Rare Plant Species Surveys for the Michigan Department of Transportation: Northbound US-31 from US-12 to M-139 MDOT project No. 201984



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Cover: Clockwise from top left: State Threatened Prairie Trillium (*Trillium recurvatum*) in the woods adjacent to the Trillium Ravine Preserve; State Threatened Toadshade (*Trillium sessile*) in the woods adjacent to the Trillium Ravine Preserve; A characteristic wetland sedge (*Carex vulpinoidea*) along the bank of Lemon Creek; A panorama of the northbound US-31 onramp from eastbound Niles-Buchanan Road.

All photos in this report, unless otherwise stated in captions, were taken by Elizabeth Haber.

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Introduction and Methods

A summary of rare plant surveys for MDOT project area 201984 is presented in this report. Surveys for rare plant species are required for this project to ensure compliance with regulations regarding potential impacts of road improvement projects on rare species. The project area is located in Berrien County and spans northbound US-31 from US-12 at the south terminus to M-139 at the north terminus (Figure 1). Resurfacing will be done on US-31 and on all northbound ramps within the project area. Paved shoulders will be widened from 9 feet to 10 feet. Both loop ramps at Niles-Buchannan Road will be removed. Fencing in the ROW will be replaced, necessitating the clearing of about 10 acres of land to do so. Guardrails and ramps may be extended if needed, and storm sewer improvements may be implemented.

A search of the Michigan Natural Heritage Database was performed to identify rare plant species records and high-quality natural communities found within a two-kilometer buffer of the project area. Survey search efforts focused on species that have been recently observed within the buffer of the project area (Table 1) and were also informed by the historical presence of other species in the area (Table 2) and by the presence of high-quality Natural Communities (Table 3) nearby.

Three surveys were carried out during the 2021 growing season in this project area. These corresponded as closely as possible to early, mid, and late season phenology to capture the changing plant species composition and abundance over the growing season and to maximize the chances to observe the target rare plant species. The early survey was conducted on June 15-17, the mid-season survey on July 23, August 2, and August 5, and the late season survey on October 5.

Since this project area is so large, it was not feasible to walk the entire ROW during each survey. A targeted approach was used to focus walking survey efforts on areas which were either likely to support rare species or were likely to be disturbed during construction activities. The habitat preferences for the rare species in Tables 1 and 2 informed this targeted approach. Aerial imagery was consulted to identify locations where 1) the tree canopy was intact, and 2) creeks or riverbanks were accessible, as these locations were considered more likely to provide habitat for rare species. Walking surveys were carried out in these areas, as well as at all interchanges. The entire project area was surveyed either on foot or by car during each visit.

In addition to searching for rare species, several other categories of observations were collected. These include: presence and identification of non-native invasive species, high-quality habitats, and other notable features.





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Results and Discussion

Biotics Database search results

The results of the Biotics database queries for listed plant species and Natural Community Element Occurrences found near this project area are presented in Tables 1-3.

Eleven rare plant species have been recently located within two kilometers of the roads impacted by this MDOT project within the last 50 years (Table 1). Of these species, two are listed as Special Concern and nine are Threatened. Special Concern species are tracked by MNFI; however, they do not have the legal protections that Threatened and Endangered species do. These species were the focal species for search efforts in this project area.

Prior to 1970, 22 additional rare plant species have been found near this MDOT project area (Table 2). Many of the historical species occurrences have very general location information, and therefore it is not certain if these species were specifically found within the two-kilometer buffer of this MDOT project area. However, if the potential range of an historical observation intersected with the project buffer, it was included in the table. Of these 22 species, three are listed as Special Concern, 12 are Threatened, three are Endangered, and four presumed to be extirpated from Michigan. These species were not the primary focus of search efforts, although their historical presence in the area informed searching behavior.

The majority of the rare plant species in Tables 1 and 2 occur in forested Natural Communities. Wet and mesic forests such as floodplain forests, mesic southern forests, and southern hardwood swamps are associated with many of the rare species in Tables 1 and 2; although drier forested habitats such as oak openings, oak barrens, bur oak plains, and dry-mesic southern forests host a fair amount of these species as well. Some of the rare species in Tables 1 and 2 also prefer prairie community types such as prairie fens and dry-mesic and mesic prairies.

| Latin name | Common name | State status | Target season |
|------------------------|--------------------|-----------------|-----------------------------|
| Baptisia lactea | White false indigo | Special Concern | Mid-late summer |
| Camassia scilloides | Wild-hyacinth | Threatened | Late spring – early summer |
| Collinsia verna | Blue-eyed Mary | Special Concern | Mid-spring – early summer |
| Coreopsis palmata | Prairie Coreopsis | Threatened | Early-late summer, autumn |
| Euphorbia commutata | Tinted spurge | Threatened | Mid-spring – early summer |
| Morus rubra | Red mulberry | Threatened | Late spring – mid-autumn |
| Panax quinquefolius | Ginseng | Threatened | Early-late summer, autumn |
| Polemonium reptans | Jacob's ladder | Threatened | Late spring |
| Trillium recurvatum | Prairie Trillium | Threatened | Early spring – early summer |
| Trillium sessile | Toadshade | Threatened | Early-late spring |
| Triphora trianthophora | Nodding pogonia | Threatened | Mid-summer – mid-autumn |

Table 1: Post-1970 records of rare plant species located near the project area.

