

The Napanee Limestone Plain: Implications for High-Speed Rail Route Choice

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Executive Summary

This document presents a technical assessment of the environmental, ecological, and engineering implications of routing the proposed Alto High-Speed Rail (HSR) corridor through the southern Ontario landscape of the Napanee Limestone Plain. The assessment is based on published scientific literature, government fact sheets, conservation authority documentation, and species recovery program data, all cited herein.

The southern corridor traverses one of the most ecologically sensitive and legally constrained landscapes in eastern Ontario. The Napanee Plain contains the highest concentration of alvar ecosystems in the province, overlying active karst geology that presents significant structural and hydrological hazards for major linear infrastructure. The corridor also encompasses critical habitat for multiple federally listed Species at Risk, including the Eastern Loggerhead Shrike — a species whose entire remaining Canadian breeding population is concentrated in the Napanee Plain and the Carden Plain.

The analysis presented here identifies six interlocking categories of concern: (1) karst geology and construction risk; (2) alvar ecosystem destruction; (3) the Salmon River Alvar as a site of exceptional conservation significance; (4) Species at Risk conflicts and federal legal obligations; (5) hydrological disruption; and (6) invasive species corridor risk. Each of these concerns, individually, would represent a significant obstacle to project approval. Together, they constitute a formidable barrier to environmentally responsible route construction through the southern corridor.

1. Karst Geology and Construction Hazard

1.1 Nature of Karst Terrain

Karst is a landscape formed through the dissolution of soluble rocks, primarily limestone (calcium carbonate) and dolostone (magnesium carbonate), by acidic groundwater over geological timescales. The word derives from the Kras plateau northeast of the Adriatic and describes a characteristic suite of surface and subsurface features including caves, caverns, sinkholes, underground rivers, and intermittently disappearing surface streams.¹

In the Napanee Plain, massive limestones were formed well before the Mesozoic era. Where they outcrop in cliffs and road cuttings, they are often interbedded with shales. Karstic weathering has produced underground rivers and lakes, and in some systems, stalactites and stalagmites indicate considerable antiquity. Surface expressions include potholes, subsidence features, and seasonally flooded pavements with fast-moving surface flow.¹

At the surface, flat karstic pavements display parallel ridges and fissures, known in European terminology as clints and grykes, that can be large enough to walk in. Wide shallow depressions accumulate thin soils (sometimes only centimetres deep) and form seasonal ponds. These flat areas in the Napanee Plain flood irregularly throughout the year, often exhibiting fast surface flow.¹

Several named karst features are documented within the Napanee Plain. The Roblin Hell Holes, located along the east slope of the Salmon River valley approximately 1.5 km east of Roblin, is a relatively undisturbed site containing a limestone escarpment with karst features including sinkholes, talus boulders, flowerpots, and caves. To the northwest, the Moira Karst contains a major solution cave that functions as a hibernaculum for five species of bats — evidence of the region's extensive and mature subsurface karst development. Both sites are identified as Areas of Natural and Scientific Interest (ANSIs) in provincial documentation.⁹

Engineering Risk Statement — Lennox & Addington Stewardship Council (2022)

"The underground drainage, flooding and potential collapse of underground rock masses make karst dangerous to build on." The document explicitly identifies transport and utility corridor construction as a regional threat to alvar ecosystems overlying this geology.

1.2 Implications for High-Speed Rail Infrastructure

High-speed rail demands exceptional precision in track alignment, grade, and sub-base stability. Track roughness is directly correlated with operational speed and ride quality, and maintenance cost escalates significantly when sub-base settlement or differential movement occurs. Karst terrain is inherently incompatible with these requirements for several reasons:

- Subsidence risk: The dissolution of limestone and potential collapse of subsurface caverns creates unpredictable and ongoing settlement hazards beneath any founded structure.
- Irregular flooding: Seasonal and episodic inundation of karstic pavements, with fast surface flows, exposes embankments and cuttings to hydraulic stress that conventional drainage engineering cannot fully mitigate.
- Foundation variability: The interbedding of limestone with shales creates highly variable bearing capacity across short distances, making uniform foundation design impractical.
- Sinkhole formation: Ongoing karstic dissolution can create new sinkholes at unpredictable locations and timescales, presenting long-term operational safety and maintenance risks.
- Drainage interference: Cut-and-fill operations and drainage infrastructure associated with HSR construction could modify subsurface flow paths, potentially triggering new subsidence events both within and beyond the right-of-way.

