
mullein (Verbascum sp.), Queen Anne’s lace (Daucus carota), common chicory (Cichorium intybus) and
asters (Aster spp.) in addition to cultivated row crops, small grains and hay.

Mixed Deciduous and Conifer areas are forested upland areas comprised predominately of hardwoods,
but also contain coniferous trees. These areas along the proposed M-231 are dominated by white oak
(Quercus alba), false solomon seal (Smilacina racemosa), sassafras (Sassafras albidium), black oak
(Quercus velutina), scotch pine (Pinus sylvestris), sugar maple (Acer saccharum), red oak (Quercus
rubra), raspberry (Rubus sp.), red pine (Pinus resinosa), white pine (Pinus strobus), black cherry (Prunus
serotina), Virginia creeper (Parthenocissus quinquefolia) and bracken fern (Pteridium aquilinium).

Single Family areas are detached, single family homes that are occupied permanently or seasonally.

Ornamental areas along the proposed M-231 are used for ornamental horticulture purposes such as
nurseries.

Emergent Wetlands are areas characterized by an herbaceous plant layer and shallow water. Typical
plant species found in the emergent wetlands along the proposed M-231 are narrow-leaved cattail (Typha
angustifolia), reed canary grass (Phalaris arundinacea), buttonbush (Cephalanthus occidentalis), arrow
arum (Peltandra virginica), riverbank grape (Vitis riparia), spotted joe-pye-weed (Eupatorium maculatum),
wood sage (Teucrium canadense), blue vervain (Verbena hastata), late goldenrod (Solidago gigantea),
tall ironweed (Vernonia gigantea) and swamp milkweed (Asclepias incarnata).

Upland Hardwood areas along the proposed M-231 are forested, non-wetland areas dominated by white
oak (Quercus alba), sassafras (Sassafras albidium), black oak (Quercus velutina), sugar maple (Acer
saccharum), red oak (Quercus rubra), black cherry (Prunus serotina), scotch pine (Pinus sylvestris), false
solomon seal (Smilacina racemosa), Virginia creeper (Parthenocissus quinquefolia), bracken fern
(Pteridium aquilinium) and raspberry (Rubus sp.).

Lowland Hardwood areas include both deciduous forested wetlands and deciduous floodplain forests.
Lowland hardwoods along the proposed M-231 were dominated by silver maple (Acer saccharinum),
spotted touch-me-not (Impatiens capensis), green ash (Fraxinus pennsylvanica), reed canary grass
Project Corridor Right of Way Impact: Land Cover/Use

<table>
<thead>
<tr>
<th>Land Cover/Use</th>
<th>Acreage</th>
<th>% of Total Acreage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cropland (1)</td>
<td>90.43</td>
<td>25.03%</td>
</tr>
<tr>
<td>Mixed Deciduous and Conifer (2)</td>
<td>97.29</td>
<td>27.47%</td>
</tr>
<tr>
<td>Single Family Residential (3)</td>
<td>69.54</td>
<td>19.55%</td>
</tr>
<tr>
<td>Ornamental (4)</td>
<td>22.89</td>
<td>6.44%</td>
</tr>
<tr>
<td>Emergent Wetland (5)</td>
<td>16.77</td>
<td>5.30%</td>
</tr>
<tr>
<td>Upland Hardwood (6)</td>
<td>37.53</td>
<td>10.60%</td>
</tr>
<tr>
<td>Lowland Hardwood (7)</td>
<td>4.26</td>
<td>1.20%</td>
</tr>
<tr>
<td>River, Stream, and Canal (8)</td>
<td>4.15</td>
<td>1.17%</td>
</tr>
<tr>
<td>Farmstead (9)</td>
<td>1.5</td>
<td>0.42%</td>
</tr>
<tr>
<td>Commercial (10)</td>
<td>7.89</td>
<td>2.22%</td>
</tr>
<tr>
<td>Scrub/Shrub Wetland (11)</td>
<td>0.25</td>
<td>0.07%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>354.2</td>
<td>100.00%</td>
</tr>
</tbody>
</table>

Legend:
- Upland Hardwood (6)
- Lowland Hardwood (7)
- River, Stream, and Canal (8)
- Farmstead (9)
- Commercial (10)
- Scrub/Shrub Wetland (11)
US-31 Final Environmental Impact Statement