Table 1: Results of a query of the Biotics database listing occurrences of protected plant species within a two-kilometer buffer of the project area last observed since 1970.

| Table 2: Pre-1970 historica | I records of rare p | lant species I | ocated near the | proiect area. |
|-----------------------------|---------------------|----------------|-----------------|---------------|
| | | | | |

| Latin name | Common name | State status | Target season |
|--------------------------|---------------------------|-----------------|---------------------------|
| Androsace occidentalis | Rock-jasmine | Endangered | Mid-late spring |
| Brickellia eupatorioides | False boneset | Special Concern | Mid-late summer, autumn |
| Carex gravida | Sedge | Extirpated | Early-mid summer |
| Carex oligocarpa | Eastern few-fruited sedge | Threatened | Late spring – mid summer |
| Carex seorsa | Sedge | Threatened | Early-mid summer |
| Corydalis flavula | Yellow fumewort | Threatened | Early-mid spring |
| Filipendula rubra | Queen-of-the-prairie | Threatened | Mid-late summer, autumn |
| Galearis spectabilis | Showy orchis | Threatened | Mid-spring – early summer |
| Gentiana saponaria | Soapwort gentian | Extirpated | Early-late autumn |
| Gentianella quinquefolia | Stiff gentian | Threatened | Early-late autumn |
| Hybanthus concolor | Green violet | Special concern | Mid-spring – late summer |
| Linum virginianum | Slender yellow flax | Threatened | Early-mid summer |
| Lithospermum molle | Marbleweed | Extirpated | Early-mid summer |
| Lycopodiella subappressa | Northern clubmoss | Special concern | Late summer – late autumn |
| Oxalis violacea | Violet wood sorrel | Extirpated | Early spring – mid summer |
| Phlox maculata | Wild sweet-William | Threatened | Early-mid summer |
| Platanthera ciliaris | Orange fringed orchid | Endangered | Mid-late summer |
| Primula meadia | Shooting star | Endangered | Late spring – mid summer |
| Pycnanthemum pilosum | Hairy mountain mint | Threatened | Mid-late summer |
| Silene stellata | Starry campion | Threatened | Mid-late summer |
| Silphium integrifolium | Rosinweed | Threatened | Mid-late summer, autumn |
| Smallanthus uvedalia | Yellow-flowered leafcup | Threatened | Late spring – late summer |

Table 2: Results of a query of the Biotics database listing historical (last seen before 1970) occurrences of protected plant species within a two-kilometer buffer of the project area.

One MNFI Natural Community element occurrences is mapped within two kilometers of this MDOT project area (Table 3). An MNFI Natural Community is "an assemblage of interacting plants, animals, and other organisms that repeatedly occurs under similar environmental conditions across the landscape and is predominantly structured by natural processes rather than modern anthropogenic disturbances."¹ This mapped element occurrence is of a floodplain forest. Fifteen of the rare plant species listed in Tables 1 & 2 occur in floodplain forest habitats, so extra search effort was devoted to searching for these species when suitable habitat was encountered.

Table 3: Natural Community Element Occurrences located near the project area

| Natural Community Name | General Location | Last observed |
|------------------------|--|---------------|
| Floodplain forest | Where Love Creek flows into the St. Joseph River, to the north of Andrews University in Berrien Springs | 1993 |

Table 3: Results of a query of the Biotics database listing Natural Community Element Occurrences within a twokilometer buffer of the project area.

Protected plant species observations

During the early season visit to this project area, on June 16, 2021, surveyors Alex Ellison and Elizabeth Haber located populations of two State Threatened *Trillium* species in the project boundary. The species are *Trillium recurvatum* (prairie trillium) and *Trillium sessile* (toadshade). The populations of these two *Trillium* species are located to the east of northbound US-31 just south of Walton Road (Figure 2, Table 4). Most of the plants were found in the woodland adjacent to the Trillium sessile was found in a wooded thicket between the northbound offramp from US-31 to Walton Road and the main northbound US-31 highway.



Figure 2: Map showing the locations where *Trillium recurvatum* and *Trillium sessile* plants were found in this project area. The map shows the area near the intersection between US-31 and Walton Road.

| Table 4: GPS coordinates for the Trillium recurvatum and T. sessile observations | | | | |
|--|------------|-------------|--|--|
| Latin name | Latitude | Longitude | | |
| Trillium sessile | 41.8519201 | -86.3161690 | | |
| Trillium sessile | 41.8516281 | -86.3164210 | | |
| Trillium recurvatum | 41.8503628 | -86.3167208 | | |
| Trillium recurvatum | 41.8492998 | -86.3164502 | | |
| Trillium sessile | 41.8539681 | -86.3162529 | | |

Table 4: GPS coordinates for the Trillium species found in this project area.

Habitat description

Trillium recurvatum and Trillium sessile are found in Michigan in similar habitats and often grow together. They prefer rich woodlands with limestone-derived soils and can be found in the following habitat types: floodplain forests, moist ravines, and mesic forests^{2,3}.

Forest to the east of the northbound offramp to Walton Road

The woodland to the east of the northbound offramp to Walton Road and adjacent to Trillium Ravine Preserve is a floodplain forest, with higher elevation areas having characteristics of a southern mesic forest. Dominant tree species include *Acer saccharum* (sugar maple), *Celtis occidentalis* (hackberry), *Liriodendron tulipifera* (tulip tree; Figure 3a), *Platanus occidentalis*

(sycamore; Figure 3b), *Tilia americana* (basswood), and *Ulmus americana* (American elm). The shrub layer includes *Acer saccharum* saplings, *Asimina triloba* (paw paw), *Euonymus obovatus* (creeping strawberry-bush), scattered invasive honeysuckle shrubs (*Lonicera* spp.), *Ribes americanum* (wild black currant), scattered *Rosa multiflora* (multiflora rose), and *Smilax hispida* (bristly greenbriar). The herbaceous layer contains *Allium tricoccum* (ramps), *Campanulastrum americanum* (tall bellflower), *Carex plantaginea* (plantain-leaved sedge), *Carex arctata, Elymus hystrix* (bottlebrush grass), *Hydrophyllum appendiculatum* (great waterleaf; Figure 3c), *Maianthemum racemosum* (false spikenard), *Persicaria virginiana* (jumpseed), *Podophyllum peltatum* (May-apple), *Thalictrum thalictroides* (rue-anemone), and *Trillium* spp.