Karst areas in Ontario are formally mapped by the Ontario Geological Survey (Groundwater Resources Study 5).¹ Any environmental assessment for this route would necessarily require detailed karst characterization surveys, geotechnical investigation programs, and long-term subsidence monitoring, representing significant additional cost and schedule risk above what would be required on more geologically stable alignments.

1.3 Construction Mitigation Strategies and Cost Implications

Constructing high-speed rail through karst limestone terrain requires engineering responses that are fundamentally different and substantially more costly than those used on geologically stable alignments. Before any construction could begin, a karst corridor would require an intensive pre-construction ground investigation program: closely-spaced boreholes, geophysical surveys (including seismic refraction, electrical resistivity, and multichannel analysis of surface waves), and systematic karst cavity mapping. By comparison, HS2 Phase 2 in the United Kingdom committed £300 million to ground investigation across its route corridor, a figure that reflects the depth of subsurface characterization needed to manage geological risk on a major HSR project, and one that would be compounded in karst terrain by the need for far denser survey spacing to resolve unpredictable void networks.[12]

Where direct embankment construction over karst is not feasible as would commonly be the case across the Napanee Plain, engineers have three primary options. The first is cavity grouting: pressure injection of cement grout to fill subsurface voids and fissures prior to construction. This reduces collapse risk but modifies subsurface hydrology, with the potential to redirect or impound

groundwater flows that sustain alvar plant communities and cave-dwelling bat populations. The second is deep micropile foundations, small-diameter steel-reinforced piles drilled through unstable overburden and karst voids to reach competent bedrock, which are standard practice in karst terrain and can support bridge piers and structural foundations where conventional driven piles would be impractical.[13] The third, and most structurally reliable, option is to abandon embankment construction altogether in favour of elevated viaduct structures that transfer all loads to deep foundations, bypassing the unstable karst surface entirely. Each option carries substantially higher capital cost than standard at-grade embankment construction on stable ground.

The choice of strategy is further constrained by the extreme precision requirements of high-speed rail. Ballastless slab track, the standard for modern HSR operations, permits post-construction subgrade settlement of no more than 15 mm, with heave limited to approximately 5 mm.[2] Even minor differential settlement beyond these thresholds compromises track geometry, accelerates wear, increases maintenance demand, and ultimately threatens operational safety at high speed. Karst terrain, characterized by irregular, unpredictable, and ongoing dissolution processes, is therefore fundamentally incompatible with the precision that HSR demands. Ground treatment measures acceptable for highway or conventional rail construction are insufficient for HSR tolerances. This means that in karst areas, engineered structures (viaducts, bridges) replacing embankments are not an optional enhancement but an engineering necessity, with commensurately higher costs.

A directly comparable scenario arose during the planning of HS2 Phase 2b in the United Kingdom, where the proposed alignment crossed the Cheshire salt-dissolution district, geologically analogous to karst in its mechanism of soluble rock dissolution, subsurface cavity formation, and unpredictable ground movement. An independent engineering assessment of that 20.2-kilometre section concluded that the piling, ground stabilization, and viaduct works required would add approximately £750 million to construction costs compared to a problem-free rural alignment — equivalent to a premium of approximately £37 million per kilometre, representing a near-doubling of expected per-kilometre costs for that section.[14] While the Napanee Plain karst is not identical in character to the Cheshire brinefield, both share the defining engineering hazards of subsurface dissolution, variable bearing capacity, and ongoing ground movement that drove that cost outcome. Scaled to a North American context and accounting for inflation and Canadian construction cost factors, the implied cost premium for karst segments of a southern corridor would represent a very substantial addition to the project's overall budget.

This creates an engineering paradox specific to the Napanee corridor. The interventions required to manage karst ground instability, cavity grouting, drainage modification, deep excavation for pile installation, are precisely the activities most likely to disrupt the subsurface hydrological regime on which alvar plant communities and bat hibernacula depend (see Section 5). Grout injection into karst void networks can permanently alter the groundwater flow paths that create the seasonal inundation cycles distinctive to alvar ecosystems; drainage works required to manage construction-phase water inrush risk may permanently dewater the cave systems used by the five bat species documented hibernating in the Moira Karst. The mitigation of construction cost risk and the mitigation of ecological impact are, in this setting, in direct conflict: the more thoroughly

the ground is stabilized for engineering purposes, the more comprehensively the karst hydrology is altered for ecological ones.