Project Corridor Right of Way Impact: Land Cover/Use

Figure 4.15-2

Legend

2008 Land Use Cover LU

- Cropland (1)
- Mixed Deciduous and Conifer (2)
- Single Family Residential (3)
- Ornamental (4)
- Emergent Wetland (5)

- Upland Hardwood (6)
- Lowland Hardwood (7)
- River, Stream, and Canal (8)
- Pasture (9)
- Commercial (10)
- Scrub/Shrub Wetland (11)
US-31 Final Environmental Impact Statement

Project Corridor Right of Way Impact:
Land Cover/Use

Legend

2008 Land Use Cover

LU

- Cropland (1)
- Mixed Deciduous and Conifer (2)
- Single Family Residential (3)
- Ornamental (4)
- Emergent Wetland (5)
- Upland Hardwood (6)
- Lowland Hardwood (7)
- River, Stream, and Canal (8)
- Farmstead (9)
- Commercial (10)
- Scrub/Shrub Wetland (11)

Figure 4.15-5
US-31 Final Environmental Impact Statement

Project Corridor Right of Way Impact: Land Cover/Use

Legend
2008 Land Use Cover
LU
- Cropland (1)
- Mixed Deciduous and Conifer (2)
- Single Family Residential (3)
- Ornamental (4)
- Emergent Wetland (5)

- Upland Hardwood (6)
- Lowland Hardwood (7)
- River, Stream, and Canal (8)
- Farmstead (9)
- Commercial (10)
- Scrub/Shrub Wetland (11)
Figure 4.15-3

Legend

2008 Land Use Cover
LU
- Upland Hardwood (6)
- Lowland Hardwood (7)
- River, Stream, and Canal (8)
- Farmstead (9)
- Commercial (10)
- Emergent Wetland (5)

2008 Land Use Cover
LU
- Cropland (1)
- Mixed Deciduous and Conifer (2)
- Single Family Residential (3)
- Ornamental (4)
- Scrub/Shrub Wetland (11)
Environmental Resources, Impacts, and Mitigation

(Phalaris arundinacea), sedges (Carex spp.), paper birch (Betula papyrifera) and speckled alder (Alnus rugosa).

Areas mapped as River, Stream or Canal are open water, linear watercourses with little or no aquatic vegetation.

Areas mapped as Farmstead indicate an area of structures associated with farming operations.

Commercial areas along the existing US-31 are areas of commercial businesses such as retail stores and professional offices.

Shrub/Scrub Wetland areas are wetlands with brush and woody vegetation less than six meters in height. These areas are dominated by broad-leaved cattail (Typha latifolia), grey dogwood (Cornus foemina), cardinal flower (Lobelia cardinalis), common boneset (Eupatorium perfoliatum), angelica (Angelica atropurpurea), spotted joe-pye-weed (Eupatorium maculatum), goldenrods (Solidago spp.), sensitive fern (Onclea sensibilis), cinnamon fern (Osmundo cinnamomea) Eastern cottonwood (Populus deltoides), spotted touch-me-not (Impatiens capensis), quaking aspen (Populus tremuloides), sumac (Rhus sp.), red-osier dogwood (Cornus stolonifera), weeping willow (Salix alba), green ash (Fraxinus pennsylvanica), American elm (Ulmus americana,) and Eastern cottonwood (Populus deltoides).

Upland Grass areas along the proposed M-231 are upland fields and meadows dominated by goldenrod (Solidago sp.), mullein (Verbascum sp.), Queen Anne’s lace (Daucus carota), common chicory (Cichorium intybus) and asters (Aster spp.).

Areas with Pine cover type are coniferous, upland forests dominated by red pine (Pinus resinosa), white pine (Pinus strobus) and scotch pine (Pinus sylvestris).

Road Transportation areas are limited-access highways, divided surface highways and the ROWs associated with them.

Upland Shrub areas are dominated by scattered shrubs and shrub masses with ground cover and young tree growth. Along the proposed M-231 these areas are dominated by sumac (Rhus sp.), sassafras (Sassafras albidium), goldenrods (Solidago spp.), autumn olive (Eleagnus umbellata), mullein (Verbascum sp.), Queen Anne’s lace (Daucus carota), common chicory (Cichorium intybus) and asters (Aster spp.).