Figure 3: Species present in the floodplain forest habitat to the east of the northbound US-31 offramp to Walton Road. a) *Liriodendron tulipifera* (tulip tree); b) *Platanus occidentalis* (sycamore); c) *Hydrophyllum appendiculatum* (great waterleaf). Photos a) and b) were taken by Alexander Ellison.

The northern part of this forest to the east of the exit ramp is of high quality, with large trees (Figure 3a and 3b) and a relatively intact groundcover flora. The southern part of the forest to the east of northbound US-31 south of the exit ramp is of lower quality, with smaller, younger trees, and is quite vulnerable because it is bordered to the east by an agricultural field.

Wooded thicket in the median between US-31 and the northbound offramp to Walton Road

The area between northbound US-31 and the offramp to Walton Road contains a severely degraded woodland surrounded by old field vegetation. The wooded thicket canopy consists of *Celtis occidentalis* (hackberry), *Juglans nigra* (black walnut), and *Populus deltoides* (cottonwood). One individual of *Quercus muehlenbergii* (chinquapin oak) was located adjacent to the closed canopy part of this thicket. The shrub layer is dominated by non-native *Lonicera* spp. (honeysuckles), and contains *Crataegus* sp. (hawthorn), *Elaeagnus umbellata* (autumnolive), *Rosa multiflora* (multiflora rose), with *Rhus typhina* (staghorn sumac) in open areas. The groundcover layer under the closed canopy consists of honeysuckle and hackberry seedlings, as well as *Circaea canadense* (enchanter's nightshade), *Geum canadense* (white avens), *Hackelia virginiana* (beggars-lice), and *Toxicodendron radicans* (poison-ivy).

Quantity and health of populations

The population of *Trillium sessile* appears to be healthy to the east of the northbound offramp to Walton Road. Many individual stems (>100) were counted in the ROW and the apparent vigor of the individuals was rated as good, with 90-100% of stems fruiting (Figure 4a). The population of *Trillium recurvatum* is less robust here, with fewer stems found (11) and the apparent vigor rated as fair (Figure 4b). However, all stems of *Trillium recurvatum* were fruiting, so although these plants are less healthy in appearance than those of *T. sessile*, they are reproducing well.



Figure 4: Rare *Trillium* species found within the project ROW. a) *Trillium sessile* (toadshade) found to the east of the northbound US-31 offramp to Walton Road; b) *Trillium recurvatum* (prairie trillium) found to the east of the northbound US-31 offramp to Walton Road; c) *Trillium sessile* (toadshade) found in the median between northbound US-31 and the offramp to Walton Road.

A single stem of *Trillium* sessile was found in the median between northbound US-31 and the offramp to Walton Road (Figure 4c). Although this individual was fruiting, it was short in stature, which may indicate a stressed and unhealthy plant. The canopy and nearby vegetation are not congruent with the typical associates of this species. It is likely that this individual is a remnant from some disturbed soil that was moved during the clearing of a larger forest tract for the construction of the highway interchange.

Threats and mitigation measures

Both areas where the rare *Trillium* species were found contain invasive plant species, including aggressive invasive shrubs like non-native honeysuckles (*Lonicera* spp.) and *Berberis thunbergii* (Japanese barberry). There is also evidence of deer browsing in these areas, which is a serious threat to *Trillium* species. Invasive species control is essential if the *Trillium* sessile population in the median is to be preserved. Non-native honeysuckle seedlings carpet the ground near where this species was found and could eventually suppress this species through competition. Although invasive species are not as pervasive in the floodplain forest to the east of the offramp, they are still present and will continue to spread if not controlled. If replacement of the ROW fencing is planned for the area to the east of the northbound offramp, care must be taken to keep the canopy intact in this area. Disturbance in a closed-canopy forest is known to assist with the spread of invasive plant species.

Descriptions of plant communities by survey section



The vegetation and habitat characteristics found in this project area are summarized in the following sections that correspond with those mapped in Figure 5. These sections were chosen because they include important interchanges, or they contain habitat that may host rare plant species. A description of the habitat, as well a list of common and/or noteworthy plant species encountered is presented for each section. Special attention is given to sensitive species, high-quality habitats, and invasive plant species found in these sections.

Suitable habitat for rare plant species was found in four survey sections: sections three, four, five, and seven (Figure 5). Section three contains a high-quality floodplain/mesic southern forest with large trees and a relatively intact groundcover layer. Section four contains a very high-quality floodplain forest/mesic southern forest where two State Threatened plant species were found. Section five contains a medium/high-quality mesic southern forest with a diverse native groundcover layer. Lastly, Lemon Creek flows through section seven and the surrounding sedge meadow and lowland forest host diverse plant communities.



A group of species that form a community that is commonly encountered throughout this project area in dry, mowed ROWs is presented in Table 5. These species are referred to as "roadside weeds" and are referenced as such throughout the rest of this report.

| Table 5: Plant species frequently encountered along dry, mowed roadsides | | | | |
|--|------------------------|------------|-------|--|
| Latin name | Common name | Origin | Habit | |
| Achillea millefolium | yarrow | native | forb | |
| Asclepias syriaca | common milkweed | native | forb | |
| Asclepias verticillata | whorled milkweed | native | forb | |
| Centaurea stoebe | spotted knapweed | non-native | forb | |
| Cirsium arvense | Canada thistle | non-native | forb | |
| Daucus carota | Queen Anne's lace | non-native | forb | |
| Dipsacus fullonum | wild teasel | non-native | forb | |
| Erigeron philadelphicus | common fleabane | native | forb | |
| Euthamia graminifolia | grass-leaved goldenrod | native | forb | |
| Hypericum perforatum | St. John's wort | non-native | forb | |
| Leucanthemum vulgare | ox-eye daisy | non-native | forb | |
| Melilotus albus | white sweet-clover | non-native | forb | |
| Plantago lanceolata | narrow-leaved plantain | non-native | forb | |
| Solidago canadensis | Canada goldenrod | native | forb | |
| Symphyotrichum pilosum | frost aster | native | forb | |
| Tragopogon dubius | goat's beard | non-native | forb | |
| Tragopogon pratensis | common goat's beard | non-native | forb | |
| Trifolium pratense | red clover | non-native | forb | |
| Verbascum blattaria | moth mullein | non-native | forb | |
| Verbascum thapsus | mullein | non-native | forb | |
| Agrostis gigantea | redtop | non-native | grass | |
| Bromus inermis | smooth brome | non-native | grass | |
| Dactylis glomerata | orchard grass | non-native | grass | |
| Elymus repens | quack grass | non-native | grass | |
| Festuca rubra | red fescue | non-native | grass | |
| Hordeum jubatum | squirrel-tail grass | non-native | grass | |
| Phleum pratense | Timothy | non-native | grass | |
| Poa pratensis | Kentucky bluegrass | non-native | grass | |
| Setaria sp. | foxtail | non-native | grass | |
| Toxicodendron radicans | poison-ivy | native | vine | |
| Vitis riparia | riverbank grape | native | vine | |