2. Alvar Ecosystems — Significance and Vulnerability

2.1 Global Rarity

Alvar is defined as a naturally flat and open vegetation pattern occurring on limestone or dolostone bedrock, characterized by thin, restricted, or absent soil cover. The nature of these landscapes is climatically extreme: they experience alternating seasonal flooding, intense summer drought, and deep winter frost heave. These conditions support a highly specialized assemblage of plants and animals, many of which are rare or absent elsewhere.²

Globally, alvar is restricted to two regions: the Great Lakes Basin of North America and the Baltic region of Europe. Within North America, 85 percent of alvar communities are found in Ontario.² Despite more than 120 identified sites in the Great Lakes region, alvars collectively comprise only 0.2 percent of the land area.² They are, by any ecological measure, a critically rare ecosystem type.

Global Conservation Context

Alvars are globally imperiled. Almost all alvar types found in the Great Lakes region are considered globally imperiled and under stress. They provide habitat for globally and provincially rare plants, contain large numbers of rare, threatened, endangered, and disjunct species, and are irreplaceable repositories of biodiversity adapted to the specific conditions of limestone bedrock environments. (MNRF, 2007; Napanee Plain Joint Initiative, 2017)

2.2 The Napanee Plain Concentration

Six major alvar regions have been identified in Ontario: Manitoulin Island, the Bruce Peninsula, the Carden Plains, the Smiths Falls Plain, the Napanee Plain, and western Lake Erie.² Approximately 50 alvar sites have been identified in the Napanee Plain and Prince Edward County alone.²

The Napanee Limestone Plain Important Bird and Biodiversity Area (IBA) is situated in eastern Ontario between Belleville and Kingston. The area consists of a mosaic of shallow-soil habitats, savanna grasslands with scattered Red Cedar or hawthorn, small woodlots, and exposed pavement, interspersed with cattle grazing and mixed farming uses.³ The rare alvar habitat supports many rare bird, insect, and plant species.³

2.3 Alvar Community Types and Their Dependencies

Alvar communities are classified by the amount of soil overburden overlying the limestone bedrock, producing a gradient of community types from bare pavement to woodland:²

- Alvar Pavement: Less than 10% tree cover, less than 25% shrub cover; high abundance of herbaceous plants or exposed bedrock colonized by gelatinous algae, lichens, and mosses. Spring ponds on pavements are ringed by rare small plants including Dwarf Skullcap (*Scutellaria parvula*), which shows 71–85% of its Great Lakes occurrences on alvars.³
- Alvar Grassland: More than 2 cm of soil supports grassland, the most widespread alvar type, with up to 20 grass species and 12 sedge species growing together, supporting a diverse grassland bird community.¹
- Alvar Savanna and Shrubland: Less than 10% tree cover with moderate to high shrub cover; variable herbaceous, moss, and lichen cover; dominated by Eastern Red Cedar (*Juniperus virginiana*).²
- Alvar Woodland: Partial canopy (25–60% cover) of trees, high shrub cover, some spring flowers and ferns in shaded areas. Red Cedar dominant.¹

Soil depth and moisture control the biomass and structure of these communities. The alternation of seasonal flooding and summer drought is ecologically essential to maintaining the distinctive plant diversity of alvar grasslands. Disturbance to either the hydrological cycle or the soil integrity eliminates this diversity irreversibly.¹

3. The Salmon River Alvar: A Site of Exceptional Conservation Value

3.1 Site Description and Status

The Salmon River Alvar, located approximately 2 km southwest of Lonsdale, Ontario, is a 847-hectare site within the Napanee Plain physiographic region. It holds ANSI designation and meets all five ANSI criteria. It is described in provincial assessments as one of the richest alvars in Ontario.⁴

The site supports a full range of alvar community types, including:⁴

- Alvar pavement and grassland, including areas of open bedrock
- Alvar woodland with Red Cedar
- Red Cedar savanna
- Dry woodlands on limestone bedrock
- Dry mixed forest
- Riverine, riparian (marshland), and lowland communities