Fauna observed in the habitats along the proposed M-231 are common to areas settled and somewhat disturbed by human activity. Mammal species that were observed in the project area include eastern chipmunk (Tamias striatus), long-tailed weasel (Mustela frenata), eastern cottontail (Sylvilagus floridanus) and white-tailed deer (Odocoileus virginianus). Other common wildlife species most likely in the area are: muskrat (Ondatra zibethicus), Virginia opossum (Didelphis virginiana), raccoon (Procyon lotor), woodchuck (Marmota monax), bats, mice, voles, moles, coyote (Canis latrans), red fox (Vulpes fulva) and striped skunk (Mephitis mephitis). Reptiles and amphibians also frequent the Preferred Alternative area including snakes, turtles, frogs, salamanders and toads. Species observed include Eastern American toad (Bufo americanus), wood frog (Rana sylvatica), northern leopard frog (Rana pipiens), and eastern box turtle (Terrapene carolina carolina).

Various birds observed inhabiting the Preferred Alternative include species such as the European Starling (Sturnus vulgaris), Song Sparrow (Melospiza melodia), American Robin (Turdus migratorius), American Crow (Corvus brachyrhynchos), and Mourning Dove (Zenaida macroura). Other perching bird species that were identified are Sedge Wren (Cistothorus platensis), Barn Swallow (Hirundo rustica), Northern Cardinal (Cardinalis cardinalis), Rose-breasted Grosbeak (Pheucticus ludovicianus), Common Yellowthroat (Geothlypis trichas) and Gray Catbird (Dumetella carolinensis). Raptors including hawks, kestrel and owls may also inhabit the project area. Red-tailed Hawk (Buteo jamaicensis) and Turkey Vulture (Cathartes aura) were identified. Red-winged Blackbird (Agelaius phoeniceus), Great Blue Heron
(Ardea herodias), Mallard (Anas platyrhynchos), and Mute Swan (Cygnus olor) were found in and adjacent to wetlands. Despite a game bird preserve being present within the Preferred Alternative, the only upland game species observed was Wild Turkey (Meleagris gallopavo).

Detailed inventories of upland habitats were conducted along proposed alternatives from 1994 to 1998. During these surveys, detailed documentation of the wildlife observed was recorded in a series of reports entitled Biological Assessment Working Papers submitted to the MDNR. This information is available for review.

**Impacts**

Terrestrial resources along the Preferred Alternative provide suitable habitat for numerous plants and animals. This project lies in an already fragmented landscape; the addition of a highway corridor will likely not greatly increase fragmentation. Most species observed along the Preferred Alternative are adaptable generalists that have become accustomed to living in proximity to human populations. Most of these species should easily relocate from areas impacted by the project.

Quantifying wildlife impacts generally requires the use of predictive habitat models such as Habitat Evaluation Procedures (HEP). In the absence of semi-quantitative techniques such as HEP, the wildlife impacts are often discussed in terms of the amount of plant community disturbance, as these communities and cover types provide the habitat for the various species found in the area.

Table 4.15-1 lists the total acreage potentially impacted by each cover type along the Preferred Alternative. Impacts were determined by assuming that everything within the proposed construction limits would be impacted by the project, which is a conservative estimation. Note that while upland hardwood and mixed deciduous and conifers are mapped in many locations, the woods in the area are generally younger and second growth stands. Much of the wooded areas contain single family residences, so functionally many of these wooded areas are actually in residential land uses.

<table>
<thead>
<tr>
<th>Land Cover/Use (MIRIS)</th>
<th>Acreage</th>
<th>Percent of Total Acreage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cropland</td>
<td>90.43</td>
<td>25.53%</td>
</tr>
<tr>
<td>Mixed Deciduous and Conifer</td>
<td>97.29</td>
<td>27.47%</td>
</tr>
<tr>
<td>Single Family Residential</td>
<td>69.24</td>
<td>19.55%</td>
</tr>
<tr>
<td>Ornamental</td>
<td>22.89</td>
<td>6.46%</td>
</tr>
<tr>
<td>Emergent Wetland</td>
<td>18.77</td>
<td>5.30%</td>
</tr>
<tr>
<td>Upland Hardwood</td>
<td>37.53</td>
<td>10.60%</td>
</tr>
<tr>
<td>Lowland Hardwood</td>
<td>4.26</td>
<td>1.20%</td>
</tr>
<tr>
<td>River, Stream, and Canal</td>
<td>4.15</td>
<td>1.17%</td>
</tr>
<tr>
<td>Farmstead</td>
<td>1.50</td>
<td>0.42%</td>
</tr>
<tr>
<td>Commercial</td>
<td>7.89</td>
<td>2.23%</td>
</tr>
<tr>
<td>Shrub/Scrub Wetland</td>
<td>0.25</td>
<td>0.07%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>383.99</td>
<td>100%</td>
</tr>
</tbody>
</table>