Table 5: Plant species referred to as "roadside weeds" in the rest of this report.

Section 1: South terminus, US-31/US-12 interchange

The intersection of US-31 and US-12 forms the south terminus of this project area. The following areas near this interchange were surveyed by foot: the median between northbound



and southbound US-31 to the north of US-12. the median between northbound US-31 and the onramp to northbound US-31, and roughly 600 meters of the north and south sides of US-12 to the east of the northbound onramp to US-31 (Figure 6). The rest of the south terminus of the project area was surveyed by car. No rare species and no suitable habitat for rare species were found in this section.

Figure 6: Map of survey section one, the intersection of US-31 and US-12. Locations of non-native invasive species collected with the MISIN app are shown as colorful dots.

A recent (Table 1) record of *Baptisia lactea* (white false indigo) is known from near Topinabee Lake Preserve, on the northeast corner of the lake in the northeast quadrant of the US-12/US-31 interchange. The south end of this lake was surveyed with the nearby rare species occurrence in mind; however, this area contains a degraded lowland forest and no rare species were found. The canopy of the forest includes of *Acer saccharinum* (silver maple), *Carya laciniata* (shellbark hickory), *Populus deltoides* (cottonwood), and *Quercus bicolor* (swamp white oak). The shrub layer is dominated by non-native shrub species including *Elaeagnus umbellata* (autumn-olive), non-native honeysuckles (*Lonicera* spp.), *Rosa multiflora* (multiflora rose), and *Viburnum opulus* (European highbush-cranberry). A few native *Cephalanthus occidentalis* (buttonbush) shrubs were found. The herbaceous layer consists of roadside weeds (Table 5) near US-12 and native and non-native wetland-adapted species in the forest understory.

Both medians surveyed by foot in this area contained similar flora. The majority of the vegetation in these medians were species in the roadside weeds community (Table 5; Figure 7). Plant communities containing wetland species were located in several areas of these medians. In the median between northbound and southbound US-31, three patches of *Phragmites australis* (common reed) were found in areas where water accumulates (Figure 6, blue dots). Other wetland invasive species, including *Lythrum salicaria* (purple loosestrife) and *Typha x glauca* (hybrid cattail) were also found near the *Phragmites australis* patches. A few *Pinus sylvestris* (Scots pine) trees were found in the median between northbound US-31 and the onramp to northbound US-31 (Figure 6, orange dot).



Figure 7: Disturbed habitats in the US-31/US-12 interchange area hosting the roadside weeds plant community. a) Northbound US-31 bridge over the railroad to the north of US-12. Centaurea stoebe (spotted knapweed), Hypericum perforatum (St. John's wort), and Leucanthemum vulgare (ox-eye daisy) are visible in this photo. b) Median between northbound and southbound US-31 to the north of US-12. Centaurea stoebe (spotted knapweed), Daucus carota (Queen Anne's lace), and Vitis riparia (riverbank grape) are visible in this photo.

Invasive species Ailanthus altissima Cirsium vulgare Dipsacus fullonum Morus alba Phragmites australis Rhamnus cathartica Robinia pseudoacacia Torilis japonica MDOT 2021 Project

Section 2: US-31/Niles-Buchanan Road interchange

Figure 8: Map of survey section two, including locations of non-native invasive plant species occurrences collected with the MISIN app.

Parts of the intersection between US-31 and Niles-Buchanan Road (Figure 8) were surveyed by foot during all three visits to this project area because this intersection will be heavily altered during construction activities with the removal of both loop ramps. There is also a recent occurrence of Trillium recurvatum (prairie Trillium; Table 1) known from the Life Action Ministries property on the north side of Niles-Buchanan Road to the west of the highway interchange. No rare plant species and no suitable habitat for rare species were found in this survey section.

Much of the landcover in this section of the project area is disturbed, open grassland with scattered shrubs and wooded thickets (Figure 9). The open areas are mostly covered by plant species in the roadside weeds assemblage (Table 5).

There is a wetland within the onramp loop from eastbound Niles-Buchanan Road to northbound US-31 (Figure 10a). This wetland is dominated by non-native cattail species (*Typha angustifolia* and *T. x glauca*) and contains a patch of non-native *Phragmites australis* (reed; Figure 8, blue dot).

Within the onramp loop from westbound Niles-Buchanan Road to southbound US-31, there is a woodland with a closed canopy. The canopy in this area consists of *Acer saccharinum* (silver maple), *Acer saccharum* (sugar maple), *Catalpa speciosa* (northern Catalpa), *Celtis occidentalis* (hackberry), *Juglans nigra* (black walnut), *Liriodendron tulipifera* (tulip tree), *Platanus occidentalis* (sycamore), *Populus deltoides* (cottonwood), and *Robinia pseudoacacia* (black locust). The understory is degraded and contains a mixture of non-native shrubs, such as non-native *Lonicera* spp. (honeysuckles) and *Rosa multiflora* (multiflora rose), as well as native understory species of floodplain forests such as *Asimina triloba* (paw paw), *Cercis canadensis* (redbud), and *Lindera benzoin* (spicebush). What is noteworthy about this onramp loop is the presence of concrete structures in the woodland (Figure 10b). Several concrete slabs and a concrete retention basin are located in this woodland. When removing this onramp during the project activities, care should be taken in order to not damage machinery while working around these concrete structures.