No other alvar community in the Napanee Plain region shows this range of community types.⁴ The site's condition is assessed as fair to good, and it represents a largely intact corridor of alvar and associated communities.⁴

3.2 Species Richness and Rarity

The Salmon River Alvar has the second-highest native species richness recorded in any Ontario alvar.⁴ It supports many rare alvar species, and field assessments conducted in the 1980s and 1990s documented a level of ecological diversity unmatched elsewhere in the Napanee Plain. Current conditions are less well-known, as most of the site is on private land.⁴

Most critically, the Salmon River Alvar woodland hosts the only population of Juniper Sedge (*Carex juniperorum*) in Canada.⁴ ¹ This is explicitly confirmed by the Lennox & Addington Stewardship Council's 2022 technical document as an internationally rare plant.¹ The extirpation of this population through habitat destruction would constitute the elimination of Juniper Sedge from Canada entirely.

Internationally Rare Species — Sole Canadian Population

*The Salmon River Alvar woodland is home to an internationally rare plant, the Juniper Sedge (*Carex juniperorum*), the only such population in Canada. Destruction of this habitat through corridor construction would result in national extirpation of the species. (Lennox & Addington Stewardship Council, 2022; *The Alvars of Ontario*)*

3.3 Existing Fragmentation and the Role of the 401

The Salmon River Alvar's wildlife corridor has already been structurally interrupted by the Highway 401 and its associated concrete barriers.⁴ This severance has been identified in site assessments as an ongoing ecological threat. One of the best remaining grassland portions south of the 401 was destroyed by an addition to the Shannonville Motorsport Park.⁴

The introduction of a second major linear infrastructure corridor, in the form of HSR right-of-way, fencing, noise barriers, and associated access roads, would compound this fragmentation severely. Species requiring expansive corridors with natural cover, including bobcat, are already stressed by existing infrastructure; an additional severing of movement corridors through the alvar complex would further isolate populations and accelerate local extirpations.¹

4. Species at Risk: Legal and Ecological Implications

4.1 Federal and Provincial Legal Framework

The Species at Risk Act (SARA, 2002) places legally binding obligations on federal proponents and those seeking federal permits in relation to listed species and their critical habitat. SARA Schedule 1 listed species receive protection from destruction of critical habitat and from killing, harming, harassing, pursuing, capturing, or taking individuals. An environmental assessment of a

project of this scale on federal lands or involving federal approvals would trigger formal assessment of SARA obligations.

Ontario's Species Conservation Act (2025) provides parallel provincial protections. Combined, these instruments mean that the presence of even a single listed species with critical habitat dependency in a project footprint creates significant legal exposure and can require costly mitigation or redesign.

4.2 Species at Risk Present in the Southern Corridor

The following table summarizes the Species at Risk documented in the Napanee Plain alvar system that would be directly affected by southern corridor construction. Conservation status data are drawn from the Napanee Plain Joint Initiative Guidebook (2017), the Eastern Loggerhead Shrike Recovery Program Fact Sheet, and the MNRF Alvar Fact Sheet (2007).

Species	ON Status	COSEWIC	SARA Status	Habitat Dependency
Eastern Loggerhead Shrike	S2-B	Endangered	SARA Schedule 1	Alvar grassland, shallow limestone soils
Bobolink	S4-B	Threatened	SARA Schedule 1	Meadow and grassland habitat
Eastern Meadowlark	S4-B	Threatened	SARA Schedule 1	Open grassland and alvar
Grasshopper Sparrow	S4-B	Special Concern	SARA Schedule 1	Alvar grassland specialist
Short-eared Owl	S2-N	Special Concern	SARA Schedule 1	Open grassland, ground nesting
Upland Sandpiper	S4-B	Special Concern	SARA Schedule 1	Open alvar grassland, ground nesting
Juniper Sedge	S1	Endangered	Federal assessment required	Salmon River Alvar woodland (sole Canadian population)
Henslow's Sparrow	S1 (historical)	Endangered	SARA Schedule 1	Tall-grass alvar meadow; historically present in IBA, suitable habitat remains