**Temporary**

Mobile wildlife species that inhabit the Preferred Alternative will be temporarily displaced to adjacent habitats during construction. Smaller, less mobile mammals, reptiles and amphibians may be directly impacted. Temporary noise associated with construction could disrupt breeding and nesting activities of birds and other wildlife, depending upon the timing of construction. However, this is an area that already experiences a good deal of noise and other activity associated with human populations. Most birds in the area should easily relocate nests and perches to un-impacted areas around the project.
**Long-Term**

Vegetation, especially species of trees and shrubs that provide wildlife food and/or cover, will be impacted within the proposed ROW during construction and in the operation of the freeway facilities. Forested areas play a critical role in the improvement and maintenance of water, soil, and air quality which provide habitat for diverse wildlife, as well as, recreation opportunities and resources for the community. Grasslands and old fields regenerate faster and are more tolerant to disturbance from construction than forests.

Some terrestrial wildlife species on their seasonal migration and daily search for food require the regular use of wetland habitats, including floodplains, ravines and forested wetlands, as well as upland habitats, as established wildlife corridors. The new alignment will not inhibit the passage of terrestrial species along the major watercourse or its floodplain. The project as planned will span the entire 100 year floodplain of the Grand River, and should therefore not pose a restriction to animal travel along the riparian corridor. Wetland losses were minimized to 3.04 acres, a small amount of permanent impact considering the amount of wetland in the project area. There were approximately 24.87 acres of wetland delineated within the project study area, thus 88% of the wetland resource will be avoided by the project.

Given the list of species observed during the various field identification efforts, it seems that the generalist species typically found in the area should be able to find additional habitat and readily move to avoid construction impacts. Proposed M-231 will likely not impact non-resident animal species. The habitat adjacent to the proposed right of way is very similar to the habitat of the surrounding areas. The majority of non-wetland habitat that will be impacted contains mixed deciduous and coniferous forests, upland hardwood forests and cropland. These habitats are common throughout Ottawa County as well as Allegan and Muskegon Counties.

**Mitigation**

Compensatory mitigation is not required for upland impacts. However, design oriented avoidance measures and the use of native plant species post construction are often applied to highway projects within Michigan. The use of invasive species control measures should be considered.

Over half of the acreage impacted by the project currently lies in cropland and single family residences. While cropland provides habitat for some species, upland forests provide habitat for multiple species. The Preferred Alternative minimizes impact to upland habitats through strategic avoidance. In these areas, options for limiting roadside wildlife fatalities will be explored. Likewise, re-vegetation of the right-of-way after construction with native plant species will be considered to enhance the floristic quality of the roadside. These strategies will be developed during the design phase. The need for restoration of upland hardwood and mixed deciduous and conifer areas will also be evaluated.

Bridges that span the waterways and floodplains will allow the continued use of these areas as wildlife corridors. At stream crossing locations where bridges are not proposed, large box culverts will be used to facilitate the passage of wildlife. Culvert design for wildlife movement will be determined based upon need and feasibility at each individual location. Wetland mitigation is addressed in Section 4.10.2. The completed Wetland Mitigation Plan will replace the acreage and associated functions and values, including the provision of habitat for wildlife.

**4.16 NATURAL AREAS**

Natural areas are unique habitats with rare botanical and biological diversity or rare natural features. The Nature Conservancy has proposed protection for one Proposed Natural Area (PNA) adjacent to the Preferred Alternative, Bruce’s Bayou. Bruce’s Bayou is hydrologically connected to the wetlands on the Spoonville Gun Club property. The Preferred Alternative will not impact the Proposed Natural Area.