Figure 9: Typical roadside vegetation in the Niles-Buchanan Road/US-31 intersection area. This photo was taken looking northward from south of the northbound US-31 onramp from eastbound Niles-Buchanan Road, in the southeast quadrant of the intersection.



Figure 10: Notable features in survey section two, Niles-Buchanan Road/US-31 intersection. a) Wetland dominated by invasive cattail species (Typha angustifolia and Typha x glauca) in the southeast quadrant of the intersection. b) Concrete retention basin within the onramp loop to southbound US-31, in the northwest quadrant of the intersection.

Section 3: North and south shores of St. Joseph River, north of Niles-Buchanan Road



The north and south banks of the St. Joseph River as it flows under US-31 to the north of Niles-Buchanan Road (Figure 11) were surveyed by foot. Several rare species from Table 1 have been located in habitats similar to those present in this survey section, so search efforts were focused on these species. These rare species are Euphorbia commutata (tinted spurge), which is known from a nearby bluff on the bank of the St. Joseph River, Morus rubra (red mulberry), which is known from a rich floodplain forest near the northern terminus of the project area, and two rare Trilliums: Trillium recurvatum and *T. sessile*, which are both known to occur a floodplain forest less than two kilometers to the north of this survey section. Despite search efforts, no rare species were found in survey section three.

Figure 11: Map of survey section three, including locations of non-native invasive plant species occurrences collected with the MISIN app and estimated extent of high-quality habitat.

A floodplain forest with elements of a mesic southern forest occurs near the south bank of the St. Joseph River in section 3 of this project area. This forest is notable because it contains large trees and a relatively high-quality understory layer. The tree canopy in lower areas close to the river consists of *Carya laciniata* (shellbark hickory), *Celtis occidentalis* (hackberry), *Liriodendron tulipifera* (tulip tree), *Platanus occidentalis* (sycamore), *Quercus rubra* (red oak), very large *Sassafras albidum* (sassafras), and *Tilia americana* (basswood). The shrub layer of this forests consists of native species such as *Asimina triloba* (paw paw), *Cercis canadensis* (redbud), *Euonymus obovatus* (creeping strawberry-bush), *Fraxinus* spp. (ash) seedlings, and *Lindera benzoin* (spicebush), as well as a few non-native species including *Berberis thunbergii* (Japanese barberry; Figure 11, yellow dots), *Rosa multiflora* (multiflora rose), as well as *Elaeagnus umbellata* (autumn-olive), non-native *Lonicera* spp. (honeysuckles), and *Morus alba* (white mulberry) nearer to the south shore of the river. The herbaceous layer in this forest contains a diverse mix of plant species typically found in rich and/or floodplain forests. These species include: *Arisaema triphyllum* (Jack-in-the-pulpit), *Asarum canadense* (wild-ginger), *Carex plantaginea* (plantain-leaved sedge; Figure 12a), *Caulophyllum thalictroides* (blue

cohosh), *Elymus hystrix* (bottlebrush grass), *Podophyllum peltatum* (May-apple), *Polystichum acrostichoides* (Christmas fern; Figure 12b), and *Sanguinaria canadensis* (bloodroot). As the forest continues southward to more upland areas, the canopy assemblage changes to contain a larger proportion of *Acer saccharum* (sugar maple) and *Fagus grandifolia* (American beech, Figure 12c). The understory in the beech-sugar maple part of the forest hosts abundant *Allium tricoccum* (ramps; Figure 12c) and *Carex plantaginea* (plantain-leaved sedge).

If ROW fencing improvements are planned for this area, it is important to keep the canopy intact to avoid creating openings for the invasive shrubs already present in this area to expand.



Figure 12: Plant species found in the rich floodplain/mesic southern forest on the south bank of the St. Joseph River in survey section 3. a) *Carex plantaginea* (plantain-leaved sedge), b) *Polystichum acrostichoides* (Christmas fern), c) *Allium tricoccum* (ramps) growing next to a large *Fagus grandifolia* (American beech) tree.

Underneath the northbound and southbound bridges on the south shore of the St. Joseph River in this survey section is an open, wet habitat resembling a southern wet meadow. This habitat is degraded, with evidence of recent disturbance and abundant invasive plant species present, but it nevertheless has value as an open-canopy riparian habitat. A small but dense clump of invasive *Phragmites australis* (reed; Figure 11, blue dot; Figure 13a) occurs near the shore in this area, as well as a larger and sparser clumps of *Typha x glauca* (hybrid cattail) and *Lythrum salicaria* (purple loosestrife; Figure 13b). Despite containing several aggressive wetland invasive plant species, this habitat contains some native wetland species such as: native wetland sedges (*Carex* spp. including *Carex comosa*, *Eleocharis erythropoda*, *Scirpus atrovirens*), *Equisetum hyemale* (scouring rush; Figure 13b), *Eupatorium perfoliatum* (boneset; Figure 13b), and *Leersia oryzoides* (cut grass).

The north shore of the St. Joseph River in survey section 3 in the highway ROW contains a small section of wooded bluff going down to the river. This wooded bluff was surveyed for potential woodland rare plant species, but none were located. Instead, a patch of invasive *Phragmites australis* (reed; Figure 11, blue dot) was found. The majority of the ROW on the north shore of the St. Joseph River in this survey section consists of rip-rap going down to the riverbank and mowed areas containing plant species in the roadside weeds assemblage (Table 5). A clone of *Ailanthus altissima* (tree-of-heaven; Figure 11, red dot) was located just above the bluff going down to the riverbank.