4.3 The Eastern Loggerhead Shrike — A Critical Case

The Eastern Loggerhead Shrike (*Lanius ludovicianus migrans*) is the most acutely endangered species in this landscape. It is a songbird that hunts like a raptor, impaling prey on thorns and barbed wire, a behaviour unique among songbirds that earned it the historic name 'butcher bird.'¹⁵

The Eastern subspecies once ranged across northeastern North America from New Brunswick to eastern Manitoba, but its numbers have collapsed over the past fifty years. Searches of all historical breeding sites have documented fewer than 30 breeding pairs remaining in Ontario, with a few pairs in Manitoba.⁵ Apart from these scattered pairs, Eastern Loggerhead Shrikes now breed regularly in only two areas in Canada.⁵ Throughout the 1990s, the Napanee Limestone Plain IBA alone supported at least 30 percent of Canada's entire Loggerhead Shrike population; as recently as 2003, approximately 35 percent of the national total, representing 50 percent of Ontario's breeding birds, were found on this site.⁹ The trajectory since then has continued downward: the total wild Canadian population is now estimated at approximately 40 individuals,¹⁰ with only 22 breeding pairs confirmed in Ontario in 2022, below the federal Recovery Strategy's stated short-term target of 35 pairs across all core areas combined.¹¹

The Napanee area, specifically its shallow-soiled limestone alvars, is one of those two remaining breeding locations.⁵ The shrike's habitat requirements are directly aligned with the alvar grassland communities of the Napanee Plain: rough or unimproved cattle pasture with a few trees and shrubs scattered through the landscape for nesting and perching.⁵

Population Context — Eastern Loggerhead Shrike

Loggerhead Shrike numbers are declining faster than any other grassland bird in North America. The Napanee Plain once held at least 30% of Canada's entire Eastern Loggerhead Shrike population (1990s); as recently as 2003, 35% of the national total bred here. Today, the total wild Canadian population is estimated at approximately 40 individuals (Wildlife Preservation Canada, 2023), with only 22 breeding pairs in all of Ontario confirmed in 2022. The Napanee limestone alvar area remains one of only two regular breeding locations in Canada. Loss or fragmentation of this habitat through infrastructure construction would represent a potentially irreversible blow to the species' national survival. (Wildlife Preservation Canada; Bland, 2004)

The shrike's ecological requirements create multiple conflict points with HSR construction:

- Open grassland habitat loss: Construction of a right-of-way through alvar grassland directly eliminates breeding and foraging territory.
- Perch disruption: Shrikes depend on dead branches, fence posts, and telephone wires in open areas for territory defence and prey spotting. Construction activity and altered landscape structure remove these features.
- Prey base reduction: The shrike's prey: grasshoppers, crickets, dragonflies, small rodents, frogs, and small snakes, is entirely dependent on intact alvar grassland. Habitat loss eliminates the prey base.
- Nesting disturbance: Construction noise and vibration during April–June nesting season would directly disturb breeding attempts during the species' most critical period.
- Barrier effects: Fencing, noise barriers, and elevated structures associated with HSR infrastructure create movement barriers across the open landscape on which shrikes depend.

4.4 Additional Grassland Bird Species

The Bobolink (*Dolichonyx oryzivorus*, Threatened nationally) and Eastern Meadowlark (*Sturnella magna*, Threatened nationally) are both grassland-obligate species whose primary threats are identified as loss of meadows and hay fields.³ Both species nest in the cultural grasslands and alvar grassland communities of the Napanee Plain.

The Grasshopper Sparrow (*Ammodramus savannarum*, Special Concern nationally), Short-eared Owl (*Asio flammeus*, Special Concern nationally, S2 in Ontario), and Upland Sandpiper (*Bartramia longicauda*, S4-B) are additional grassland specialists documented in the Napanee Plain IBA.³ All are ground-associated and directly sensitive to the fragmentation and noise disturbance that HSR infrastructure would introduce. Population surveys documented in the 2004 IBA Conservation Plan recorded 150–200 pairs of Upland Sandpiper breeding annually in the IBA, estimated at approximately 2 percent of the entire Canadian population, along with 150–200 pairs of Grasshopper Sparrow, 150–200 pairs of Vesper Sparrow, and 200–400 pairs of Eastern Meadowlark (Bland, 2004).⁹

The Henslow's Sparrow (*Centronyx henslowii*, Endangered nationally under COSEWIC), though present in the IBA in low numbers during the 1990s, has not been recently recorded. Breeding Bird Survey data show this species has declined at approximately 7.5 percent per year across its range since 1966, one of the steepest declines of any grassland bird in eastern North America (Bland, 2004).⁹ Its former presence confirms the Napanee Plain as historically capable of supporting this species; its absence likely reflects ongoing degradation of grassland habitat quality. Suitable habitat for Henslow's Sparrow persists in the IBA, and any further habitat loss through corridor construction would foreclose potential recolonization.

5. Hydrological Disruption of Karst Systems

5.1 Karst Hydrology and Alvar Dependence

The ecological integrity of Napanee Plain alvars is fundamentally dependent on the karst hydrological system beneath them. Alvar communities require the seasonal alternation of flooding and drought that karst drainage creates: spring flooding maintains pavement pond species assemblages, while summer drought is essential to suppressing the competitive exclusion of specialized alvar plants by more aggressive species.^{1 2}

This hydrological cycle operates through subsurface drainage networks, underground streams, solution channels, and caverns, that are interconnected across the landscape. Because these pathways cross property boundaries and extend well beyond individual sites, disruption at one point in the system can have cascading effects on alvar communities at significant distances from the construction footprint.¹

5.2 HSR Construction as a Hydrological Threat

The MNRF Alvar Fact Sheet (2007) lists change in the flow or amount of water as one of ten major regional threats to alvar ecosystems.² HSR construction would introduce multiple hydrological disruptions:

- Cut-and-fill earthworks sever or redirect subsurface drainage pathways.
- Drainage infrastructure (culverts, ditches, interceptor drains) modifies the timing and volume of water reaching alvar communities.
- Impermeable surfaces in the right-of-way alter surface run-off patterns that feed seasonal ponds.
- Grouting of karst voids for foundation stabilization can block underground flow systems, affecting spring emergence and wetland communities.
- Long-term compaction of soils in adjacent areas alters infiltration rates, modifying groundwater recharge patterns that sustain karst systems.

These effects are particularly difficult to predict, model, and mitigate in karst terrain because the subsurface drainage system is often incompletely mapped and the connections between surface and subsurface water are highly dynamic. An environmental assessment would face significant uncertainty in characterizing baseline conditions and predicting hydrological impacts — uncertainty that is systematically biased toward underestimating disruption.

6. Invasive Species Corridor Risk

6.1 Alvar Vulnerability to Invasion

The introduction of weeds and non-native species is identified as one of the top ten regional threats to alvar ecosystems in the MNR Fact Sheet (2007).² Alvar communities are particularly vulnerable to invasive species for several reasons: their shallow soils and extreme hydrological conditions restrict the competitive ability of native species, and disturbance events that expose bare soil or create new edge habitat provide immediate establishment opportunities for invasive plants.

Drought periodicity is a key mechanism maintaining alvar biodiversity: drought suppresses competitive dominants and allows stress-tolerant specialists to persist. Introduction of invasive species, particularly phragmites, common buckthorn, dog-strangling vine, and garlic mustard, can override this mechanism by establishing dense monocultures that exclude native alvar flora regardless of hydrological conditions.²

6.2 HSR as an Invasive Species Vector

Linear infrastructure is among the most effective vectors for invasive species dispersal in Ontario's landscape. HSR construction would create a continuous disturbance corridor through the Napanee Plain alvar complex that would function as a persistent invasive species introduction pathway. Key mechanisms include:

- Construction equipment transporting invasive plant propagules in soil, gravel fill, and tire treads across multiple alvar sites.
- Disturbed fill material providing ideal bare-soil establishment conditions for invasive annuals.
- Permanent right-of-way edge creating a maintained grass strip that favours weedy species over alvar specialists.

- Drainage ditches and disturbed verges providing dispersal corridors linking previously isolated invasive populations.
- Increased maintenance vehicle access introducing new propagules repeatedly over the operational life of the line.

The alvars that have survived thousands of years of climate variability and species competition since deglaciation are now, as documented by the Lennox & Addington Stewardship Council (2022), directly threatened by new infrastructure and recreational vehicle access.¹ A high-speed rail corridor would represent an order-of-magnitude increase in the intensity of this threat, with effects persisting for the full operational life of the project.