Figure 13: Open wetland habitat underneath the US-31 northbound and southbound bridges on the south shore of the St. Joseph River in survey section 3. a) Invasive *Phragmites australis* (reed) and *Typha x glauca* (hybrid cattail). b) Southern wet meadow-like habitat with invasive *Lytrhum salicaria* (purple loosestrife) and native *Equisetum hyemale* (scouring rush) and *Eupatorium perfoliatum* (boneset).

Section 4: US-31 and Walton Road interchange

Survey section four includes the ROWs surrounding the intersection between Walton Road and US-31 (Figure 14). This section was surveyed by foot during all three visits to this project area and contains three main habitat types: 1) a very high-quality floodplain/mesic southern forest to the east of the northbound offramp to Walton Road, 2) a wooded thicket in the median between northbound US-31 and the northbound offramp to Walton Road, and 3) dry, open habitats elsewhere. Two State Threatened species were found in the forest to the east of the offramp to Walton Road: *Trillium recurvatum* (prairie trillium) and *T. sessile* (toadshade), and one State Threatened species was found in the wooded thicket in the median: *Trillium sessile*



(toadshade). The habitat descriptions of the two areas where the rare Trilliums were found are detailed in the "Rare plant species observations" section of this report on pages 5-7. It is important to protect the habitats where these rare Trillium species are found, especially the floodplain/mesic southern forest habitat to the east of the northbound offramp to Walton Road. This area to the east of the offramp is part of a forest that is contiguous with Trillium Ravine Preserve, a conservation area of regional significance that hosts both State Threatened *Trillium* species, as well as other exceptional spring-blooming flora⁴.

Figure 14: Map of survey section four, including locations of non-native invasive plant species occurrences collected with the MISIN app, locations where rare plant species were found, and the extent of high-quality habitat within the ROW.

The dry, open habitats located along the margins of the highway, off- and onramps contain a mixture of species from the roadside weeds assemblage (Table 5; Figure 15). No suitable habitat for rare plant species was found in these areas.



Figure 15: Roadside weeds in the median between northbound US-31 and the onramp to northbound US-31 from Walton Road. Species that are visible in this photo include: *Centaurea stoebe* (spotted knapweed), *Daucus carota* (Queen Anne's lace), *Lotus corniculatus* (birdfoot trefoil), and *Rhus typhina* (staghorn sumac).

Section 5: Woodlands to the south of Lake Chapin

Two wooded areas along the stretch of northbound US-31 between Walton Road and Lake Chapin were identified from aerial photos as areas that could potentially host rare plant species (Figure 16). These two woodlands were surveyed by foot during the first visit to this project area to check for potential occurrences of rare spring ephemerals found in rich woodlands from Table 1: *Collinsia verna* (blue-eyed Mary), *Polemonium reptans* (Jacob's ladder), *Trillium recurvatum* (prairie Trillium), and *T. sessile* (toadshade). No rare plant species were found in these woodlands, although the southern forested area may contain habitat for rare plant species.

A forest containing elements of a mesic southern forest occurs along northbound US-31 north of Matthew Road at roughly mile number 10. A small patch of forest still exists on the east side of the highway, with a much larger patch of this forest continuing on the west side of US-31 (Figure 16, green polygons). Although this forest is small, it is of medium-high quality. The canopy contains *Acer saccharum* (sugar maple), *Carya cordiformis* (bitternut hickory), *Prunus serotina* (black cherry), *Tilia americana* (basswood), and *Ulmus americana* (American elm).



Figure 16: Map of survey section five, including locations of non-native invasive plant species occurrences collected with the MISIN app and the estimated extent of medium/high-quality and degraded forested habitat within the ROW.

The shrub layer consists of *Asimina triloba* (paw paw), *Crataegus* sp. (hawthorn), *Fraxinus* spp. (ash) saplings, *Parthenocissus quinquefolia* (Virginia creeper), *Ribes cynosbati* (prickly gooseberry; Figure 17b), and a small amount of *Rosa multiflora* (multiflora rose). The subcanopy is open (Figure 17a), with few invasive shrubs present, which allows for a diverse understory to persist. The understory consists of species commonly associated with mesic southern forests, including: *Actaea pachypoda* (white baneberry), *Allium tricoccum* (ramps), *Anemone canadensis* (Canada anemone; Figure 17c), *Asarum canadense* (wild-ginger; Figure 17d), *Caulophyllum thalictroides* (blue cohosh), *Hepatica acutiloba* (sharp-lobed hepatica), *Hydrophyllum appendiculatum* (great waterleaf), *Podophyllum peltatum* (May-apple), *Trillium grandiflorum* (common trillium), and *Triosteum aurantiacum* (horse-gentian).

If ROW fencing improvements are planned for this area, it is important to keep the canopy intact to avoid creating openings for the invasive shrubs already present in this area to expand.

There is a small lowland area in this forest which contains wetland flora. The canopy in this area is dominated by *Populus deltoides* (cottonwood) and the understory contains *Carex scoparia* (broom sedge), *Glyceria striata* (fowl manna grass), *Juncus* spp. (rushes), *Phalaris arundinacea* (reed-canary grass), *Persicaria* spp. (smartweeds), and other wetland-adapted species.



Figure 17: Vegetation found in the mesic southern forest patch in survey section five. a) View of the forest showing an open shrub layer and several medium-sized *Carya cordiformis* (bitternut hickory) trees. b) *Ribes cynosbati* (prickly gooseberry) in the forest understory. c) *Anemone canadensis* (Canada anemone) found in an open-canopy area on a gradual grade going down to a wetland. d) *Asarum canadense* (wild-ginger).