7. Adequacy of Existing Protections

A recurring theme in the source documents reviewed for this assessment is the inadequacy of existing regulatory designations to protect alvar ecosystems from development pressure. The Lennox & Addington Stewardship Council (2022) states explicitly that an Area of Natural and Scientific Importance (ANSI) designation "no longer defends that area from development."¹

The Salmon River Alvar ANSI meets all five designation criteria yet remains predominantly privately owned and subject to incremental threat from residential subdivision, recreational vehicle traffic, and agricultural intensification.⁴ The 2022 documentation closes with the observation: "Our remaining Alvars need protection."¹

In the context of Alto HSR, this framing has specific implications. A federal environmental assessment triggered by SARA obligations would require Alto to demonstrate that critical habitat for listed species would not be destroyed or adversely affected. Given the concentration of SARA-listed species in the Napanee Plain, and the alignment of the southern corridor through their documented habitat, the burden of proof on the proponent would be substantial. The inadequacy of existing protections does not reduce this burden, rather, it places additional responsibility on the assessment process to fill the gap.

8. Cumulative Impacts

The concerns documented in this assessment do not operate independently. They interact and compound in ways that make the cumulative impact of HSR construction through the southern corridor substantially greater than the sum of its parts:

1. Karst construction hazards (Section 1) require drainage engineering that directly disrupts the hydrological regime on which alvar ecology depends (Section 5).
2. Alvar habitat loss (Section 2) eliminates the prey base and nesting habitat of Species at Risk grassland birds (Section 4), while the construction disturbance corridor provides the vector for invasive species introduction that will degrade adjacent unaffected alvar (Section 6).
3. The Salmon River Alvar (Section 3) is already fragmented by Highway 401. A second linear corridor would further isolate the remaining intact portions, eliminating corridor function for species, including bobcat, grey ratsnake, and Blanding's Turtle, that depend on connected habitat patches.

4. The inadequacy of ANSI designation (Section 7) means that the alvar network has no regulatory backstop against infrastructure development, making the environmental assessment process the only mechanism for identifying and responding to these risks.
5. The Juniper Sedge's sole Canadian population (Section 3) sits within a site that is simultaneously one of Ontario's richest alvars, one of the two remaining Loggerhead Shrike breeding strongholds in Canada, and a site underlain by unstable karst geology. The overlap of these conditions in a single landscape means that negative outcomes in any one category cascade into all others.

The cumulative effect of these interlocking risks is that a southern corridor alignment through the Napanee Plain would face an environmental assessment process of extraordinary complexity and cost, with a high probability of triggering SARA critical habitat conflicts that cannot be mitigated, in a geological setting that imposes ongoing structural and safety risk to the infrastructure itself.

9. Conclusion

The southern corridor alignment through the Napanee Limestone Plain presents a convergence of engineering hazard, ecological sensitivity, and federal legal constraint that is without parallel in the Alto corridor options. The karst geology underlying the region is explicitly characterized as dangerous to build on. The alvar ecosystems overlying that geology are globally rare, legally recognised, and home to species whose national survival depends on the integrity of this precise landscape.

The Eastern Loggerhead Shrike's entire remaining Canadian breeding population is concentrated in the Napanee limestone alvar system, and in the Carden Plain. The only Canadian population of Juniper Sedge exists in the Salmon River Alvar. The Bobolink, Eastern Meadowlark, Grasshopper Sparrow, Short-eared Owl, Upland Sandpiper, and the historically present Henslow's Sparrow are all documented in the Napanee Plain IBA with SARA-listed or COSEWIC-assessed conservation status.

Any route assessment that does not account for these conditions in full, including the inadequacy of ANSI designations to protect these sites, the hydrological interconnectedness of the karst system, and the invasive species risk posed by a permanent infrastructure corridor, will produce recommendations that are environmentally unsound and legally vulnerable.

These facts are not in dispute. They are drawn directly from the published record of government agencies, conservation authorities, species recovery programs, and naturalist organizations with direct knowledge of this landscape. They are presented here to ensure that the Alto consultation process engages with the full weight of the ecological and engineering evidence.

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Document Provenance

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