Another patch of forest was surveyed in this survey section and is located to the west of Range Line Road and to the south of Lake Chapin Road (Figure 16, blue polygon). This forest patch is larger than the mesic southern forest patch to the south; however, the condition of the forest in the highway ROW is degraded and no habitat for rare species was found. The canopy of this degraded forest consists of *Acer saccharum* (sugar maple), *Ailanthus altissima* (tree-of-heaven; Figure 16, red dot), *Celtis occidentalis* (hackberry), *Morus alba* (white mulberry), *Populus grandidentata* (bigtooth aspen), and *Tilia americana* (basswood). The understory of this forested area is degraded and the following invasive species were found: *Alliaria petiolata* (garlic-mustard), *Berberis thunbergii* (Japanese barberry; Figure 16, yellow dot), non-native *Lonicera* spp. (honeysuckles), and *Rosa multiflora* (multiflora rose). Trees in this patch of forest are generally smaller (Figure 18a) than those found in the mesic southern forest patch to the south, indicating a younger forest with more recent disturbance. The vegetation near the highway adjacent to this patch of forest consists of species in the roadside weeds assemblage (Table 5, Figure 18b).



Figure 18: Degraded forest to south of the Lake Chapin Road bridge over US-31. a) Typical forest understory in this area of the ROW with young trees; b) Roadside vegetation adjacent to the degraded forest.

Section 6: US-31 and Snow Road interchange, including the north shore of Lake Chapin



Survey section six contains the intersection between Snow Road and US-31, as well as ROW southward to the north shore of Lake Chapin (Figure 19). This survey section includes several different habitats; however, all habitats in this survey section are degraded and no suitable habitat for rare species was found. The habitat types encountered while surveying this section include: degraded forest, wooded thicket, forested drainage basins, a retention pond, ditches with wetland plant species, and upland areas containing the roadside weeds plant community.

Figure 19: Map of survey section six, including locations of non-native invasive plant species occurrences collected with the MISIN app.

Brief descriptions of the degraded habitats found in this survey section follow. Toward the north end of the onramp from Snow Road to northbound US-31 is a very degraded forest. The canopy consists almost entirely of invasive *Robinia pseudoacacia* (black locust; Figure 20a) and the understory is dominated by dense non-native *Lonicera* spp. (honeysuckles). The majority of the ROW in this survey section consists of the roadside weeds plant community (Table 5, Figure 20b). Two forested retention basins occur in this survey section; one basin is in the offramp loop from northbound US-31 to Snow Road (Figure 20c) and the other is to the north of Lake Chapin. Both basins have a canopy consisting of *Populus deltoides* (cottonwood) and *Salix* spp. (willows) and an understory dominated by non-native *Phalaris arundinacea* (reed-canary grass). A large retention pond is located to the south of the US-31/Snow Road interchange. At the boundary of this pond is a dense patch of invasive *Phragmites australis* (reed; Figure 20d). Finally, the bluff going down to the north shore of Lake Chapin is covered with rip-rap and hosts a degraded plant community (Figure 20e). To the margin of the rip-rap, at the east boundary of the ROW, is a degraded forest.



Figure 20: Vegetation and habitats found in survey section six. a) Invasive *Robinia pseudoacacia* (black locust) canopy at the north end of the Snow Road onramp to northbound US-31. b) Mowed roadside vegetation near the entrance to the northbound offramp to Snow Road. c) *Populus deltoides* (cottonwood) canopy over *Phalaris arundinacea* (reed-canary grass) in a retention basin within the offramp loop from northbound US-31 to Snow Road. d) Invasive *Phalaris arundinacea* (reed) near the retention pond to the south of the US-31/Snow Road interchange. e) Rip-rap and degraded forest at the north shore of Lake Chapin (photo taken by Alexander Ellison).

Section 7: Lemon Creek area

Survey section seven consists of the ROW area near Lemon Creek and the two adjacent retention ponds (Figure 21). This section was surveyed by foot during each of the three visits to this project area because of the high probability of finding rare species here. Six of the eleven



rare species in Table 1 have been found within ~3.8 kilometers of this survey section, with the nearest species occurring only 1.5 kilometers to the northeast. These nearby rare species are Camassia scilloides (wild-hvacinth). Collinsia verna (blue-eyed Mary), Morus rubra (red mulberry), Polemonium reptans (Jacob's ladder), Trillium recurvatum (prairie Trillium), and Trillium sessile (toadshade). Furthermore, the most recent collection of a presumed extirpated species, Oxalis violacea (violet wood sorrel), was collected at Lemon Creek in 1964. Despite search efforts, no rare plant species were found within the ROW; however, suitable habitat for rare species exists in this survey section.

Figure 21: Map of survey section seven, including locations of non-native invasive plant species occurrences collected with the MISIN app and the estimated extent of medium/high-quality habitat within the ROW.

Two streams flow through the ROW in this survey section: Lemon Creek and a small tributary to the north of Lemon Creek. The habitats in and adjacent to these two waterways are of medium/high quality and contain a mixture of floodplain forest and southern wet meadow natural communities (Figure 21, teal polygon). Where there is tree canopy, the canopy consists of *Acer saccharinum* (silver maple), *Celtis occidentalis* (hackberry), *Gleditsia triacanthos* (honey locust; Figure 22a), *Quercus bicolor* (swamp white oak), *Populus deltoides* (cottonwood), *Prunus serotina* (black cherry), and *Ulmus americana* (American elm). The shrub layer includes a diversity of native species adapted to seasonally flooded conditions: *Asimina triloba* (paw paw), *Euonymus obovatus* (creeping strawberry-bush), *Fraxinus* spp. (ash) saplings, and *Lindera benzoin* (spicebush). Invasive shrubs are also present here; *Elaeagnus umbellata* (autumnolive) and non-native *Lonicera* spp. (honeysuckles) were found in low-medium densities.

The herbaceous layer near the two streams is diverse and contains some species of high floristic quality. Notably, a healthy population of *Arisaema dracontium* (green dragon; Figure 22b) was found to the south of Lemon Creek. This species has a coefficient of conservatism of 8, meaning that it is usually found in high-quality habitats⁵. Other native herbaceous species

found in these riparian areas include: *Amphicarpaea bracteata* (hog-peanut), *Asclepias incarnata* (swamp milkweed), *Carex* spp. including *C. grayi* (Figure 22c), *C. lupulina*, and *C. vulpinoidea*, *Elymus riparius* (riverbank wild-rye), *Eutrochium maculatum* (Joe-pye-weed), *Geranium maculatum* (wild geranium), *Iris virginica* (southern blue flag; Figure 22d), *Laportea canadensis* (wood nettle), *Packera aurea* (golden ragwort), *Scirpus atrovirens* (bulrush), *Verbesina alternifolia* (wing-stem), and *Vernonia missurica* (Missouri ironweed).



Figure 22: Native floodplain and wet meadow species found near Lemon Creek and its tributary. a) *Gleditsia triacanthos* (honey locust), b) *Arisaema dracontium* (green dragon), c) *Carex grayi*, d) *Iris virginica* (southern blue flag), and e) *Chelydra serpentina* (common snapping turtle; photo taken by Alexander Ellison).

Several herbaceous non-native invasive plant species were found adjacent to Lemon Creek and its tributary. These include *Hesperis matronalis* (Dame's rocket; Figure 21, blue dot) and *Lysimachia nummularia* (moneywort; Figure 21, yellow dots). These two species are aggressive invaders of woodlands (*Hesperis matronalis*) and open-canopy wetlands (*Lysimachia nummularia*). Other herbaceous invasive species found in this area include *Cirsium arvense* (Canada thistle) and *Phalaris arundinacea* (reed-canary grass). Overall, the habitat near these two streams is of medium/high quality, and is important to local fauna as demonstrated by the sighting of a large snapping turtle in the tributary of Lemon Creek (Figure 22e). Care should be taken to protect these streams from clearing and sedimentation during construction activities.

Survey section seven contains two retention ponds: one to the north of Lemon Creek and one to the south. The southern pond, although constructed, has developed into a medium-quality habitat resembling a submerged/emergent marsh natural community (Figure 21, blue polygon; Figure 23a). The southern pond is lined with *Cephalanthus occidentalis* (buttonbush) and *Salix* spp. (willows) shrubs. The dominant macrophyte in this pond is *Ceratophyllum demersum* (coontail). Diverse fauna were observed in this habitat, including a Great Blue Heron, dragonflies, and damselflies. The northern pond (Figure 23b) is degraded and is lined with



invasive *Phalaris arundinacea* (reedcanary grass) and *Typha x glauca* (hybrid cattail). The surface of the northern pond is covered with duckweeds (Lemnaceae, including *Lemna* spp. and *Wolffia* spp.).

Figure 23: Retention ponds within the highway ROW in survey section seven. a) The southern pond, and b) the northern pond.

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Section 8: North terminus, US-31/M-139 interchange

The northern terminus of this project area corresponds with survey section eight and contains the intersection of US-31 and M-139 (Figure 24). This section was surveyed by foot during each visit to the project area. Although there are recent observations of rare plant species (Table 1) as near as 0.5 km to the east, the land in this survey section has undergone vast changes in landcover due to disturbance and no habitat for rare plant species was found in this section.



Figure 24: Map of survey section eight, including locations of nonnative invasive plant species occurrences collected with the MISIN app and the estimated extent of medium -quality habitat within the ROW.

Two landcovers (roadside weeds communities and a submerged/emergent marsh) in this survey section are described below. The majority of the landcover in this survey section contains plant species in the roadside weeds assemblage (Table 5; Figure 25a). Small areas where water accumulates within the roadside weeds habitats contain wetland invasive plant species, such as invasive Phragmites australis (Figure 24, blue dots) and Lythrum salicaria (purple loosestrife; Figure 25b). During the second visit to this project area, a notably large patch of Asclepias verticillata (whorled milkweed; Figure 25c) was observed on the west side of the offramp to eastbound M-139. Although this species is not rare, it was producing a stunning display of flowers which demanded to be noticed.

A constructed retention pond exists within the median between northbound US-31 and the exit ramp from northbound US-31 to eastbound M-139 (Figure 24, light blue polygon; Figure 26a). This pond is of medium

quality in terms of plant community composition and resembles a submerged/emergent marsh natural community. This pond is important for fauna: abundant frogs, killdeer, red-winged blackbirds, and a green heron were all observed in and near the pond. Native riparian vegetation in and around this pond includes: *Carex vulpinoidea* (fox sedge), *Cyperus strigosus* (long-scaled nut sedge), *Eleocharis* spp. (spike-rushes), *Lemna turionifera* (red duckweed), *Ludwigia palustris* (water-purslane), *Lycopus americanus* (common water horehound), *Persicaria lapathifolia* (nodding smartweed), *Salix exigua* (sandbar willow), and *Schoenoplectus tabernaemontani* (softstem bulrush; Figure 26b).



Figure 25: Roadside weeds plant community in section eight of this project area. a) Roadside weeds community with scattered *Populus deltoides* (cottonwood) on the north side of M-139 to the west of the onramp to northbound US-31; b) *Lythrum salicaria* (purple loosestrife) to the west of the offramp to eastbound M-139; c) *Asclepias verticillata* (whorled milkweed) patch.

Fluctuating water levels cause disturbance along the shores of this pond and create open habitat for non-native species to establish. There are some non-native species in this habitat, but the densities of these species are low. Non-native invasive species present in this habitat include: *Phalaris arundinacea* (reed-canary grass), a small patch of *Phragmites australis* (reed; Figure 24, blue dot), *Rumex crispus* (curly dock; Figure 26c), *Solidago sempervirens* (seaside goldenrod), *Typha x glauca* (hybrid cattail), and *Xanthium strumarium* (common cocklebur).



Figure 26: Habitat and vegetation around the retention pond in section eight. a) View of the pond with shore vegetation; b) *Schoenoplectus tabernaemontani* (softstem bulrush); c) *Rumex crispus* (curly dock).

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